‘Blue health’ for healthy aging?
Urban blue spaces as potentially therapeutic landscapes for older people in Ahmedabad and Ruhr Metropolis

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ABSTRACT

In recent decades, increasing scientific evidence has emerged demonstrating the health benefits of exposure to surface waters called "blue spaces" in analogy to green spaces. Those health benefits mainly relate to positive effects on health behavior and physical and mental health and protective effects from environmental health threats. Despite increasing differentiation, research to date has only been able to clarify fundamental questions, which is why exploratory approaches to specific issues are still needed. This applies, among others, to the question of how 'blue health' manifests in old age, for example what influence age has on the experience of the blue space-health relationship and which health effects for this population group exist. Since demographic change and urbanization are two converging megatrends in the 21st century, older people (aged 65 years and over) in cities make up one of the fastest growing population groups. Given the high levels of morbidity in old age and the need to act on healthy aging, older people could particularly benefit from health effects of blue spaces.

This research investigates the relationship between blue spaces and older people's health and wellbeing using a multiple case study approach in two distinct urban contexts: Ahmedabad in India and Ruhr Metropolis in Germany. A participatory action research methodology called photovoice was applied which included participant observations and baseline surveys at two main research sites, photowalks (walking interviews incorporating photo elicitation), focus group discussions, stated preference choice experiments and key informant and expert interviews.

The analysis shows that older people in both cases experience blue spaces as 'potentially therapeutic landscapes' and place high value on having access to those spaces in cities. Most preferred were larger blue spaces such as rivers and lakes as well as landscaped blue-green environments. Mental health benefits such as restoration and stress relief were ranked most important, followed by physical activity/sense of improved physical health and social interaction. The study identifies various factors influencing older people's urban blue space use as well as aspects and landscape elements that are perceived as age-friendly and health-enabling. Looking at the supply side, obstacles to accessibility, a lack of amenities and maintenance difficulties are major reasons causing misfits between older people's demands and needs and the actual blue space provision in both cases and represent key intervention points for urban planning and design. Overall, the results provide some tentative evidence on the determinants of success and failure in age-friendly urban blue space governance for health. Despite many challenges, the present findings are encouraging as they highlight that blue health futures across the world can be shaped for and with aging urban populations. For this purpose, this research provides concrete recommendations for action.

„Blaue Gesundheit“ für gesundes Altern? Stadtblau als potenzielle therapeutische Landschaften für ältere Menschen in Ahmedabad und im Ruhrgebiet

KURZFASSUNG

In den letzten Jahrzehnten haben die wissenschaftlichen Erkenntnisse zu positiven Effekten von Gewässern auf die Gesundheit zugenommen. In Analogie zu „Stadtgrün“ werden diese Landschaften in urbanen Räumen auch als „Stadtblau“ bezeichnet. Die gesundheitlichen Effekte beziehen sich hauptsächlich auf positive Auswirkungen auf das Gesundheitsverhalten, auf die körperliche und mentale Gesundheit und auf schützende Wirkungen vor umweltbedingten Gesundheitsrisiken. Trotz zunehmender Ausdifferenzierung konnte die bisherige Forschung nur grundlegende Fragen klären, weshalb explorative Ansätze zu spezifischen Themen erforderlich sind. Dies gilt unter anderem für die Frage, wie sich die „blaue Gesundheit“ im Alter manifestiert, beispielsweise welchen Einfluss das Alter auf das Erleben der Beziehung zwischen Stadtblau und Gesundheit hat und welche gesundheitlichen Auswirkungen für diese Bevölkerungsgruppe bestehen. Da der demografische Wandel und die Urbanisierung zwei konvergierende Megatrends des 21. Jahrhunderts sind, zählen ältere Menschen (ab 65 Jahren) in Städten zu den weltweit am schnellsten wachsenden Bevölkerungsgruppen. Angesichts der hohen Morbidität im Alter und der Notwendigkeit, Maßnahmen für ein gesundes Altern zu ergreifen, könnten ältere Menschen besonders von den gesundheitlichen Auswirkungen urbaner Blauflächen profitieren.

Diese Studie untersucht den Zusammenhang zwischen Stadtblau und der Gesundheit und dem Wohlbefinden älterer Menschen anhand einer multiplen Fallstudie in zwei unterschiedlichen städtischen Kontexten: Ahmedabad in Indien und das Ruhrgebiet in Deutschland. Es wurde die Methodik „Photovoice“ der partizipativen Aktionsforschung angewendet. Diese umfasste teilnehmende Beobachtungen und Befragungen an zwei ausgewählten Hauptforschungsorten, „Fotospaziergänge“ (begleitende Interviews mit Fotobefragungen), Fokusgruppendiskussionen, Entscheidungsexperimente zu Landschaftspräferenzen sowie Interviews mit wichtigen Informanten und Experten.

Die Analyse zeigt, dass ältere Menschen in beiden Fällen Stadtblau als „potenziell therapeutische Landschaften“ erleben und großen Wert auf den Zugang zu diesen Orten legen. Am beliebtesten waren größere urbane Blauflächen wie Flüsse und Seen sowie landschaftlich gestaltete blau-grüne Flächen. Psychische Gesundheitseffekte wie Erholung und Stressabbau wurden als am wichtigsten eingestuft, gefolgt von körperlichen Aktivitäten beziehungsweise dem Gefühl einer verbesserten körperlichen Gesundheit und sozialer Interaktion. Es werden verschiedene Faktoren identifiziert, die die Nutzung von Stadtblau durch ältere Menschen beeinflussen sowie Aspekte und Landschaftselemente, die als altersfreundlich und gesundheitsfördernd wahrgenommen werden.

Betrachtet man das derzeitige Angebot von Stadtblau, so sind folgende Hauptgründe für die Diskrepanz zwischen den Bedarfen und Bedürfnissen älterer Menschen und dem tatsächlichen Angebot an Stadtblau in beiden Fällen verantwortlich: Hindernisse bei der

Erreichbarkeit und qualitative Mängel wie Komfort bietende Infrastruktur und Schwierigkeiten bei der Instandhaltung. Diese stellen wichtige Ansatzpunkte für die Stadtplanung und -gestaltung dar.

Insgesamt liefern die vorliegenden Studienergebnisse Hinweise auf die Determinanten von Erfolg und Misserfolg von politischem Handeln für gesundheitsförderliches Stadtblau sowie deren altersfreundlicher Entwicklung. Trotz vieler Herausforderungen sind die vorliegenden Ergebnisse ermutigend. Sie zeigen, dass die Zukunft von „blauer Gesundheit“ weltweit für und mit alternden städtischen Bevölkerungen gestaltet werden kann. Zu diesem Zweck liefert diese Studie konkrete Handlungsempfehlungen.

DEDICATION

"Medicus curat, natura sanat" – "The doctor treats, nature heals"

I dedicate this dissertation to my family – both immediate and extended, who has been a great source of inspiration, motivation and support throughout the years.

In particular to and in memory of my grandmother Uta Leuk, née Kuhl. You have been a shining role model of active and healthy aging for me and many other people. While you shared the recipes for your famous cakes at some point, I had to figure out your recipes for a long and fulfilled life for myself. I am sure important ingredients were your positive approach to life, even when it can be bitter, and your continuous willpower to care for yourself and others. Your cheerful and quick-witted personality and your remarkable sense of aesthetics –as exemplified in the design of your garden called 'Isola Bella'– continue to fascinate me and I keep carrying on your words "Somehow, life goes on". This is 'my book' as you used to say, which you still wanted to read. I am sorry it comes a bit late. But having written a book yourself, you know it can take some time. After all, the time we spent together was more important than reading this thesis!

ACKNOWLEDGEMENTS

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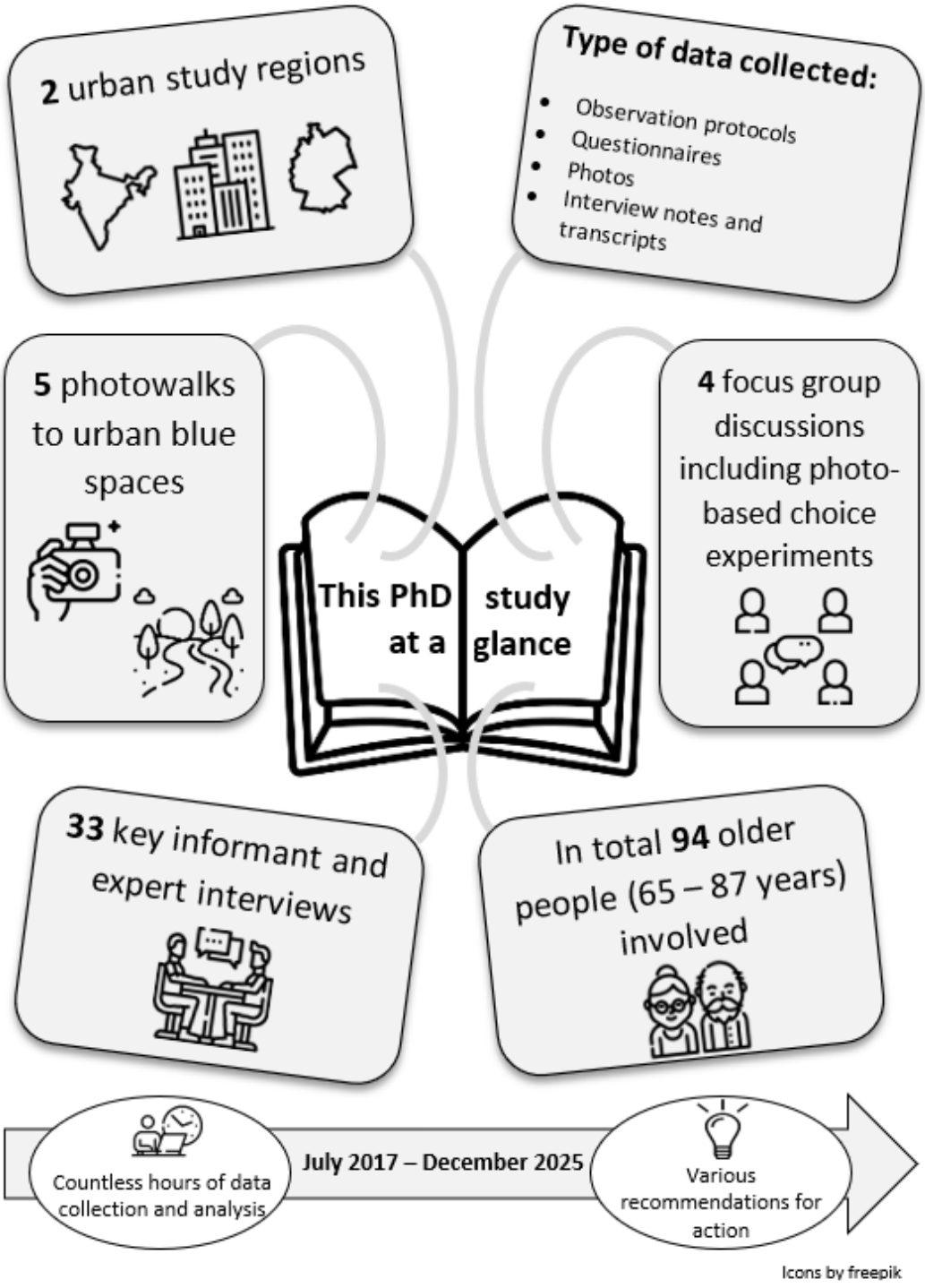
I happened to be the author of this dissertation, but there have been many hearts and minds beyond whom I express my sincere gratitude for their contributions to this work. Special thanks to all participants in India and Germany who gave their time and shared their experiences for this study. Without you, this research approach would have been impossible! I would also like to express my great appreciation to my research teams in both countries and to all those people who facilitated this research, enabled my stay in India and supported the data collection and analysis. In addition, I would like to thank my supervisor Prof. Dr. Thomas Kistemann and my tutor PD Dr. Timo Falkenberg for their continuous guidance and support throughout the research process. To the members of the thesis committee, Prof. Dr. Mariele Evers, Prof. Dr. Julian Klaus and Prof. Dr. Christian Borgemeister: Thank you very much for your time and effort and for helping me finish this PhD study.

I am extremely grateful that I was able to experience my time as a PhD student together with others. Many thanks to all fellow students at the graduate school 'One Health and Urban Transformation' and at ZEF! You have enriched this journey so much, especially on a personal level! Many thanks should also go to all my friends and colleagues as well as to my family. Words cannot express how grateful I am for your support, patience and love. Ben, if you had not been there, completing this thesis would have been much more difficult. My heartfelt thanks! Finally, much more than advancing my research skills, doing this PhD has contributed in an unforgettable way to my personal development and my perspectives on life. I am grateful to have been given this privilege.


2 urban study regions
Type of data collected:
Observation protocols
Questionnaires
Photos
Interview notes and transcripts
5 photowalks to urban blue spaces
This PhD study at a glance
4 focus group discussions including photo-based choice experiments
33 key informant and expert interviews
In total 94 older people (65 – 87 years) involved
Countless hours of data collection and analysis
July 2017 – December 2025
Various recommendations for action
Icons by freepik

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LIST OF ACRONYMS AND ABBREVIATIONS

AFC	Age-friendly cities and communities
AMC	Ahmedabad Municipal Corporation
ART	Attention restoration theory
AUDA	Ahmedabad Urban Development Authority
CAC	Coronary artery calcium
CICES	Common International Classification of Ecosystem Services
CSR	Corporate social responsibility
DALYs	Disability-adjusted life years
ESS	Ecosystem services
FGDs	Focus group discussions
fig.	Figure
ha	hectares
HIAs	Health impact assessments
HICs	High-income countries
km	kilometers
LMICs	Low- and middle-income countries
m	meters
NCDs	Non-communicable diseases
PAR	Participatory action research
PO	Participant observation
QALYs	Quality-adjusted life years
RAs	Research assistants
resp.	respectively
SAM	Self-assessment manikin
SES	Socio-economic status
SOPARC	System for Observing Play and Recreation in Communities
sq m	square meters
SRT	Stress reduction theory
TDS	Total dissolved solids
UK	United Kingdom
UN	United Nations
vs.	versus
WASH	Water, sanitation and hygiene
WHO	World Health Organization

1 INTRODUCTION

Human settlements and the development and rise of cities are closely intertwined with the availability of water (Kistemann 2018; Rietveld et al. 2016; Kistemann et al. 2010). Various uses of waters such as for agricultural, ecological, industrial, commercial and recreational purposes have shaped urban areas and continue to do so today, with direct and indirect effects on public health (Kistemann & Völker 2014). In addition, water has always been known as a healing power and highly preferred landscape element across cultures (Doughty 2019; Foley et al. 2019; White et al. 2010). In recent decades, a distinct branch of research called 'healthy blue space research' emerged to investigate coastal and freshwater bodies from a salutogenic perspective, which has been given little attention for a long time (Foley et al. 2019; White et al. 2018; Foley & Kistemann 2015). The term 'blue space' is a relatively new name for all types of aquatic landscapes, whether water plays a central or secondary aspect of the scene (Völker & Kistemann 2011; White et al. 2010). A growing number of studies provides evidence for the various positive health effects of blue spaces and justifies speaking of them as "potentially therapeutic landscapes" (Conradson 2005). Health benefits of blue spaces include behavioral ones such as the promotion of physical activity and social interaction, environmental health effects such as cooling and noise buffering as well as positive impacts on mental health and wellbeing (White et al. 2018). However, those effects are not uniform and universal, and research must become increasingly differentiated (Grace et al. 2023; Georgiou et al. 2021). The linkages between blue spaces and health and wellbeing are a complex cause-and-effect relationship with numerous influencing variables (White et al. 2020).

Interestingly, the health benefits of urban blue spaces for older people[1] have been studied relatively little, even though population aging is a rapidly advancing global development trend (Wang & Sani 2024; Finlay et al. 2015). In fact, due to urbanization and demographic change, the number of older people living in cities is increasing considerably, while the impacts of this convergence are poorly understood (WHO 2015b). As the risk for non-communicable and lifestyle-associated diseases increases with age

[1] The terms "older people" and "older adults" commonly refer to people aged 65+ years. Both terms have been found to be neutral, i.e., not containing any negative connotations, and are recommended to be used by relevant institutions such as the UN Office of the High Commissioner for Human Rights or by the Thesaurus of Aging Terminology.

and the burden of disease is particularly high among older people, promoting their physical and mental health is important for preserving functional abilities and autonomy and for preventing or delaying the need for care (WHO 2020; Crimmins 2015). This includes the need for maintaining and strengthening remaining individual health resources even if older adults already have (chronic) diseases. Effective prevention and health promotion in old age are also beneficial from a health economics perspective to reduce the high national expenditures for health care and long-term care as well as associated social costs. Generally, the creation of healthy living conditions and supportive (age-friendly) environments as well as the promotion of healthy behaviors are both necessary. Health benefits of blue spaces such as encouraged physical activity, increased social interaction and improved mental health can have a powerful impact on older people and on healthy aging, i.e., "the process of developing and maintaining the functional ability that enables wellbeing in older age" (WHO 2020).

This thesis is committed to exploring the blue space-health relationship of older adults and its manifestations in distinct urban contexts (India and Germany). It begins by laying out the theoretical dimensions of the research, including the linkages between water, blue space, health and wellbeing in the urban context (chapter 2.1) and the emergence of healthy blue space research (chapter 2.2) as well as its current limitations (chapter 2.3). In addition, it is explained why population aging in cities is a relevant topic for healthy blue space research (chapter 2.4) and what the state of the art is on this subject (chapter 2.5). This is followed by an overview of the research aim and the research questions (chapter 2.6). The third chapter explains the chosen research design and the methods used. It also describes the data analysis procedure. The empirical results of this study are presented in the fourth chapter: the results of the case study Ahmedabad in India in chapter 4.1 and the results of the case study Ruhr Metropolis in Germany in chapter 4.2. Chapter 5 is concerned with a cross-case analysis and discussion of the results (chapter 5.1), discusses the research strength and limitations (chapter 5.2), and derives recommendations for action (chapter 5.3). Finally, chapter 6 concludes this dissertation.

2 THEORETICAL BACKGROUND

The following chapter outlines the current state of knowledge on the linkages between blue spaces, health and wellbeing with a focus on older people and on the urban setting. While chapter 2.1 first provides a general overview of the subject, chapter 2.2 presents the development of the research strand of healthy blue spaces and thus, the key ideas and theories to understand 'blue health'. As a relatively young research area, there are still many knowledge gaps and limitations, which are described in chapter 2.3. Finally, chapter 2.4 addresses development trends and perspectives that are relevant regarding blue health futures such as aging urban populations and chapter 2.5 reviews the available evidence on the blue space-health relationship of older adults. Chapter 2.6 summarizes the background established in the previous sections and states the aim and research questions of this dissertation.

The literature presented in this chapter was derived using different databases such as PubMed, ScienceDirect and the University Bonn Library database and by snowballing, focusing particularly on compiling the most recent evidence base. As the search was conducted over several years, a last review was carried out in summer 2024. Broad keyword combinations (in title/abstract) such as "blue space AND health" or "blue space AND wellbeing" were used. The search was limited to publications written in German and English.

2.1 Water, blue space, health and wellbeing in the urban context

While there may be undiscovered life forms that do not rely on water, it is essential for human life on earth: "For humans it is a truly fundamental determinant of health; we cannot survive for more than three to four days without access to water" (White et al. 2018: 154). In addition to the necessity of water for biological function and for driving environmental processes on earth, apparent linkages of water to health include the need of water for agriculture/food production and for sanitation and hygiene (ibid. 2018). The indispensability of water for life has been recognized in the declaration of water as a human right by the United Nations (UN) General Assembly in 2010.

The academic literature on linkages between water, health and wellbeing, in recent years, has revealed various ways in which 'the blue' has been used and appreciated as a

provider of healing in ancient and modern societies, including water as a material healing substance ("from crystal purity to muddy lumps", p. 3) and waters as sites of healing (Foley et al. 2019). The curative and restorative utilization of water(s) has encompassed diverse manifestations of health and illness, e.g., treatment and recovery, health maintenance, mental wellbeing and a range of spiritual and religious practices, as well as varied interactions with water, e.g., washing, bodily immersion, drinking spring water or simply being in proximity to water (Doughty 2019; Foley et al. 2019). According to Doughty (2019), the development of conceptions on "the therapeutic blue" throughout history involves a shift from linking the health potential of water rather to its chemical and physical properties to a medium for health-promoting practices, or, in other words, from "(…) water as a 'curative agent' to more recent understandings of water as part of a wider health-promoting environment, mobilized through embodied and sensory engagements on an individual level" (Doughty 2019: 80). This trajectory –from the ancient bathing culture and the development of water-based treatments to the modern culture of spa as "the 21st century health promotion" (Kickbusch & Payne 2003: 275) to today's valuation of blue leisure- and experience scapes (Doughty 2019)– reflects changes in medical knowledge and public health discourses (which increasingly recognize the natural environment as a key site for health and wellbeing), "as well as changes in the positioning of the cure-seeker themselves, between the poles of 'passive patient' and responsibilized neoliberal subject" (ibid. 2019: 81).

With regard to urban development, the availability of waters such as coastlines and rivers has always been economically advantageous (e.g., by enabling energy production, facilitating transport and trade) and therefore constituted a major reason[2] for human settlement (Kistemann & Völker 2014). In fact, the history of urbanization as well as urban health are closely linked to water(s) (Rietveld et al. 2016; Kistemann et al. 2010). Following the transition from urban industrialization to de-industrialization (particularly in high-income countries (HICs)), the utilization of and therefore cities' interaction with blue spaces changed considerably over time, broadly speaking from cities turning back from their waters to cities rediscovering 'the blue' (Kistemann & Völker 2014). The

[2] Other reasons were also decisive for founding cities along waters, e.g., military (using waterbodies as barriers/borders) and health-related (availability of springs) purposes (Kistemann et al. 2010).

industrial use of waters (e.g., for manufacturing, cooling, disposal of waste and transportation) and their associated reconfiguration (e.g., canalization) led to urban blue spaces losing their natural aesthetics and becoming mostly inaccessible for the public (e.g., through privatization and obstructing access) (Kistemann 2018). As a consequence, urban blue spaces disappeared from public awareness and were predominantly linked to danger and health risks (e.g., water-associated diseases) (ibid. 2018; Kistemann & Völker 2014). Yet, blue spaces outside the industrial city continued to be perceived as sites for cure and restoration, as the rise of seaside leisure tourism during industrialization exemplary shows (Gammon & Jarrett 2019). Since the 1970s in North America and the 1980s in Europe, followed by other regions, cities have increasingly reclaimed their waters for public uses such as recreation and leisure activities. This shift is evident in the prominence of 'waterfront revitalizations' on urban planning agendas (Völker & Kistemann 2013). From then on, 'the blue' was recognized as a soft location factor linked to diverse social aspirations (e.g., enhanced urban aesthetics and quality of life), increased economic prospects and as an important element of sustainable urban development (Samant & Brears 2017; Kistemann & Völker 2014).

At the beginning of the 21st century, concerns about advancing climate change have promoted the idea of sustainable development globally, resulting in environmental objectives such as combating biodiversity loss, enhancing ecosystem resilience, improving water quality and supply playing a greater role in urban regeneration efforts (Hall & Barrett 2018; Roberts et al. 2017). In the course of recent urban greening activities –often aided by de-industrialization (Short 2020)– "(…) it can actually be observed that cities worldwide are in the process of also becoming blue" (Brückner et al. 2022: 1). This urban blue-green transformation involves a host of actions and (integrative) approaches. These include biophilic architecture and design, which incorporates natural elements and materials and nature-based solutions for climate change adaptation and mitigation (targeting both existing and new blue-green infrastructure such as river renaturalization, the installation of retention ponds, constructed wetlands, rain gardens). It also encompasses water sensitive urban design seeking to link urban stormwater management and urban development aims (Castellar et al. 2021). Examples from the Netherlands, South Korea and Maldives illustrate a potential scenario in future urban development planning where architecture merges entirely with 'the blue'. This approach brings urban

living onto the water as a response to the rising threat of flooding and is often referred to as "floating architecture or floating cities" (Lewis 2022).

Water has been identified as a highly preferred landscape element in both, natural and built (urban) settings (White et al. 2010), or, in the words of Breen & Rigby (1996), "water is a fundamental attraction in all cultures and among all classes of people" (p. 2). Hence, it is not surprising that water has been appreciated in landscape design throughout history (Kaplan & Kaplan 1989). The use of water for aesthetics and beautification can be seen in the installation of artificial pools in ancient cities, the integration of blue elements (e.g., fountains, ponds) in Chinese gardens since early Chinese dynasties and in 18th-century parks in Western culture and at modern urban plazas (Völker et al. 2016). Design qualities of water include its ability to give structure, to create an illusion of space and mystery and –in the case of larger waterbodies– to offer panoramic views and the opportunity to develop open space axes (Kistemann & Völker 2014; Keswick 2003). In the case of Chinese garden design, the beauty of water entails a spiritual and symbolic significance, e.g., representing peace and harmony and providing contemplative experiences (Keswick 2003).

The previous section indicates the multifaceted nexus of water, health and wellbeing (that is explained in more detail in the next chapter) and that humans have sought "salutogenic first-hand experiences of blue spaces" ever since (White et al. 2018: 154). As argued by Foley et al. (2019), humans might even possess an innate affinity for 'the blue', coined as "hydrophilia". In addition, urban development has been closely linked to and shaped by water and 'the blue' seems to have formed an integral part of prevailing visions of the city (e.g., 'the Green City') and recent urban design plans throughout the world (Short 2020; Völker et al. 2016). Similar to the wide range of reasons for incorporating green space, there are various and often interconnected motivations that drive the creation, regeneration and maintenance of blue space in cities. Some of these motivations endure from the past, while others have evolved more recently and range from fulfilling existential and utilitarian to less explicable needs (Feng & Tan 2017). Based on classifications of the drivers and objectives for urban greening, the following themes beyond 'urban blueing' activities can be distinguished. This non-exhaustive list highlights

the various (environmental, social and economic) interests associated with 'the blue'. Themes include biodiversity conservation, climate change adaptation and mitigation, eco-health and environmental sustainability and water quality and supply. Additionally, they encompass religion, spirituality and symbolism, social hierarchy and relations, social reform and community building, aesthetics and beautification, recreation and leisure, and the protection and promotion of human health and wellbeing/quality of life. Finally, urban entrepreneurship and competitiveness (blue spaces as highly commercially attractive spaces) are also important themes (ibid. 2017; Naumann et al. 2011).

Despite the "centrality of water to human culture" (White et al. 2018: 154) and the recognition of its health-promoting and -protecting properties, which have been supported by increasing empirical research, researchers have observed that the potential of blue spaces for improved public health remains largely unfulfilled in planning practice (Hunter et al. 2023; Smith et al. 2021; Grellier et al. 2017). This includes benefits such as reducing non-communicable diseases (NCDs) associated with sedentary lifestyle and stress as well as reducing heat-related morbidity and mortality. So far, public health is often not or rather implicitly considered in urban blue space development (Brückner et al. 2022; Zhang et al. 2022; Baumeister 2017; Kistemann & Völker 2014). Diverse challenges in policy and practice and difficulties in measuring 'blue health' appropriately hinder the delivery of health-enhancing blue spaces ('blue health promotion') (Hunter et al. 2023). Exceptions to this trend include intentional community-based health interventions involving blue spaces that are planned outside of therapeutics, rehabilitation and care settings. Examples of such interventions consist of smaller-scale projects conducted within the framework of research programs (see Brückner et al. 2022).

A note on terminology: Blue space

Though the term blue space (Völker & Kistemann 2011; "Stadtblau" – Kistemann et al. 2010; White et al. 2010) –in analogy to green space– has found approval (at least in academia) to describe visible (artificial and natural) surface waters, a variety of aquatic landscapes that fall under it have been recognized, including hybrid environments ranging from green-blue to blue-grey settings (Doughty 2019; Foley & Kistemann 2015). In light of its potential therapeutic value, "healthy blue space" (Foley & Kistemann 2015) can be defined as "health-enabling places and spaces, where water is at the center of a range of environments with identifiable potential for the promotion of human wellbeing" (ibid. 2015: 158). Other scholars have applied a broader understanding, including "environments where water may be a secondary aspect of the scene (e.g., fountains or streams)" (White et al. 2010: 483). This understanding acknowledges not only a possible dose-response relationship to be studied, i.e., whether health benefits increase with rising blue exposure (ibid. 2010), but also accommodates to the dynamic (impermanent) types of 'the blue' such as retention basins and swales emerging from recent urban planning and policy approaches. Therefore, it guides the present research work. For 'the urban blue', Völker et al. (2016) have suggested the following classification:

- "large-scale, normally natural waterbodies connected to the ocean, such as seas, bays, gulfs, lagoons or estuaries;
- flowing inland waterbodies like rivers, streams or canals of different sizes, flow rates, turbulence and transported sediments;
- stagnant inland waterbodies like lakes, ponds, pools or basins of different size and turbidity;
- and other urban blue elements which are not waterbodies, such as geysers or waterfalls.

Fountains and other artificial water features are included in one of the last three categories depending on their appearance" (p. 2).

While the term blue space usually considers physically accessible environments, some researchers have included other types of access, i.e., "distally/virtually (being able to see, hear or otherwise sense water") (Grellier et al. 2017: 3). While the health potential of 'the virtual blue' has yet to be further investigated, initial research in this field has demonstrated that virtual nature could promote health and wellbeing in similar fashion to the pathways linking natural environments and health (Lee et al. 2025; White et al. 2018b). For example, Lee et al. (2025) have observed significant physiological relaxation (measured by reductions in blood pressure and heart rate and higher levels of positive emotions) among Taiwanese retirees through virtual reality-based exposure to different waterscapes.

While the present research work has a strong salutogenic focus, linkages of water to ill-health and hydrophobic dimensions related to blue space (hydrophobia) are still critical perspectives to consider (Foley et al. 2019). The inherent pathogenic nature of water is evident in the hazard of drowning, which is one of the most common causes of unintentional death globally (Grellier et al. 2017). As one of the most common natural disasters occurring worldwide, floods pose various (immediate and long-term) dangers to human health and negative mental health outcomes such as suicide have been associated with many waterbodies (Foley et al. 2019b; Paterson et al. 2018). Adverse health effects also include the transmission of pathogens, with water serving as habitats for pathogenic microorganisms such as Vibrio cholera, toxic algal blooms and disease vectors such as mosquitos. Moreover, waters pose risks of human exposure to chemical pollutants from agriculture and industry, to emerging anthropogenic pollutants like active pharmaceutical

ingredients and microplastics (Wilkinson et al. 2022; Foley et al. 2019b; Grellier et al. 2017; Colao et al. 2016). Despite improvements in recent decades, unsafe drinking-water, sanitation and hygiene (WASH) continues to cause a high burden of disease and premature death along with serious socioeconomic consequences, particularly in low- and middle-income countries (LMICs), where deprivations in water supply for basic human survival still needs to be tackled urgently (WHO 2023; Foley et al. 2019; UN & World Bank 2018; Rietveld et al. 2016). According to UN estimates, over 2.3 billion people still lack basic sanitation services and 4.5 billion people have access to inadequate sanitation services[3] (UN 2018). In 2019, water pollution was responsible for 1.4 million premature deaths globally (Fuller et al. 2022). About 89% of all WASH-attributable deaths in 2019 were in Africa and South-East Asia (WHO 2023). As Foley et al. (2019b) conclude: "It is also clear that there is a huge global socio-spatial inequity in the distribution of 'healthy waters' and opportunities to enjoy them, between countries and among population groups within them" (p. 232).

Finally, the recreational use of blue spaces can be associated with harmful health effects, including those unrelated to water itself or primarily linked to green space, e.g., increased risk of sunburn and skin cancer, allergies and poisoning caused by plants, vector-borne diseases non-associated with water and attack risks by animals and fallen trees (Grellier et al. 2017; Zhang et al. 2017). In addition to those negative environmental effects on health, physical and mental harm linked to blue space might arise from individual, spatial and social factors and their intermingling. For example, feelings of fear, danger and discomfort can be caused (among others) by dense vegetation, littering/lacking maintenance, olfactory and noise pollution, perceptions of stigma and discrimination and user conflicts (e.g., blue-green spaces becoming avenues for illegal activities such as drug dealing) (Doughty 2019; Kistemann 2018; Zhang et al. 2017). Therefore, "it should (…) not be assumed that the (…) health benefits of green and blue spaces are universally accessible" (Doughty 2019: 89), even if physical access is given.

[3] Even in predominantly high-income regions such as Europe, 29 million people still do not have access to even basic sanitation and 16 million lack access to basic drinking-water supplies (WHO 2025).

A note on terminology: Health and wellbeing

The present work takes up the health definitions of the WHO, involving its first health definition as "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" (WHO 1948) and health as "a resource for everyday life, not the objective of living". Health is a positive concept emphasizing social and personal resources, as well as physical capacities" (WHO 1986). The latter definition was declared in the Ottawa-Charter for Health Promotion which was guided by the concept of salutogenesis (Antonovsky 1979), focusing on the origins and causes of health instead of the factors causing disease (pathogenesis). The concepts have contrasting perceptions of health and illness: in pathogenesis, disease is the deviation from the norm (health), whereas in salutogenesis, health is a movement along a continuum of total health (ease) and ill-health (dis-ease). According to Antonovsky (1993), the sense of coherence is central for the experience of health, composed of the ability to assess and understand the situation people find themselves in (sense of comprehensibility), to find a meaning to move towards health (sense of meaningfulness) and to have the capacity to do so (sense of manageability). Since this PhD study comprises empirical investigations in two distinct cultures, it is important to recognize the cultural context of health and that perceptions and experiences of health can change as culture changes (Sobo & Loustaunau 2010). While the comprehensive understanding of and holistic approach to health involving physical, social and mental wellbeing, influenced by biological, societal and environmental determinants, is widely accepted, "the precise interpretation of wellbeing is unclear" (WHO 2021b: 7). "Wellbeing as a stand-alone concept has been a subject of philosophical and scholarly attention for millennia. Wellbeing applies naturally to both individuals and societies" (ibid. 2021b: 8). On an individual level, wellbeing has been defined (among others) as "the balance point between an individual's resource pool and the challenges faced [both encompassing psychological, social, physical ones]" (Dodge et al. 2012: 230). Societal wellbeing is considered greater than the sum of individual wellbeing, a holistic goal of development considering psychological, physical, social, economic and environmental dimensions of wellbeing (WHO 2021b). As reflected in the uptake of wellbeing at national and international level (e.g., the OECD's Economy of Wellbeing, WHO's Geneva Charter for Wellbeing), wellbeing is framed as a positive aspirational aim and is inextricably linked to health (ibid. 2021b).

2.2 The emergence of healthy blue space research: Theoretical and methodological approaches to study 'blue health'

Despite the appreciation and notions of the healing virtues and positive effects of water on health and wellbeing throughout history, research has been for a long time concerned with harmful human-water-interactions (Doughty 2019; Foley et al. 2019b; White et al. 2018; Grellier et al. 2017). Particularly compared to green space, the health-promoting and -protecting (salutogenic) qualities of 'the blue' have received relatively little attention and systematic investigation in environment-health research in the past (White et al. 2018; Grellier et al. 2017; Völker & Kistemann 2011). Yet, in recent times, the scientific understanding of 'blue health'[4] has grown significantly, with studies within and beyond

[4] The term 'blue health' has been introduced by Miller et al. (2012) to describe relationships between water in the landscape and health and wellbeing. It was later used to title the first research project systematically exploring the health benefits of interacting with blue spaces (Grellier et al. 2017). In the present work, 'blue health' refers to all positive relationships between blue spaces and health and wellbeing, i.e., benefits for health and wellbeing derived from blue space exposure.

health geography establishing and shaping the research strand of 'healthy blue space' complementary to green space research (Zhang et al. 2022; Doughty 2019; Foley et al. 2019; Foley & Kistemann 2015). "This growing literature has begun to build awareness of how blue landscapes serve as important sites of meaning and health-related practices of different people, at different times, or under different circumstances" (Doughty 2019: 80) and ongoing research continues to explore the role of water as part of healthy living environments and contemporary health practices (ibid. 2019). Leading scientific experts in the field agreed that "a new hydrophilic turn" (Foley et al. 2019: 1) towards the health-enabling potential of blue spaces has finally emerged. An important result of this development is the recognition that blue spaces possess specific properties that can improve individual and public health, indicating that 'the blue' is not simply a part of green space. Despite many commonalities and overlaps in how health is enabled, it is essential to consider place differences and the distinct benefits and risks with each type of space (White et al. 2020; Foley & Kistemann 2015).

As suggested by White et al. (2018), the existing evidence base on linkages between blue space, health and wellbeing can be classified into four broad scientific approaches involving different methodologies, respectively (see table 2.1):

The preference-based approach

The *preference-based approach* examines people's blue landscape preferences derived from direct questioning (stated preferences) or from their actual choices or behaviors (revealed preferences) (ibid. 2018). Using this approach, researchers have been able to show that people generally prefer urban environments containing water over non-blue urban settings and that those preferences do not differ significantly from rural landscapes without water, "suggesting that urban landscapes could be significantly enhanced by the addition of aquatic elements" (ibid. 2018: 154; White et al. 2010). In line with previous studies, Luo et al. (2022) applying a choice experiment with manipulated images showed that the presence of water was the most important characteristic for perception of and interaction with nature; suggesting that "(…) priority should be given to providing water features to increase the preference for nature experience (…) in blue-green spaces, followed by bushes, upkeep, and trees" (p. 21). While Ballesteros-Olza (2024) provided

supporting evidence for people's preference for urban blue spaces over urban non-blue spaces, they found, however, no conclusive evidence regarding the presence of ornamental water elements (e.g., fountains, small ponds).

Studies applying economic valuation methods such as hedonic pricing have revealed that views of and the proximity to water significantly affect home sale prices and room rates, i.e., people's preference for water is reflected in a higher willingness-to-pay (Peng et al. 2023; Knapp & Vandegehuchte 2022; Sander & Zhao 2015; Lange & Schaeffer 2001; Luttik 2000). Yet –as noted in a study in the metropolitan region of Minnesota– inner-city variations in the preferences for blue (and green) spaces (indicated by the willingness-to-pay) are important to consider (Sander & Zhao 2015). Interestingly, the authors discovered that less wealthy individuals might value views of water and proximity to parks more than their wealthier counterparts. Additionally, the landscape context surrounding a blue space influences its value, with water views being more highly valued in (protected) natural areas as compared to other settings such as industrial surroundings (ibid. 2015). Recent evidence from a systematic review on the economic valuation of accessing and using blue and green spaces to improve public health suggests that people are even willing to pay for improving local environments to gain the health benefits of undertaking leisure activities in blue and green spaces (Lynch et al. 2020). "In sum, the results of many decades of preference-based work suggest that people like being near (clean) blue landscapes" (White et al. 2018: 155).

The experiential and experimental approaches

Both, *the experiential and the experimental approaches*, assume that there should be demonstrable health benefits from specific exposures to blue spaces. Within the *experiential approach*, people's lived experiences such as uses of and feelings associated with blue spaces are sampled, e.g., by reflecting on specific visits or favorite places, by measuring emotional states before/during/after blue space visits or by applying open-ended approaches in situ (ibid. 2018). The provision of insights into people's health-related choices and the sensitivity for the diversity of blue space experiences (that deepens the understanding of how 'blue health' is produced) are seen as strengths of this approach; yet, it is criticized that potential selection effects (people choosing to go to places they already know they like) confound the positive experiences reported at blue spaces and

thus limit any generalization of the findings (Doughty 2019; White et al. 2018). Building on this criticism, studies using the *experimental approach* expose people randomly to different landscapes and compare their reactions to various types of 'the blue' (White et al. 2018).

Studies using the experiential approach have been able, among others, to demonstrate the restorative qualities of blue spaces (more evident compared to urban green space) and to show a positive emotional bonding (sense of place) people have to blue spaces, as e.g., reflected in descriptions of positive memories and expressions of strong and enduring connections to 'the blue' (ibid. 2018; Bell et al. 2015; Völker & Kistemann 2013, 2015; White et al. 2010). In addition, findings of such studies include positive emotional states associated with blue space visits, suggesting that people are happiest in marine and coastal settings (MacKerron & Mourato 2013). Experiential research has demonstrated the importance of cultural determinants of health, e.g., aesthetics and the symbolic significance of blue spaces (White et al. 2018). "In sum, people report a range of positive health-related outcomes in blue landscapes" (ibid. 2018: 156).

With regard to the experimental approach, White et al. (2018) concluded that much of the work done so far has been inconclusive. Despite landscapes containing water were found to be more attractive and interesting, it has not been possible to confirm this by consistent physiological measurements and to capture potential differences between blue and green spaces. "In sum, work conducted using the experimental approach (…) has offered less support for the notion that blue landscapes offer particular psychophysiological benefits over and above green landscapes" (ibid. 2018: 156). Yet, there is evidence that that people tend to exercise longer in blue than in green or other urban settings (Elliott et al. 2015) and that people are more willing to repeat exercises in blue than in green landscapes (White et al. 2015), echoing the results of the preference-based approach. Nicolosi et al. (2020) have provided recent experimental evidence that blue spaces are restorative environments as the study participants reported significantly higher average perceived restoration scores from a coastal compared to an urban walk. Similarly, Vert et al. (2020) found that randomly assigning healthy adults to different environments resulted in significantly improved wellbeing and mood responses after blue

space walks compared to urban non-blue sites; however, they did not observe any significant cardiovascular responses.

The quantitative spatial approach

The *quantitative spatial approach* hypothesizes that health benefits from blue space exposure are cumulative, e.g., that people living closer to 'the blue' should be healthier and happier compared to those living further away. Thus, this approach explores relationships between residential environments and health outcomes, typically using large datasets. Four generally recognized pathways between nature and health drive the assumption that living closer to blue spaces is linked to greater (physical and mental) health: (i.) ecosystem services and environmental quality, (ii.) increased physical activity, (iii.) stress recovery/mental wellbeing and (iv.) social interaction/improved social capital (White et al. 2018). These mediating salutogenic mechanisms have been applied to investigate how blue spaces promote health and wellbeing (e.g., Georgiou et al. 2021; White et al. 2020; De Bell et al. 2017) and are outlined further below.

Research findings indicate that living closer to the coast is indeed associated with greater life satisfaction (Brereton et al. 2008) and self-reported general and mental health (Hooyberg et al. 2020; Garrett et al. 2019; Pasanen et al. 2019; Dempsey et al. 2018; White et al. 2013; Wheeler et al. 2012); yet, there is also some evidence not confirming those coastal health advantages (e.g., Sandifer et al. (2021) for general health, White et al. (2021) and Hooyberg et al. (2020) for mental health and White et al. (2013) for life satisfaction). Studies including coastal and inland waterbodies have shown a positive association between greater exposure to blue spaces and better mental health (e.g., Pasanen et al. 2019; Gascon et al. 2017) and less ill-health (De Vries et al. 2003) and between higher visit frequency/longer blue space visit duration and better subjective mental wellbeing (e.g., higher levels of happiness) (Garrett et al. 2023; White et al. 2021). In addition, positive health outcomes seem to be derived from greater blue space visibility, as e.g., shown by Garrett et al. (2019b) (having residential blue space view linked to better self-reported general health); Dempsey et al. (2018) (largest coastal view linked to depression reduction) and Nutsford et al. (2016) (higher levels of blue space visibility associated with lower psychological distress). However, longitudinal analyses are scarce and, if available, could not consistently show that changes in blue space

exposure over time improved public health outcomes (e.g., Geary et al. 2023: no evidence found that changes in blue and green spaces impacted on common mental health disorders, but living in bluer areas was associated with a reduced likelihood of seeking help for common mental disorders).

Regarding freshwater blue space, more spatial approaches are needed to quantify the health and wellbeing benefits (McDougall et al. 2020). Yet, there are several studies on urban freshwaters that provide supporting evidence for cumulative health effects of blue space. For example, Völker et al. (2018) found that the use frequency of urban blue spaces is linked to better (self-assessed) mental health. Likewise, Dzambov (2018) reported that residential blue space in a Bulgarian city correlates with lower levels of anxiety/depression in both, a cross-sectional (baseline) and a longitudinal (follow-up) analysis. In a population-based retrospective cohort study over a 10-year period, Georgiou et al. (2022) found that living near a canal modified the risk of mental health disorders deriving from socio-economic deprivation by 4-6%, supporting "(…) the notion that living near blue space could play an important role in reducing the burden of mental health inequalities in urban populations" (p. 1).

"In short, there is a growing body of evidence suggesting that people living near blue landscapes do tend to be healthier and happier than those who do not live near water and this might be through relatively simple mechanisms such as getting out more and engaging in more exercise, precisely because people like spending time in these environments" (White et al. 2018: 158). Nonetheless, researchers widely agree that the existing evidence supporting a *causal* relationship between blue space exposure and various health and wellbeing outcomes such as cardiovascular diseases, diabetes, obesity or mental health biomarkers is limited (Hermanski et al. 2021; Gascon et al. 2017; Gascon et al. 2015; Triguero-Mas et al. 2015). For example, in their review on quantitative studies of outdoor blue spaces, human health and wellbeing, Gascon et al. (2017) concluded: "Based on the few studies available, the quality of the studies, the heterogeneity in both study design and results obtained (…), we classified the evidence of an association between outdoor blue space exposure and general health as 'inadequate' to make a firm conclusion for either inland or coastal waters at this time" (p. 10). This view is supported by Geneshka et al. (2021) who found that "(…) there is currently minimal evidence of a

consistent, significant longitudinal relationship between exposure to green and blue space and mental and physical health. Where statistically significant relationships existed, the associations were quite weak" (ibid. 2021: 20). However, in their review of longitudinal observational data, only four out of 44 studies focused solely on blue space.

Along the same lines –yet in parts in contrast to Gascon et al. (2017)– a recent systematic literature review and meta-analysis on *urban* blue spaces (fresh and salt water bodies) and health showed a beneficial association between residential proximity to blue spaces and the health indicators all-cause mortality, general health, obesity and self-reported mental health and wellbeing (Smith et al. 2021). The authors reported that the effect sizes were small, but significant, and the studies included of good quality (ibid. 2021). Xie et al. (2021) reviewed the health-related outcomes of interacting with artificial water features (ponds, fountains, streams, waterfalls, water play features) and concluded that despite reports about mental and behavioral benefits, direct health outcomes have not been well documented. Yet, the proximity to blue spaces was not systematically considered in this study.

Table 2.1: Classification of scientific approaches to exploring 'blue health' (White et al. 2018)

	Preference-based approach	**Experiential approach**	**Experimental approach**	**Quantitative spatial approach**
Main research questions	Which blue spaces do people like/dislike?	How do people feel at blue spaces?	What are the relative benefits of different types of blue spaces compared to other settings?	Are there cumulative health and wellbeing benefits from living near blue spaces?
Examples of methods	Revealed preferences (e.g., house prices), Stated preferences (e.g., photo ratings)	Post visit surveys and interviews, experience sampling (in situ)	Controlled comparison of reactions to different environmental settings (often have a stress induction to explore restorative properties of blue spaces)	Analysis of large datasets where health data has been merged with residential geographical information

"Generally speaking, there seems to be more evidence in support of an association between exposure to blue landscapes and positive health outcomes in the preference,

experiential and quantitative spatial approaches than the experimental approach; however, boundary conditions were noted across all approaches" (White et al. 2018: 158).

Techniques from economics can be applied to estimate the health value of blue spaces, e.g., assessing the cost of illness using quality-adjusted life years (QALYs)/disability-adjusted life years (DALYs) to enable comparisons between changes in different health states (WHO 2023b). For example, in a pre-/post intervention study, Vert et al. (2019) have shown that improving access to an urban river has significantly increased the physical activity level of community residents in Barcelona which corresponds to 11.9 DALYs and an annual cost reduction of 23.4 million euros. Along the same lines, Papathanasopoulou et al. (2016) found that the UK (United Kingdom) economy could benefit from about 176 million pounds in annual healthcare savings assuming that more than 400,000 people engage in physical activities in aquatic environments (beginning from state of inactivity) and that the quality of life of those adults would increase by about 24,853 QALYs. Several pre-/post and intervention studies add findings to such health valuations, e.g., Van den Bogerd et al. (2021) (showing significant higher life satisfaction and positive wellbeing after a co-created urban beach regeneration) and Satariano (2021) (provision of perceived restorative benefits and positive therapeutic experiences among people after the restoration of an urban fountain). A review of urban blue space regeneration projects has demonstrated threefold public health effects, including behavioral changes toward healthier lifestyles, healthier urban environments and beneficial policy changes (e.g., integrated actions on public health) (Brückner et al. 2022).

The increasing conceptualization of the linkages between blue spaces, health and wellbeing has made use of different theories and several models have been proposed to explain the blue space-health relationship. In the following, some of those commonly used in healthy blue space research are presented in more detail.

The concept/theory of therapeutic landscapes

Introduced by the geographer Wilbert Gesler in 1992 (and subsequently further developed), the concept/theory[5] of therapeutic landscapes has been widely established in

[5] Kistemann & Falkenberg (2025) argue to speak of a "theory" of therapeutic landscapes.

health geography[6] to describe how landscapes and places can maintain and enhance human health and wellbeing (Rathmann 2021). Thus, a therapeutic landscape is used as a geographic metaphor for aiding to explain how healing processes unfold at certain places (Gesler 1992). While the focus of interest was initially on the healing effects of extraordinary environments (e.g., thermal springs, pilgrimage sites), the theory was eventually applied to everyday landscapes and their health-enhancing qualities (Kistemann 2016). Gesler's understanding[7] of therapeutic landscapes encompasses not only the natural but also the built environment, the symbolically charged environment and the social environment (Rathmann 2021). The theory includes different dimensions or interpretations of landscapes that overlap as layers within a therapeutic landscape such as landscapes as people-environment-interactions (the built/naturalistic view), a humanistic perspective, which recognizes that places acquire a specific meaning for individuals/groups/societies (e.g., through symbolic or spiritual attributions, thereby complementing the objectively describable space) and a structuralist perspective, which views landscapes as social constructs produced by social institutions. A further perspective, the post-structuralist view, considers landscapes as discursive constructions of knowledge and experience (Rathmann 2021; Kistemann 2016; Gesler 1992). The relative importance of those layers varies from situation to situation and between different user groups (Kistemann 2016; Claßen & Kistemann 2010).

The success of Gesler's work has been related to the criticism of the long-time prevailing biomedical understanding of health/illness and the adoption of cultural geographies in health geography ('cultural turn') since the 1980s/90s which resulted in a revised view on the significance of the spatial dimension for people and their health (Kistemann 2016). As noted by Gesler himself, the therapeutic landscape theory encourages a holistic analysis of places and works well with the salutogenic view proposed by Antonovsky, despite the term 'therapeutic' implying a pathogenic background (Völker & Kistemann 2011; Gesler 2005).

[6] As noted by Conradson (2005), the literature on therapeutic landscapes in healthy geography is complemented by work on restorative environments in environmental psychology and on health-enabling settings in landscape architecture.

[7] Gesler (1993) defined therapeutic landscapes as "those changing places, settings, situations, locations and milieus that encompass the physical, psychological and social environments associated with treatment or healing; they are reputed to have an enduring reputation for achieving physical, mental, and spiritual healing" (p. 171).

Based on the criticism that empirical research tends to attribute intrinsic therapeutic properties to certain environments and the associated likelihood to equate the physical presence at therapeutic landscapes with the unproblematic uptake of their positive effects, Conradson (2005) highlights the need to consider individual variations in experiencing landscapes. While not denying the therapeutic qualities of certain landscapes, he urges that the analysis of therapeutic landscapes must therefore be extended beyond the physical properties to an individual's interaction with the landscape and differentiates between a therapeutic landscape as a setting (e.g., healing effects of clean air, water) and a therapeutic landscape experience. In the latter, people perceive health benefits from interacting with a landscape[8]. He argues that a landscape experience should be best understood as a relational outcome, "(…) something that emerges through a complex set of transactions between a person and their broader socio-environmental setting" (Conradson 2005: 338). The complex and multifaceted interactions between a person and a landscape involve immediate bodily experiences but are also subject of subsequent interpretations. Given the interconnectedness of body and mind, the physiological and interpretative elements of a therapeutic landscape experience are difficult to disentangle (ibid. 2005). For exploring those relational dynamics between places and health, Conradson considers qualitative research methods to be particularly appropriate. Further, "a comprehensive relational analysis needs to consider not only immediate practices of self-landscape encounter, but also the broader web of socio-natural relations within which an individual is imbricated" (ibid. 2005: 338). Taking up Conradson's arguments, Gesler (2005) concludes:

> *"Therapeutic landscapes (...) may be perceived differently by different people; what is therapeutic must be seen in the context of social and economic conditions and changes. (...) Ideas about what is therapeutic vary in time as well as place. This means that the idea of therapeutic landscape is 'context dependent', as well as variable between individuals"* (p. 296).

[8] This contention is reflected in the concept of "sense of place", describing the subjective emotional bonds (values, meanings, symbols) persons/social groups can have to places and that are linked to the experience of wellbeing (Kistemann 2016; Eyles & Williams 2008). The concept is supported by neuroscientific findings: The ability to recognize and imagine places and to associate emotions and meaning to them stems from the stimulation of emotional parts of the limbic system (Gebhard & Kistemann 2016). As a comprehensive concept, sense of place includes similar aspects such as "place attachment", "place identity" and "place dependence" (Hunziker et al. 2007).

Therapeutic landscapes can therefore range from environments with an obviously high aesthetical value to those whose health potential may not even be perceptible to outsiders; they can be perceived as health-promoting and -limiting at the same time[9] (dependent on the people experiencing it) (Kistemann 2016). This has also been shown by experiential research on blue spaces (e.g., Finlay et al. 2015). As noted by Conradson (2005), it might be more appropriate to speak of "potentially therapeutic landscapes" (p. 346).

Völker & Kistemann (2011, 2015) developed a two-dimensional matrix of therapeutic landscapes (see figure (fig.) 2.1) incorporating the above-mentioned dimensions of landscapes (dimensions of substantiality) and four dimensions of health-related appropriative processes occurring in a place, which can be analyzed on the four dimensions of substantiality. The dimensions of appropriation –though not distinctly separated and able to coincide– describe the ways of interaction (usage, experience) with landscapes, which can potentially generate positive or negative health effects:

- contemplative/aesthetic experiences and sensory perceptions (experienced space),
- active and passive (recreational) activities (activity space),
- social encounters/relations, shared rituals (social space) and
- symbolization/sense of place (symbolic space) (Völker & Kistemann 2011, 2015).

While not being specific for blue spaces, the conceptual framework has been used in empirical investigations to structure the salutogenic experiences of blue spaces, e.g., in Völker & Kistemann (2013), Bell et al. (2015); Pitt (2018) and Smith et al. (2022).

[9] In fact, the causalities explaining the therapeutic potential of landscapes are subject of controversy and a conceptual model based on empirical results is still missing. Given the inconclusive evidence, it remains unclear which specific aspects of places can be regarded as particularly health-promoting; discussed are physical characteristics, psychophysiological, social, aesthetic and relational dimensions (Kistemann 2016).

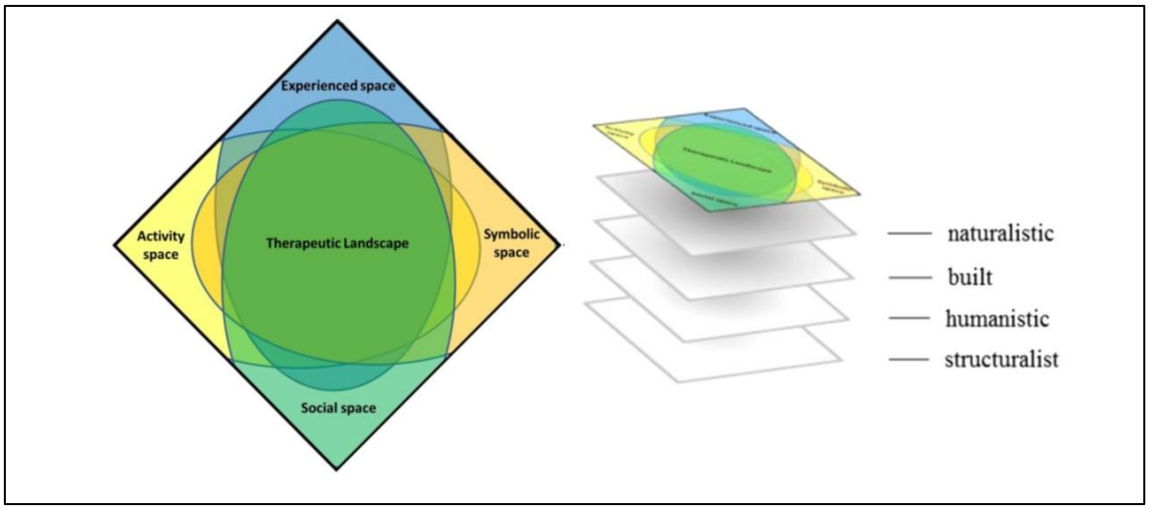


Figure 2.1: The two-dimensional therapeutic landscape matrix according to Völker & Kistemann (2011, 2015) (Völker & Kistemann 2015: 197f)

Despite the circumstance that the health outcomes of therapeutic landscape experiences are unpredictable and difficult to measure, researchers such as Doughty (2019) argue for using the therapeutic landscape theory in studies on 'blue health' as it draws our attention to "the cultural, historical and individual factors influencing people's encounters with blue spaces, and (…) on the experiential." This "(…) may open opportunities to integrate a differently measured 'valuation' of more intangible aspects that promote health and wellbeing in blue landscapes" (Doughty 2019: 85). Like Conradson, Doughty (2019) holds the view that "the richness of experience [of spending time in nature] is best captured by qualitative methodologies, which are sensitive to the powerfully emotional and sensory nature of such experiences" (p. 85). She highlights that many studies on nature and health as well as other theoretical foundations such as the concept of ecosystem services tend to neglect the lived meanings of places, the actual experience of engaging with nature ("What it is about immersion in natural environments that make some people feel better, physically, mentally, emotionally, spiritually?") and alternative narratives of value (Doughty 2019: 85). A broader perspective has been adopted by Kistemann (2018), who recognizes commonalities between the concepts of therapeutic landscapes and ecosystem services and considers them as complementary rather than competing to systematically consider the health impact of blue spaces. According to him, the more natural scientific concept of ecosystem services is particularly suited for taking up aspects

of health protection while the cultural scientific theory of therapeutic landscapes is particularly appropriate for capturing aspects of health promotion (Kistemann 2018).

The concept of ecosystem services

Ecosystem services (ESS) have been defined as "the benefits people obtain from ecosystems" (Millennium Ecosystem Assessment 2005: 1). The Common International Classification of Ecosystem Services (CICES) provided an updated definition according to which ESS are "the contributions that ecosystems make to human well-being" (Haines-Young & Potschin 2018: 3). Those contributions arise from the interaction of biotic and abiotic processes and refer to 'what ecosystems do' for people, in the sense of 'final' outputs or products consumed or used by people (ibid. 2018). While the CICES still recognizes the original differentiation of ESS by the Millenium Ecosystem Assessment (with the exception of the supporting services[10]), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has recently superseded this classification into provisioning, regulating, supporting and cultural services arguing that many services fit into more than one category (e.g., food is considered a provisioning and a cultural service) (IPBES 2021). Fig. 2.2 illustrates which services are provided by blue spaces. No distinction was made between marine/coastal and freshwater ecosystems or between different blue space types, yet there are distinct variations in the ecosystem services provided.

[10] In the CICES-classification, the supporting services are considered as part of the underlying structures, processes and functions that characterize ecosystems ("regulation & maintenance") since they are only indirectly consumed or used and may facilitate the output of many 'final outputs' (Haines-Young & Potschin 2018).

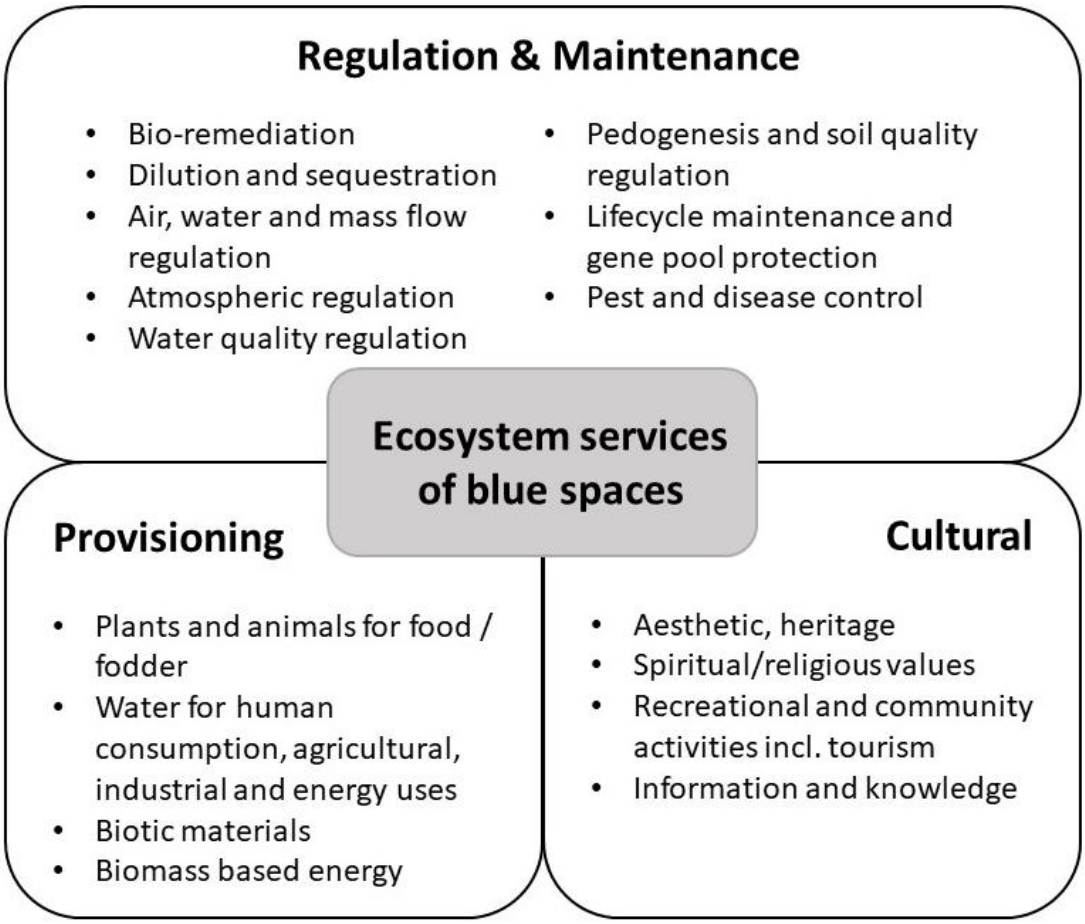


Figure 2.2: Classification of ecosystem services of aquatic ecosystems (author's compilation according to Haines-Young & Potschin 2018)

Generally, the concept of ESS understands ecosystems as the basis for human wellbeing since human health depends in many regards on environmental influences (Rathmann 2021). Thus, it has been widely established to communicate societal dependence on nature and attract support for nature conservation. It has also transcended the scientific domain to reach policymaking and the private sector where it has been increasingly used for economic decision-making by monetizing nature's services (ibid. 2021; Gómez-Baggethun et al. 2009). Not least because of the economic valuation of ecosystem services, the concept is considered a key framework for driving a new form of valuation of healthy living environments (ibid. 2021; Doughty 2019). Yet, for the 'everyday health benefits of outdoor recreation', researchers have noted that ecosystem service valuation is still underprioritized in urban planning and policy (Kronstedt et al. 2023).

With regard to blue spaces, the ecosystem service perspective has been extensively used in studies to describe the role of aquatic environments for health and

wellbeing. However, comparatively little research has been done on cultural ecosystem services and a conceptual model integrating mental health effects into the ESS framework has only recently been applied to recreational blue space visits (Garrett et al. 2023).

Other concepts/theories

As mentioned earlier, Foley et al. (2019) have pointed to a potential innate tendency for 'the blue', coined as hydrophilia. This contention refers to the *theory of biophilia* (Wilson 1984) which the researchers extend to water/blue spaces as "a logical leap" (Foley et al. 2019: 4). Originally used by the psychoanalyst Erich Fromm (1964) to describe 'the love of life and of all that is alive', Wilson (1984) defined biophilia as "the innate tendency to focus on life and lifelike processes" (p. 1) to explain the affinity of humans to other living beings. Together with others such as the savanna hypothesis[11], the biophilia theory provides biological explanations for the strong preference humans seem to have for (certain) natural environments and other living beings based on evolutionary history (Rathmann 2021; Feng & Tan 2017). Accordingly, landscape preferences (aesthetic value attributions) and affective/emotional/cognitive reactions to landscapes developed partly from the survival requirements of early humans given that the history of humankind has always taken place in close contact with the surrounding natural environment (Wilson 1984). This genetic imprinting during evolution could explain why humans across all cultures continue to seek contact with nature for mental and physical wellbeing (Rathmann 2021). Yet, despite some empirical work supporting such theories, "studies on both genetically anchored and developmental influences on such preferences with complex interactions of both are missing so far" (ibid. 2021: 19).

Further theoretical support for explaining the beneficial effects of natural environments is provided by the attention restoration theory (ART) (Kaplan & Kaplan 1989) and the stress reduction theory (SRT) (Ulrich 1983). Both describe how/why people gain restoration from visible or physical exposure to landscapes[12], which has been

[11] The savanna hypothesis implies that people across cultures retain a genetically based preference for savannah-like open landscapes with loose tree cover as those represented the habitats of early humans.

[12] According to the ART, natural environments such as blue spaces draw an individual's attention, which in turn facilitates brain inhibitory mechanisms and provides recovery from mental fatigue, meaning that people can concentrate better after exposure to nature. The SRT adds an evolutionary biological argument by implying that humans can process natural stimuli more easily than artificial ones, because the human brain used to be exposed to natural stimuli during evolution. Thus, natural stimuli bring about positive emotions and reduce the individual stress response, whereas artificial stimuli tend to be more exhausting.

demonstrated in several studies, e.g., experimental research on patients' recovery and their need for analgesics in hospitals with versus (vs.) without views of nature, including water views (e.g., Ulrich et al. 1993, Ulrich 1984), or on patients' perception of pain during dental treatments with vs. without coastal virtual reality interaction (e.g., Tanja-Dijkstra et al. 2018).

Four mediating salutogenic pathways linking blue space and health

As mentioned previously, four mediating salutogenic mechanisms[13] have been commonly recognized that link nature to health, which are basically reflected in the above-mentioned concepts and theories. In the following, scientific evidence regarding those pathways between blue space and health is presented (focusing on recent systematic/literature reviews and studies on the urban context, if available).

(i.) Ecosystem services and environmental quality

Urban living is often associated with unhealthy environments involving human exposure to 'urban stressors' such as high (traffic) density and noise, heat islands, poor air quality and a lack of green space (Kistemann 2018; Van den Bosch et al. 2018). Although relatively little research has yet investigated the ecosystem services and environmental quality pathway, data from several studies suggest that certain ecological aspects of blue spaces might be important for mitigating those stressors and for improving the environmental quality in cities (Georgiou et al. 2021; Kistemann 2018; White et al. 2018). Previous studies have found that blue spaces have the potential to buffer temperatures and can therefore mitigate urban heat islands; thus, helping to reduce the heat-related morbidity and mortality, particularly in vulnerable populations (Völker 2022; Georgiou et al. 2021; White et al. 2018; Kistemann 2018; Gunawardena et al. 2017). For example, in a meta-analysis, Völker et al. (2013) –comparing different urban blue spaces with non-blue sites at defined distances in the same city across different countries– calculated an average cooling effect of 2.5° Celsius during the warmest months, with larger blue spaces

[13] Other classifications exist, e.g., the WHO (2016) suggests nine possible pathways linking urban green spaces (including some types of blue space) and health. This approach particularly considers a further differentiation of the pathway (i.) ecosystem services and environmental quality into improved functioning of the immune system, anthropogenic noise buffering and production of natural sounds, reduced exposure to air pollution, reduction of the urban heat island effect, optimized exposure to sunlight and improved sleep. Another pathway considered is enhanced pro-environmental behavior (WHO 2016).

providing the largest temperature differential. Similarly, Sun & Chen (2012) showed temperature reductions of 0.58° Celsius compared to green spaces and of 3.74° Celsius compared to built-up areas. Greenery and green spaces surrounding 'the blue' can further add to its cooling potential (Bowler et al. 2010). A recent Chinese study found significant protective associations between blue (i.e., lakes) and green space exposure and heat-related cardiovascular mortality risks, specifically indicating reductions of 20% and 14%, respectively (Hu et al. 2024). In addition, high levels of blue space exposure (rivers and coasts) lowered the risk of cold-related mortality risks due to warming effects (ibid. 2024). Despite the significant cooling effects identified, other authors (e.g., Ampatzidis & Kershaw 2020) argued that existing studies tend to overestimate the cooling potential of blue spaces and that blue spaces may provide warming at night, thus even reinforcing urban heat. According to a review on thermal effects of standing urban blue spaces, the size and shape of blue spaces as well as the distribution of wind directions are important influencing factors for the cooling achieved (Ampatzidis & Kershaw 2020).

While there are findings suggesting that blue spaces might be able to reduce urban air pollution (by improving ventilation and near-ground air exchange, increasing humidity), to objectively or subjectively mask unpleasant, stress-inducing sounds and to provide pleasant sounds as well as to enhance light conditions of adjacent areas by minimizing shadowing (e.g., Georgiou et al. 2021; Qi et al. 2021; Kistemann 2018; Li et al. 2012; De Coensel et al. 2011; Alvarsson et al. 2010; Jeon et al. 2010; Kistemann et al. 2010; White et al. 2010; You et al. 2010; Kuttler et al. 2002; Chazette & Liousse 2001), the available evidence remains inconclusive. For example, blue spaces might also enhance incident sunlight through reflection, may cause acoustic aversion to humans and seem to be less capable of reducing air and noise pollution compared to green spaces (Patón et al. 2020; Klompmaker et al. 2019; Kistemann 2018; Rådsten-Ekman 2015). Shafray & Kim (2017) reported that the restoration of a stream in Seoul has reduced fine particle pollution by 35% which decreased the risk of local residents suffering from respiratory diseases by more than half compared to the risk of other communities. In contrast, Hooyberg et al. (2020) did not find evidence supporting significant better health outcomes by the mediating effect of reduced air pollution by blue spaces. In their cross-sectional study comparing the (self-reported) general health of Belgian citizens living in inland areas vs. those living near to the coast (and between different coastal proximity

radii), air pollution (annual mean PM10 concentrations) was lower within 5 kilometers (km) from the coast but not statistically associated with better general health.

Further health benefits discussed in the scientific literature are higher levels of vitamin D due to the increased amount of ultraviolet radiation in water which contributes to the prevention of several autoimmune and cardiovascular diseases (Cherrie et al. 2015; Collins & Kearns 2007) and potential positive physiological, immunoregulatory and mental effects (e.g., activated immune system, enhanced lung function, reduced blood pressure and symptoms of allergic asthma and mental disorders) caused by high amounts of negative ions in and near water (Andersen et al. 2022; Ryushi et al. 1998). Yet, the evidence on those mechanisms is very weak and important influencing factors such as the blue space type and behavioral factors (e.g., sun protection) have to be considered (Völker 2022; White et al. 2018). Lastly, direct and indirect health benefits are provided by other ecosystem services such as blue spaces as resources for freshwater and energy and economic gains from tourism and industry (Kistemann 2018).

(ii.) Increased physical activity

Despite some contrasting findings (e.g., Hooyberg et al. 2020; Ying et al. 2015) and a systematic review (Gascon et al. 2017) concluding that the evidence for a positive association between blue space exposure and higher physical activity is 'limited' given the methodological heterogeneities between the studies included, this pathway is still regarded as the best-studied in healthy blue space research (Georgiou et al. 2021; White et al. 2020; White et al. 2018). In fact, a more recent systematic review and meta-analysis found "(…) that the development of blue space within shorter distances to residences and increasing the amount of blue space within neighborhoods could significantly benefit health through the mediating pathway of physical activity" (Georgiou et al. 2021: 33). All 18 papers were rated of very good quality (ibid. 2021). While the majority of studies on blue space exposure and physical activity has been conducted in coastal areas, there is also growing evidence for inland/urban waterbodies encouraging physical activity, possibly more than green spaces (e.g., Ballesteros-Olza et al. 2024; Afentou et al. 2022; Haeffner et al. 2017; Perchoux et al. 2015; Karusisi et al. 2012) (Georgiou et al. 2021; Gascon et al. 2017).

Despite blue spaces offering unique opportunities for activities such as swimming, canoeing and fishing, research has further shown that much of the physical activity undertaken at blue spaces are actually land-based activities (particularly walking) and that walking along 'the blue' partially explains links between blue space proximity and mental health benefits (Murrin et al. 2023; McDougall et al. 2020; White et al. 2020; Pasanen et al. 2019). In a study exploring the mediating role of physical activity in England, Pasanen et al. (2019) reported that living closer to the coast eases the access to watersports, but that relatively few people engage in them and that they did not account for positive associations to health. Several qualitative studies have confirmed that (access and exposure to) blue spaces encourage physical activity (Xie et al. 2021). For example, urban canals and riverfronts have been identified as well-attended spaces for light and moderate physical activities such as (dog) walking, running, cycling as well as for passive recreation and commuting (Smith et al. 2022; Vert al. 2020; Pitt 2018; Vaeztavakoli et al. 2018; Völker et al. 2016; Völker & Kistemann 2013, 2015).

(iii.) Stress recovery/Mental wellbeing

As mentioned above, there is a significant and growing evidence base showing that spending time at, viewing and living nearby blue spaces is associated with various positive mental health outcomes and that these effects are potentially cumulative. In addition, several studies have shown that people derive emotional benefits from blue spaces and that 'the blue' entails high aesthetic and symbolic values. The following section presents a more detailed overview of the available evidence.

In recent years, three reviews (two systematic reviews: Georgiou et al. 2021; Gascon et al. 2015, one scoping review: Hermanski et al. 2021) focused on linkages between blue spaces and mental health. While Gascon et al. (2015) found limited evidence for a causal relationship between residential blue (and green) space and mental health, Georgiou et al. (2021) reported that larger amounts of residential blue space, but not proximity to it, are significantly associated with higher levels of restoration and that the aesthetic quality of 'the blue' is likely to contribute to mental health benefits. The results were based on a meta-analysis. Furthermore, increases in the amount of residential blue space was found to be the highest among all mediating pathways and exposures (ibid. 2021). In consequence, the authors concluded that "this evidence suggests that developing

more blue spaces within neighborhoods could primarily benefit the restorative character of an area" (ibid. 2021: 33) and that creating more blue spaces and promoting contact with them might help to reverse negative mental health effects of urban living. In line with Gascon et al. (2015), Hermanski et al. (2021) noted that their review confirms positive impacts of blue space exposure on mental health, with visits being more beneficial than views; however, due to the limited number of studies included, no conclusions could be drawn regarding measurable changes in biomarker responses. Thus, the authors concluded that "the specific pathway(s) that could link blue space exposure to mental health outcomes remains unclear (…). A variety of pathways could be hypothesized such as a calming feeling that comes from the breeze or the sound of the ocean, or a variety of other mechanisms which occur near blue spaces" (ibid. 2021: 11). The WHO (2021), in a report on green and blue spaces and mental health, summarized that the most pronounced effects were found for affect and affective disorders (e.g., depression) and that positive associations between blue space and mental health appeared clearer for coastal than inland blue space.

Positive sensory perceptions (e.g., attractive/panoramic views, pleasant sounds, changing appearances by light reflections and water movement, higher humidity, distinct wildlife) that are conducive to mental wellbeing and that contribute to the high preference for watery landscapes have been reported as a central theme in one of the first reviews on blue space and health (Völker & Kistemann 2011) and have subsequently been confirmed in mainly qualitative studies (WHO 2021). Intense sensory perceptions at blue spaces are not only considered in terms of aesthetic, but also conducive for contemplative experiences (Völker & Kistemann 2011, 2015).

Emotional and restorative benefits from blue space exposure were identified as other key themes by Völker & Kistemann (2011). This includes for example relaxation, stress reduction and relief from negative emotions such as sadness, anxiety as well as increased positive feelings such as calmness and energy. It also refers to the strong emotional attachments people may have to blue space (sense of place) and the spiritual, religious or symbolic meanings attributed to it such as miraculous powers, fertility, purification (Völker & Kistemann 2011, 2013). These effects have been proven in numerous studies. For example, many interview studies and surveys on inland blue spaces (e.g., by Smith et al. 2022; Satariano 2021; Reeves et al. 2019; Pitt 2018; Vaeztavakoli et

al. 2018; De Bell et al. 2017; Völker & Kistemann 2015) have shown that mental health benefits were among the most important/most common benefits obtained from blue space visits and have provided extensive experiential accounts highlighting the appreciation of aesthetics, nature and meaning attributed to 'the blue'. Drawing on those, urban blue spaces have been widely experienced as (everyday) therapeutic landscapes and valuable community health assets. Recurring themes include the promotion of wellbeing through visual pleasure, relaxation and a sense of rehabilitation and restoration. Other benefits include escaping from urban traffic, chaos, noise and pollution that cause anxiety and stress, experiencing mental immersion and contemplation, a sense of identity and belonging, a sense of place, connectedness to nature and appreciation of cultural heritage and history (symbolic space). While almost all of this research has been done in HICs in the global North, a notable exception is a study by Vaeztavakoli et al. (2018) in Iran, showing that the therapeutic potential of urban blue spaces also applies to less developed settings. Out of the 200 study participants, 79% stated that the Niasarm Canal in the city of Isfahan contributes to feeling happier and healthier and 64% noted that the canal provides contributions to mental health (ibid. 2018). On a similar note, Fonseka & Coorey (2023), in a mixed methods study involving an urban beach and two lakes in Colombo, Sri Lanka, found that physical attributes of water such as fluidity, sound and lighting contribute to an enhanced experience of solitude among residents. Solitude was understood as a pleasant state of being alone (ibid. 2023).

In a recent study involving more than 200 canal users in Glasgow, UK, Smith et al. (2022) classified the restorative benefits (reported by 58% of the participants) broadly into four categories: *improving mood*, *being relaxing*, *allowing to switch off* (clearing the head, distancing from everyday concerns) and *giving time to think*.

Importantly, several studies using quantitative methods (e.g., Liu et al. 2024; Murrin et al. 2023; Pasanen et al. 2019) have confirmed that mental health benefits can arise from passive interaction with blue space (and are not always mediated by physical activity). In a study exploring whether inactive exposure to urban blue space can reduce emotion-related impulsivity (ERI) –a significant predisposing factor for various mental health issues via alleviating perceived crowdedness– Liu et al. (2024) found that passive exposure to blue space could reduce impulsive behavior (ERI), even when individuals are unaware of the blue space exposure, consistent with prior research. The authors concluded

that the positive impact of blue space on mental wellbeing could help to mitigate the urban stressor of crowdedness and thus, recommend considering blue space access in urban planning (ibid. 2024). Finally, it has been demonstrated that the active and passive use of blue spaces for intended nature-based interventions targeting patients with (physical and mental) chronic diseases ('blue care') provide particularly psychosocial wellbeing benefits, while there are relatively few findings for improved physical health (Britton et al. 2020). This is consistent with studies outside 'blue care' reporting significant positive outcomes from blue space exposure such as improved mood responses and stress reduction primarily among participants feeling ill or stressed (Vert et al. 2020; Reeves et al. 2019) and research indicating that blue spaces are used by people with mental disorders to manage rehabilitation and recovery (White et al. 2021).

(iv.) Social interaction/Improved social capital

People use blue spaces not only individually, but also to meet, socialize and enjoy group activities (Völker & Kistemann 2011). In this way, blue spaces can promote social interaction and thus, beneficial social relationships, which are known to positively affect individual outcomes such as mental and physical health, health behavior and mortality risk as well as broader public health outcomes (Beatley & Konijnendijk 2018; Umberson & Karaz Montez 2010). While it has been demonstrated in some academic literature (e.g., Smith et al. 2022; De Bell et al. 2017; Völker & Kistemann 2015) that blue space is also appreciated because of intentional and incidental contact with other people and joint activities, social interaction is the least studied pathway in healthy blue space research (White et al. 2018). Not surprisingly, a recent systematic review concluded that the evidence about the role of social interaction is inconclusive and in the corresponding meta-analysis, no significant association was found between greater blue space exposure and increased social interaction (Georgiou et al. 2021). Nevertheless, the authors recognize that blue space may have a beneficial effect on social wellbeing and evidence from green space research supports this notion (ibid. 2021; Beatley & Konijnendijk 2018).

Overall, it can be summarized that blue spaces provide both apparent (direct) and less obvious (indirect) health benefits which are mediated through behavioral, environmental

and mental health effects. Three of the four hypothesized pathways linking blue space and health (environmental factors, physical activity, stress recovery/mental wellbeing) are supported by empirical evidence, while findings for social interaction are so far inconclusive (Georgiou et al. 2021). Similar to the green space-health relationship, the mechanisms are complex and interacting and are likely to have synergistic effects (WHO 2016). For example, physical activity (as a preventive and therapeutic approach) is known to positively impact mental health (Schuch & Vancampfort 2021). Given that blue and green spaces hardly occur completely isolated from each other, beneficial spillover effects from 'the green' might reinforce the therapeutic properties of 'the blue' and vice versa (White et al. 2020).

Conceptual model of the blue space-health relationship

To illustrate the health benefits obtained from blue space, the different mediating pathways and possible influences on the relationship, researchers have proposed several conceptual models, which differ primarily concerning their focus (e.g., Grace et al. 2023 and Smith et al. 2022b focus on influencing factors only) and their level of detail. Most are adapted from green space research (e.g., White et al. 2020; De Bell et al. 2017) or include urban green spaces without differentiating between blue and green spaces (e.g., Hunter et al. 2023). While the terminology may vary, all models incorporate the previously mentioned mediating mechanisms between blue space and health which are supported by various theories (as outlined above). Fig. 2.3 shows an adapted version of the model by White and colleagues (White et al. 2020), which is currently the most comprehensive framework available.

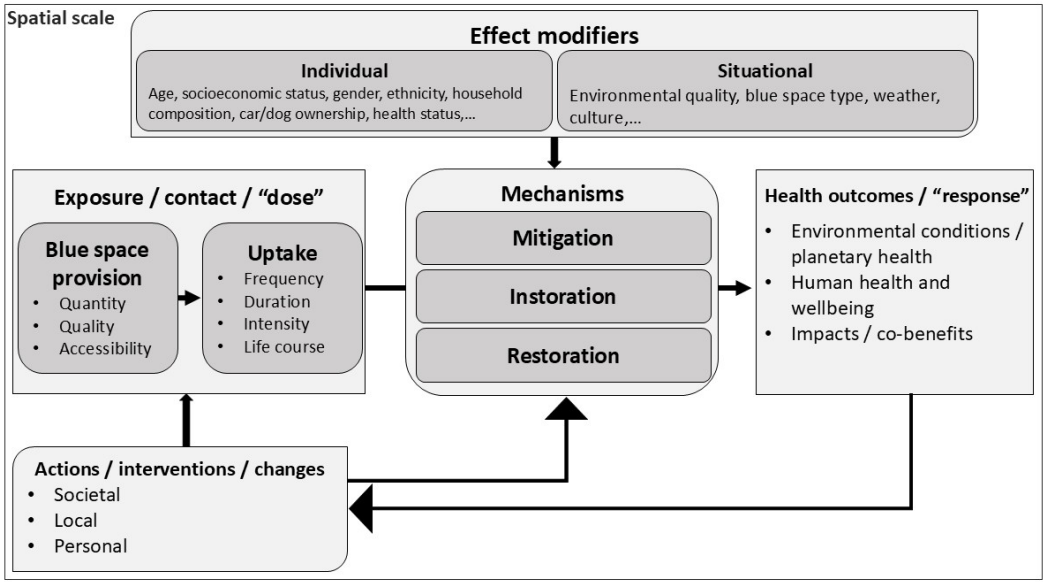


Figure 2.3: Conceptual model of the blue space-health relationship (adapted from White et al. 2020)

As noted by Zhang et al. (2017) for urban green spaces, quantity, quality and accessibility form the three main attributes of blue space provision or availability. The "uptake" of blue space is influenced by several factors, including frequency (the number of exposures within a specific time frame), duration (the length of each single exposure) and the intensity or type of interaction such as indirect exposure (e.g., window views, virtual access), incidental exposure (e.g., commuting through blue spaces) and intentional exposure (e.g., recreational visits) and is likely to change over the course of an individual's life (White et al. 2020). Together, blue space provision and uptake form the exposure/contact or "dose" of blue space, as the latter is more than the mere physical availability, but also depends on the characteristics of exposure/uptake as well as people's perceptions of blue spaces, including their feelings and preferences (Zhang et al. 2017). Generally, a dose-response-relationship has been widely assumed in nature and health studies, including blue space and health, but could not yet be clearly confirmed[14] and the

[14] It is hypothesized that there is a threshold at which there is no health effect if blue (or green) space is below a certain level, similarly that when blue-green space reaches a certain high level, additional health benefits become increasingly marginal (Zhang et al. 2017). For blue space, one of the first evidence supporting a dose-response-relationship has been provided by Herzog et al. (1985) who noted that preferences for landscapes were greater with increasing proportions of water.

optimal dose of blue or green space to deliver the most health benefits remains unknown (ibid. 2017; White et al. 2010).

The provision of blue space –and consequently its uptake and health effects– is influenced by actions, interventions and changes at the societal (both national and international), local and personal levels (White et al. 2020). At the societal (macro) and regional/local levels, this includes policies, planning and design interventions and management strategies targeting blue spaces such as the introduction of bathing water quality monitoring, land-use changes and urban blue space regeneration activities, as well as shifts in societal perspectives such as changing perceptions and uses of public spaces during the Covid-19 pandemic and environmental changes (Grace et al. 2023; Hunter et al. 2023; White et al. 2020). While the latter can include manmade changes (e.g., climate change mitigation strategies such as engineering interventions to prevent flooding or the implementation of nature-based solutions), it points to natural environmental changes (e.g., seasonal variations) and the dynamic nature of water and public spaces itself that can influence the appearance and thus, user behavior of blue spaces (Grace et al. 2023). "The dynamic nature of water in both space and time means that blue space environments are continually changing. Changes in water characteristics can be observed across multiple timescales, from minutes (e.g., responses to rainfall runoff) to months (e.g., river base flow vs. spate) to years (e.g., drought year vs. flood year)" (ibid. 2023: 4). Furthermore, the ambience of blue spaces might change during the day, e.g., with regard to wildlife presence and visitor numbers which in turn can influence which user groups seek blue spaces and when (ibid. 2023). The macro-level changes and development trends are taken up in more detail in chapter 2.4.

On the personal level, changes in personal circumstances such as life events and employment status affect blue space exposure (physically or by altering perceptions, preferences and user behavior) (ibid. 2023). These issues are also reflected in the top of fig. 2.3 (effect modifiers). As noted by White et al. (2020), 'blue care' interventions in health care contexts targeting specific groups of people such as hospitalized patients or people with certain chronic diseases can be further included on this level. Finally, Grace et al. (2023) suggested to differentiate between *temporal factors* (environmental changes, changes in personal circumstances and shifts in societal perspectives) and *contextual*

factors (rural/urban dichotomy, differing cultural practices) possibly interrupting (or promoting) the blue space-health relationship. In fig. 2.3, the latter aspects are considered as situational effect modifiers, but those generally overlap with actions, interventions and changes to a certain extent.

Building on evidence from green space research[15] (Markevych et al. 2017), White et al. (2020) differentiate three mechanisms linking blue space exposure to health, incorporating the four pathways mentioned above: (i.) Mitigation (i.e., reduction of harm, e.g., cooling function), (ii.) Instoration or capacity building (e.g., promotion of positive outcomes such as improved mood or greater physical activity) and (iii.) Restoration (e.g., recovery from depleted attentional capacity or stress). The authors further distinguish two types of outcomes variables: planetary health and wellbeing (e.g., pro-environmental behaviors) –although the evidence that blue space exposure improves pro-environmental behavior which in turn positively impacts human health is still limited– and human health and wellbeing (e.g., general and mental health) (White et al. 2020). With regard to the positive effects of healthy blue spaces for the environmental quality and human reliance on healthy ecosystems for survival and health, fig. 2.3 considers (improved) environmental conditions (e.g., air quality, biodiversity) and planetary health as a possible outcome. Other potential outcome variables could be EcoHealth or One Health, which are similar concepts to planetary health that emerged to address the interconnectedness between ecosystems and humans. In fact, a recent systematic review highlighted that the fundamental questions addressed by the three concepts differ only slightly and therefore "offer complementary perspectives on the interconnections between human, animal, and environmental health and can be strategically employed to address different aspects of complex health challenges" (Talukder et al. 2024: 74). As seen in previous blue health research work (Grellier et al. 2017), human health and wellbeing could be further split into *outcome indicators* (state of health and wellbeing such as mental health) and *health determinants* or *antecedents of health*, given the fact that the mediating pathways act particularly on determinants of health (e.g., physical activity, stress, place attachment, social contacts). Health outcomes of blue and green space exposure could be further

[15] Other designations for these mechanisms suggested in green space research are "improved perceptions of the environment", "aesthetic pleasure and relaxation" and "use of (blue or green) spaces" (Lachowycz & Jones 2013) or "environmental effects", "physiological/mental effects" and "avenue for behaviors" (Zhang et al. 2017).

arranged on a proximal-distal continuum with pathways linking each proximal outcome (e.g., clinical symptoms, disease-specific outcomes) to the more distal outcomes (e.g., life satisfaction, longevity) (Zhang et al. 2017). The adapted model also recognizes health-related (longer-term) individual and societal impacts/co-benefits of blue spaces as suggested by other researchers (Hunter et al. 2023; Grellier et al. 2017), but that are not explicitly included into the model by White and colleagues. Those include e.g., the quality of life, health care savings, other economic benefits (e.g., employment and labor, tourism, property and land value) and the potential of blue and green spaces to reduce health and social inequities, although being themselves potential drivers of environmental injustice (ibid. 2023; ibid. 2017). Feedback loops from health outcomes to actions/interventions/changes are considered that might be undertaken to increase blue space exposure (White et al. 2020). The spatial scale refers to the spatial context of the blue space-health relationship employed in studies, e.g., the neighborhood, district or city (Zhang et al. 2017).

Despite several authors of recent reviews concur that quantitative blue health studies have mostly adjusted for various confounding variables to some degree, researchers in the field widely agree that effect modifiers and their interlinkages[16] are so far underexplored (Georgiou et al. 2021; Smith et al. 2021; White et al. 2018). For example, "research has identified the potential for sociodemographic factors to influence inland blue space usage. However, to date, most research has been cross-sectional and so the reasoning behind sociodemographic trends in blue space access cannot be established" (Grace et al. 2023: 8). As shown in fig. 2.3, the variables known to cause effect modification have been classified into individual and situational factors (White et al. 2020). The situational factors partly overlap with the blue space provision attributes quantity, quality and

[16] In a multi-country study including 17 blue space types, Garrett et al. (2023) identified the combination of environmental and visit characteristics associated with particularly high levels of wellbeing for a specific outcome. With regard to happiness, for example, an optimal visit "(…) might be to sandy beaches where there are high levels of perceived safety and excellent water quality; with a visit lasting at least three hours; and possibly involving playing with children, socializing, sunbathing/paddling and/or walking with a dog; and has short travel times that do not involve public transport" (ibid. 2023: 9). A further example of the complexity between different effect modifiers and health outcomes appears with regard to the moderator variable biodiversity and provision of facilities. While studies have consistently shown that the presence of facilities and wildlife is generally associated with better subjective wellbeing, both were also associated with higher levels of anxiety, indicating that some wildlife may be deemed unpleasant and that good facilities might be linked to visitor density (depending on people's preferences) (ibid. 2023).

accessibility (and with actions, interventions and changes, e.g., seasonal changes, as noted above), but further include issues such as weather, cultural context and urbanity. On the individual level, e.g., age, gender, socioeconomic status, ethnicity, household composition/marital status, health status, car and dog ownership and other personal factors have been identified as influencing factors of the blue space-health relationship. Table 2 gives an overview of major possibilities for effect modification (non-exclusive list). The effect modifier age is excluded, as this matter is treated in-depth in chapter 2.5. For urban blue space usage, Smith et al. (2022b) identified *exercise & health* (options for being physically active) and *urban nature* (being able to enjoy the natural environment) as leading (and strongly interconnected) influencing factors and key leverage points for interventions aiming to increase blue space usage. Further, *cleanliness & maintenance* was found to be of vital importance (ibid. 2022b). These findings align with other research results such as those by Wang et al. (2025) who found that enhancing experiential and perceptional qualities such as the visual quality and the recreational value of urban blue spaces can maximize wellbeing benefits as those are strongly shaped by the subjective experience and perception.

Table 2.2: Overview of effect modifiers in the blue space-health relationship (author's compilation)

Situational effect modifiers	
Factor	**Description / Examples**
Blue space type	The type of blue space has been found to influence the health outcome, e.g., in a study by Garrett et al. (2023), swimming was associated with relatively high levels of wellbeing at a sandy beach, but lower than average levels of wellbeing in an outdoor public pool. Health outcomes seem to differ even for different virtual blue space exposures as demonstrated by Lee et al. (2025). Further, blue space types naturally vary in their ability to enable certain types of physical activity, e.g., outdoor swimming is more likely to occur in lakes than waterways (McDougall et al. 2020). In a first study systematically assessing physical activity levels for specific ages and gender at different blue space types in Australia, White et al. (2024) have shown that adults are less likely to be active at inland beaches and rivers, when compared to coastal beaches. Compared to marine blue space, inland waterbodies involve a greater diversity of environments with different aesthetic characteristics and distinct differences in the experiences of water and nature (Grace et al. 2023).
Accessibility	Accessibility has been identified as a decisive influencing factor of blue space use as it contributes, e.g., to more frequent visits. Greater accessibility/usage seem to be linked to cumulative health and wellbeing effects (Afentou et al. 2022; Llanos-Paez & Acuña 2022; White et al. 2018, Haeffner et al. 2017). Yet, there is also evidence that the mere proximity to blue space does not necessarily translate into usage (Tillmann et al. 2018).

Situational effect modifiers	
Factor	**Description / Examples**
Quality	The quality of blue space refers to the amenity value (i.e., the provision and maintenance of features such as benches, paths, play/fitness equipment), aesthetics, safety and ecological quality (e.g., water quality, biodiversity). Across different research approaches, visible environmental degradation (e.g., algal bloom, surface foam, littering) has been shown to reduce the attractiveness of blue spaces, the willingness to visit and the health benefits obtained (White et al. 2018). The presence of wildlife and greater perceived biodiversity are linked to higher visit satisfaction and greater wellbeing; yet, the degree varies depending on the blue space type (Garrett et al. 2023; Luo et al. 2023; Dallimer et al. 2012). Further, the presence of greenery/vegetation has been identified as a key influencing factor of perceived blue space attractiveness (Luo et al. 2022; Völker & Kistemann 2011). Perceived safety (e.g., fear of crime and drowning, pedestrian safety) has been found to be a relevant aspect to blue space visits in many blue health studies (Garrett et al. 2023). Importantly, there seems to be some discrepancy between subjective perceptions and objective measurements and their respective impacts on outcome variables (e.g., perceived vs. objectively measured biodiversity in green spaces on mental health, perceived environmental improvements of small-scale blue spaces vs. real environmental quality effects) which needs to be further investigated (Wang et al. 2025).
Weather	While the evidence on the impact of weather is yet inconclusive, it seems that landscape preferences are generally sensitive to the weather and that unfavorable weather conditions reduce blue space visits/the length of visit (White et al. 2018). Interestingly, Cao et al. (2023) found that blue spaces improved restoration under sunny and cloudy conditions, hypothesizing that calm waters improve mood more likely on cloudy days while flowing waters do so on sunny days.
Cultural context	Differing cultural practices involve variations in traditional narratives and spiritual connections to the water, different blue space recreation/leisure practices and might also include alternative perceptions of health and wellbeing (Grace et al. 2023; Hunter et al. 2023). In addition, landscape preferences and connectedness to nature can be culturally determined (Rathmann 2021).
Urbanity	In addition to the impact of urbanization on blue space exposure, Grace et al. (2023) point to the possibility of different blue space perceptions across urban vs. rural populations. Limited research has so far contrasted the impact of rural and urban blue space exposure, yet, in a study by De Bell et al. (2017), users from urban areas were more likely to visit blue space in a built-up area while rural residents visited blue spaces more frequently.
Individual effect modifiers	
Factor	**Description / Examples**
Socioeconomic status	Across many studies, socioeconomic status (SES) was found to be a predictor of frequency of blue space visits and location of visits: people with a higher SES are more likely to access (high-quality) blue space (and tend to live closer to them), while people with lower SES face issues accessing blue space (Georgiou et al. 2021; White et al. 2018; De Bell et al. 2017; Sander et al. 2015). Yet, people with a lower SES seem to benefit more from blue space exposure as e.g., the proximity gradient was found to be greater in deprived neighborhoods (Geary et al. 2023; Georgiou et al. 2022; White et al. 2018; Wheeler et al. 2012). As shown in a study by De Bell et al. (2017), SES might be also associated with the type/relative importance of health outcomes from blue space visits: people with a lower SES were nearly twice as likely to choose social interaction as the single most important benefit.
Gender	Studies have shown that men tend to visit blue spaces more than women and engage in different activities, probably due to safety reasons and promoted by a certain masculinity associated with some watersports (e.g., fishing, surfing)

Individual effect modifiers	
Factor	**Description / Examples**
	(Vert et al. 2020; White et al. 2020; Britton et al. 2018; Elliott et al. 2018). There is some evidence that men tend to benefit more from blue (and green) space exposure than women, potentially reflecting the higher prevalence of unhealthier lifestyles in men (Liu et al. 2024). Yet, De Bell et al. (2017) have shown that women appreciated nature more than men and were more likely to report physical activity as their single most important benefit from blue space visits. By contrast, White et al. (2025) have revealed gender differences in the physical activity level at blue spaces, with men being equally active at coastal beaches, inland beaches and watering holes, whereas females were less active at inland beaches and watering holes compared to coastal beaches.
Ethnicity	In studies in the US, people from ethnic minorities visited blue spaces less frequently than their white counterparts, even if living closer to them (Haeffner et al. 2017). In other contexts, the relationship between blue space and health may be particularly different for indigenous peoples having different relations with nature and 'the blue' (White et al. 2020).
Car ownership	De Bell et al. (2017) identified car ownership as a predictor of blue space visit location, with people without a car being less likely to visit rural blue spaces.
Dog ownership	As blue spaces are used for dog walking, dog ownership might be an important influencing factor in the blue space-health relationship (as already been shown for green space usage (White et al. 2018c; Lachowycz & Jones 2013); however, the evidence is so far rather anecdotal (e.g., Smith et al. 2022).
Household composition/ Marital status	As shown by De Bell et al. (2017), the household composition (cohabiting status, number of dependent children) influences the relative importance of health outcomes from blue space visits as people without children were less likely to choose social interaction as the most important benefit. In addition, single participants were more likely to report mental health benefits as the most important benefit compared to married respondents.
Health status	The presence of chronic diseases, particularly if linked to mobility impairments, can obviously limit people's ability to access and use blue space. As shown by De Bell et al. (2017), seeking blue spaces for being physically active is less likely for those having a limiting chronic disease. On the other hand, blue spaces seem to be used particularly by people with poor mental health and those with feelings of stress who might benefit more from blue space exposure (Vert et al. 2020; White et al. 2020; Reeves et al. 2019). This stands in contrast to Gammon & Jarratt (2019) who argued that positive outcomes of blue space exposure might only occur with the appropriate mindset ("leisure state of mind"), yet they highlight that the mental state of blue space visitors has been widely neglected in blue health studies.
Other personal factors	This includes variables such as attitudes, traits, landscape preferences/nature connectedness, spare time available, knowledge (e.g., on benefits and risks of nature exposure), feelings of safety/fear of harm, familiarity with the environment/sense of place, personal drivers/barriers relative to health behavior. Those can influence people's decision for or against blue space exposure and if and to which extent a therapeutic value is experienced (White et al. 2018; Grellier et al. 2017).

2.3 Limitations in current healthy blue space research

Despite a range of theoretical and methodological approaches to investigate 'blue health' and a growing evidence base across disciplines in recent years, researchers in the field

concur that considerable knowledge gaps remain. This applies particularly to the context-dependency of the blue space-health relationship and as such, the possibilities for effect modification on the individual and situational levels (Grace et al. 2023; Georgiou et al. 2021; White et al. 2018). Researchers strongly call for studies that are responsive to those factors, such as blue space type, geographic/cultural settings, population groups and ecological aspects. Each of these factors are described in detail below.

Blue space type

While a great deal of blue space research has focused on coastal environments, less research attention has been given to inland waterbodies, which differ e.g., in terms of biodiversity, aesthetic values and ecosystem services provided (Grace et al. 2023; Pitt 2019; Völker et al. 2018). Encouragingly, the number of studies conducted on freshwater blue space is increasing, yet urban blue spaces and smaller artificial water features in particular remain underrepresented (Zhang et al. 2022; Hermanski et al. 2021; Smith et al. 2021; Xie et al. 2021; McDougall et al. 2020). In addition, little work has been done to compare the impact of rural vs. urban blue space exposure (Grace et al. 2023). With regard to the urban context, researchers conclude that studies to date have neglected to differentiate between blue space types and/or urban blue spaces have been merged with green space or blue spaces outside the city (Völker et al. 2016; Völker & Kistemann 2015). Further, research still has to expand to 'the blue' in smaller and medium-sized cities and to explore blue space/blue health experiences in dense urban settings (Li & Zdravko 2024; Hunter et al. 2023).

Geographic/cultural settings

So far, blue space research has been conducted almost exclusively in HICs in Europe, North America and Oceania, where the natural environment typically presents less threats (WHO 2023b; White et al. 2021; Grellier et al. 2017). Yet, blue spaces are likely to have different meanings, functions and impacts on health and wellbeing across cultures and climates worldwide (Gascon et al., 2017). Even if hypothetically, similar health benefits are likely to occur, differences in terms of ecological/climatic conditions (in which blue spaces underlie), living standard, infrastructure, disease burden and socio-economic aspects (e.g., public safety) and cultural norms limit the generalizability of study results

(Hunter et al. 2023; White et al. 2021, Gascon et al. 2015). Thus, investigating 'blue health' in different geographic and cultural settings, particularly in LMICs, is a recurring recommendation for future research (Hunter et al. 2023; White et al. 2021, Gascon et al. 2017). This counts particularly with regard to the distinct urbanization, high levels of poverty, poor infrastructure, the vulnerability to the impacts of climate change and challenges relative to WASH occurring in LMICs –e.g., living close to water in countries with poor sanitary conditions might increase the risk for communicable (water-associated) diseases (Hunter et al. 2023; Gascon et al. 2015). As noted for urban green space research in LMICs, modifying data collection methods to facilitate low-cost research might also contribute to advancing blue space research in less developed contexts (Shuvo et al. 2020).

Population groups

Although previous studies have considered confounding variables such as age, gender or ethnicity/cultural background and have become sensitive "to the diversity of experiences, capacities, positionalities and power relations of different bodies within these [blue] spaces" (Doughty 2019: 88), researchers have not treated the blue space-health relationship of different population groups and thus, potential real and perceived differences, in much detail (Hunter et al. 2023; Foley et al. 2019; Finlay et al. 2015; Foley & Kistemann 2015). Further, it remains largely unclear how blue space-health relationships develop over the life course and how shifting circumstances or certain life events can alter perceptions of and capacities/motivations to use blue spaces; making the case for exploring the health benefits for specific age groups (Grace et al. 2023; Zhang et al. 2022; Gascon et al. 2015). For example, compared to younger age groups, older people might attribute different benefits to blue spaces as a consequence of shifting life circumstances and accumulated experiences of blue spaces (Grace et al. 2023). Given the subjectivity involved in 'blue health' (e.g., different perceptions of water/nature, health, leisure behavior), researchers call for a stronger consideration of "geographies of difference" and "deeper comparative cultural geographies of water" (Foley & Kistemann 2015: 162), i.e., studies explicitly addressing key user determinants within and across different contexts (Grace et al. 2023; WHO 2023b; Foley et al. 2019; Gascon et al. 2015). At the same time, blue space research to date has only focused on users, failing to include

the voices of non-users and the reasons for not using blue spaces ("their hydrophobias") (Doughty 2019; Pitt 2019; Völker et al. 2018). For example, Garrett et al. (2019b) noted that despite the high availability of blue spaces in the city of Hong Kong, more than a quarter of their older study sample reported to never visit blue spaces for recreation. Since the decision of not using blue space is not always a free personal choice, "but (…) constrained by vulnerability or ignorance of opportunities" (Pitt 2019: 145), a number of researchers point to the need for more inclusive blue health studies exploring the perspectives of marginalized and minority groups and analyzing inequities in the blue space distribution/accessibility and its links with health inequalities (Hunter et al. 2023; Foley et al. 2019; Schüle et al. 2019).

Ecological aspects

Detrimental effects on the experience of 'blue health' caused by negative environmental quality point to the importance of providing not only aesthetically pleasing and well-maintained, but also 'ecologically healthy' blue spaces (White et al. 2018). Researchers therefore highlight the need for more consistent evidence on influencing ecological factors in the blue space-health relationship such as environmental/water quality and biodiversity, not least because the current levels of pollution of blue spaces (e.g., marine litter) are usually high (Hunter et al. 2023; Zhang et al. 2021; Higgins et al. 2019; White et al. 2018; Wüstemann et al. 2017). In a recent study examining the association between subjective experience and perception of urban-inland blue spaces (in terms of their quality, attraction, facility and management) and individual wellbeing, environmental quality was identified as the only experience indicator that directly influenced urban blue space users' individual perceived wellbeing (Wang et al. 2025).

Finally, while adequately accounting for such variables and their impact on health-related exposure outcomes is challenged by the dynamic and subjective nature of blue space experiences, this insight is considered of paramount importance for informing planning and policy (Grace et al. 2023). For example, a better understanding of sociodemographic influences is vital to effectively address existing environmental injustices related to blue space and should be a key research priority (ibid. 2023). In addition to the effect modifiers, the following evidence gaps have been identified:

Mediating/causal pathways

Despite some compelling evidence exists *how* blue spaces benefit human health and wellbeing, the causal mechanisms and their variations across different (freshwater) blue environments are still not fully understood (Hunter et al. 2023; McDougall et al. 2020; Higgins et al. 2019). Particularly the mediating pathway social interaction has been hardly investigated and available findings remain inconclusive (Georgiou et al. 2021; White et al. 2018). With regard to the lacking comparability of existing studies (e.g., in terms of outcome measures, confounders considered), there is also the need for improving the work on the environmental quality and ecosystem services pathway (Georgiou et al. 2021; White et al. 2018). Research on this issue has been mostly restricted to the potential contribution of blue spaces to thermal comfort/microclimate regulation and improving air quality, less on acoustic attractiveness/beneficial effects on noise pollution and biodiversity (Georgiou et al. 2021; Qi et al. 2021; Ampatzidis & Kershaw 2020). Future studies should also examine which blue space attributes have the strongest effect on each mediating pathway (Georgiou et al. 2021).

Research designs/Methodological approaches

As outlined in chapter 2.2, diverse scientific approaches to 'blue health' have emerged and different quantitative and qualitative methods have been shown applicable to assess the value of blue spaces for human health and wellbeing (WHO 2023b). Quantitative approaches are deemed useful, among others, for estimating numbers of users or valuating the economic benefits of blue spaces, while qualitative approaches qualify for recording aspects that are not easily enumerated such as the meanings and emotional experiences attached to/evoked by blue spaces and to investigate factors often overlooked in survey research, e.g., cultural aspects (ibid. 2023b; Doughty 2019; White et al. 2018). Consequently, both types are considered necessary in future blue space research (WHO 2021; Völker et al. 2018).

With regard to quantitative approaches, a key limitation discussed in the literature is a pronounced methodological heterogeneity, for example, in terms of exposure metrics, outcome measures and confounder adjustment (Geneshka et al. 2021; Georgiou et al. 2021; Smith et al. 2021; Gascon et al. 2017). Consequently, researchers recommend methodological improvements such as analyses at finer spatial scales, multiple exposure

assessments as well as more standardized approaches to facilitate comparative evaluation and systematic synthesis including more robust effect sizes (currently often small) (Geneshka et al. 2021; McDougall et al. 2020, Labib et al. 2019; White et al. 2018). Consistent reporting methods would also improve the transfer of knowledge between contexts (WHO 2023b). The 'BlueHealth Toolbox' by Grellier et al. (2020) provides initial standardized tools such as those for assessing the quality of blue spaces and user behavior, but mainly builds upon research on coastal environments.

Another critical point raised by researchers is that most of the blue health studies conducted so far has been cross-sectional by nature (Hunter et al. 2023; Smith et al. 2021). While cross-sectional blue space research could be improved by stronger consideration of effect modifiers and differentiation of mediating pathways and health outcomes, there is a need for further study designs, particularly well-designed longitudinal, (natural) experimental and pre-/post intervention studies (Hunter et al. 2023; WHO 2023; Smith et al. 2021; Gascon et al. 2017). Comprehensive evaluations of blue space interventions are crucial due to the inherent complexity in providing health and other benefits and to identify "what works, for whom, or where the real problems lie" (Hunter et al. 2023: 739). Yet, according to a review by Brückner et al. (2022), only half of the urban blue space regeneration projects studied provide information on evaluation and the type and level of evaluation varies greatly.

Future studies should include realistic blue spaces as effect modifiers such as environmental quality and weather demonstrating that exposing "(…) people to idealized versions of blue landscapes in laboratory conditions" limits transferability to real-world settings (White et al. 2018: 155). In addition, in situ investigations (and longitudinal studies) enable researchers to record people's experiences without the influence of a recall bias (Grace et al. 2023). Further research recommendations include the examination of the hypothesized dose-response-relationship and the use of biomarkers such as cortisol as a stress biomarker (WHO 2023; Hermanski et al. 2015; Gascon et al. 2015). There is scope to better integrate positive and negative dimensions of water for health as on the one side, "much of the research on the health-promoting qualities of our blue environments fails to recognize the potential risks, whether to our own health and wellbeing or to the aquatic environments themselves" (Foley et al. 2019b: 229f). On the other hand, the well-developed research on water and health risks often fails to consider

the health potential of blue space given the right social, political and environmental circumstances (WHO 2023b; ibid. 2019b; Grellier et al. 2017). Finally, Grace et al. (2023) highlight the potential of mixed methods approaches to advance blue space research such as linking experiential or in-depth case studies with large-scale population-based research or big data. The authors suggest combining sensitive quantitative and qualitative methods, including novel ones such as diaries, wearable technology and videography (ibid. 2023). Big data such as real-time mobility patterns offers the advantage of accelerating the research process and informing policy-makers more quickly (Hunter et al. 2023).

Actors and disciplines involved

Considering the blue space-health relationship as an opportunity for "truly interdisciplinary research" (Shanahan et al. 2014: 471), several writers in the field call for more multi-/transdisciplinary/holistic approaches, for example aligned to the concept of one health (Grace et al. 2023; Hunter et al. 2023; McDougall et al. 2020; Higgins et al. 2019). In addition, the existing evidence base could be strengthened by a stronger collaboration with actors outside the scientific community (whole-system approaches) (Grace et al. 2023; Hunter et al. 2023). This includes, for example, "genuine co-creation approaches involving researchers, policy makers and practitioners working in a virtuous cycle with community voices embedded" (Hunter et al. 2023: 738). Interestingly, further investigation is needed to clarify the role of public health representatives in (health-oriented) blue space planning. Research has shown that there are significant benefits to involving public health professionals, but that in contrast, urban blue spaces can be also beneficial for public health even if not explicitly conceptualized as environmental public health interventions (Brückner et al. 2022). As seen in previous studies, highly participatory methods such as photovoice can provide a rich understanding of an individual's or community's relationship with (blue) spaces but these methods are rarely applied (Grace et al. 2023; Hunter et al. 2023). Involving policy makers and practitioners to a greater extent would facilitate integrating supply factors in blue space research "to critically consider complex ways in which blue spaces are made available to societies for the creation of an effective public health" (Foley et al. 2019b: 233).

Application-oriented research

As noted for urban green spaces, findings are still lacking that could guide blue space planning and design for improved health outcomes (Zhang et al. 2022; McDougall et al. 2020; Zhang et al. 2017). For example, knowledge gaps remain about how to balance different interests in urban greening and blueing actions and how to enhance multi-functionality in practice, which "dose" of blue or green space is actually relevant for better health[17] or which blue space features carry weight in deriving health benefits (Haase et al. 2017; Hansen et al. 2017; Gascon et al. 2015). The most telling evidence for a lack of translation of scientific results into practice is probably that "(…) few cities, if any at all, can claim to have successfully and systematically devoted resources to use urban green spaces as a public health solution to the same extent that conventional health-care facilities are deemed as critical city services" (Zhang et al. 2017: 2). This applies equally to urban blue spaces (Hunter et al. 2023; Brückner et al. 2022). In fact, Zhang et al. (2022) identified studies from the design perspective that could "(…) facilitate the practicality and operability of health evidence" (p. 12) as the main vacuum in freshwater blue space research. Thus, developing adaptive design knowledge that integrates the available health evidence and operationalizes it into blue space design should be on the future research agenda (ibid. 2022). Obviously, the uniqueness of each blue space and the relational encounter deciding on therapeutic landscape experiences complicates efforts to generate concrete design guidance, yet landscape design can facilitate (and impede) experiential thinking (Hurtubia et al. 2015). While acknowledging that subjective interpretations of a landscape and different perceptions of its amenity and health value remain, for example, features such as clear sightlines, well-maintained vegetation and lighted pathways, have been identified as supportive features for feeling safe in public spaces (Hegetschweiler et al. 2017; Zhang et al. 2017).

Methodologically, providing practical guidance for planners and policymakers requires particularly multi-level (whole-system) analyses, economic valuation and

[17] While not being empirically linked to better health outcomes, there exists guidance on the provision of green spaces. For example, the WHO (2017) recommends that all people reside within 300m of green space. According to the '3-30-300 rule', every citizen should be able to see at least 3 trees from their home, should have 30% tree canopy cover in their neighborhood and should not live more than 300m away from the next green space (Konijnendijk 2022). Yet, these guidelines have not been systematically evaluated and might differ across contexts with varying levels of population density and socio-economic status (Hunter et al. 2023).

longitudinal studies (Hunter et al. 2023; WHO 2023b). The latter are important for application-oriented blue space research as they establish causality and improve the understanding of whether and to what extent temporal changes can impact blue space exposure outcomes (Grace et al. 2023; McDougall et al. 2020; Gascon et al. 2015). Cost-effectiveness analyses (considering capital and operations and maintenance costs) can support decision-making, as decisions (…) would otherwise be based on understated returns on investment (Hunter et al. 2023: 738). So far, economic valuation evidence remains unconvincing, "(…) particularly when balanced against competing, market-related demands in HICs or population densification in LMICs" (ibid. 2023: 738). Studies applying the quantitative-spatial approach contribute to proving actual (preventive and curative) health gains by blue spaces (De Vries et al. 2003). Such evidence has strong implications for planning and policy as access to blue spaces may then become a necessity rather than a luxury asset as is often assumed (ibid. 2003). In the same vein, studies showing that blue spaces reduce morbidity could alter the prioritization of blue spaces in policymaking and research, "(…) since reducing suffering may be a morally higher priority than improving wellbeing" (Antonovsky 1997: 128). The difference in moral appeal between health/wellbeing and disease/suffering and as such, varying perspectives on the priority of health promotion and prevention and treatment of disease is subject of ongoing research (e.g., Hofmann 2023), which might lead to changes in the conceptions of health and disease and priority setting in future.

In conclusion, a good (urban) blue governance for health (Baumeister 2017) needs to be built upon consistent information on the health potential of blue space, but the current evidence base –particularly in comparison to green space– is still relatively small and heterogeneous (Smith et al. 2021; White et al. 2018). Policy-relevant data beyond accessibility to blue spaces (which on the household/individual level, is in fact widely missing across countries) such as the size, levels of use and quality needed to deliver health benefits, are scarce (Hunter et al. 2023; Wüstemann et al. 2017). "Whilst an increasing portfolio of research findings indicates the potential of blue space environments to be utilized as public health resources, further investigation is needed to fully understand the range of factors that can affect blue space experiences and modify

the potential of these natural environments to improve population health and wellbeing" (Grace et al. 2023: 14).

2.4 Development trends and values to consider for blue health futures – Aging urban populations shaping the 21st century

As noted in chapter 2.2, the provision of blue space and the uptake of 'blue health' are affected by actions, interventions and changes on the micro-, meso- and macro levels (White et al. 2020). With regard to the latter, the world is undergoing rapid climatic, environmental and societal changes (Hall et al. 2020). While blue space is likely to be widely affected by these development trends, 'the blue' can also contribute to address the challenges arising from these transformations (ibid. 2020). The pan-European research project 'BlueHealth' (2016-2020) identified key values/perspectives to consider for blue health futures, including: (1.) Sustainable use of natural capital, (2.) Promoting a healthy long life, (3.) Economic valuation of blue spaces/'blue health' and (4.) Stimulating health equity: "Blue health for all" (Wuijts 2017). The key values/perspectives are linked to various challenges to be taken into account for blue health futures (ibid. 2017). Surprisingly, the project team did not explicitly consider urbanization, although "the 21st century will be the century of the cities" (WBGU 2016: 1) and many of the above-mentioned values/perspectives are pressured by urbanization or their significance intensifies in the urban context. As highlighted by other researchers, e.g., Zhang et al. (2022), (future) healthy blue space research should incorporate the relationship of 'the blue' with global challenges such as urbanization. Therefore, the four above-mentioned values/perspectives are outlined below in relation to the urban context (along with a discrete section on urbanization and urban transformations). The relevance and relative importance of the values/perspectives and the associated challenges might differ across (urban) contexts (Wuijts 2017).

Urbanization and urban transformations

Over half of the world population (55% in 2018) lives in cities and with rapid urbanization continuing, this number is expected to increase to more than two-thirds by 2050 (UN 2019). The scale of urbanization of course takes different forms: while the largest increase of the urban population will happen in Africa and Asia (which will host most of the global

megacities), many cities in HICs will stabilize or even experience urban shrinkage (Graybill et al. 2020). Yet, "cities are here to stay, and (…) the future of humanity is undoubtedly urban, but not exclusively in large metropolitan areas" (UN 2022: 4). Spatially, urbanization translates into increasing land consumption (urban sprawl), interactions of cities with rural areas (urban fringe), the emergence of conurbations and – particularly in LMICs– unplanned (peri-) urbanization with growing urban slums due to massive rural-to-urban migration (WBGU 2016; UN 2009).

Being a global megatrend, urbanization is intertwined with several global challenges that the world has faced in recent decades such as climate change, rising inequality and the spread of zoonotic diseases (UN 2022). Regarding public health, a range of physical and mental health problems driven by sedentary lifestyle, 'technostress', urban stressors such as air pollution and unhealthy urban environments and consumption patterns have become the current "urban plagues" that require effective health-promoting planning approaches (Lederbogen et al. 2018; Sarkar & Webster 2017; WBGU 2016). Such "urban acupuncture" can involve blue spaces ("urban aqua-puncture") (Lerner 2014), while at the same time, urban land contestations obviously challenge the provision of blue spaces in cities. As the Covid-19 pandemic has clearly shown, 'old' and 'new' infectious diseases remain highly relevant risks for urban health (WBGU 2016). Particularly in LMICs and emerging economies, city dwellers face a triple disease burden from communicable and non-infectious diseases and accidents and violence, while particularly mental health is largely undervalued (Gascon et al. 2015; WHO 2010).

While cities must be prepared for dynamic and unpredictable futures that are not uniform across regions, the following main forces are expected to shape urban change in the 21st century: ecological challenges (cities as key drivers for global environmental problems such as biodiversity loss, climate change with negative impacts vice versa), socio-demographic shifts (e.g., population aging, expanding youth in LMICs, socio-economic disparities, social cohesion under pressure), economic transformations (e.g., global restructuring of production processes, growing importance of real-estate market and informal sector, global recession), institutional changes (increasing complexity of urban management, multi-sectoral approaches) and technological transformations (digitalization and technology-driven urban design) (UN 2022; WBGU 2016; UN 2009).

Broadly speaking, for cities in HICs, the 20th century ended with disillusionment about modernist planning due to its partial success in addressing urban problems like poverty, though it sometimes exacerbated those problems (Hall & Barrett 2018). In this context, urban priorities for the future include managing cultural diversity, regenerating outdated infrastructure, addressing urban shrinkage and meeting the needs of an aging population (UN 2022). The distinct situation in many cities in LMICs/emerging economies requires different policy and planning solutions. Here, key priorities for the future include tackling growing poverty/unemployment, improving slum conditions (while catering to the needs of an increasing middle class) and providing adequate housing, infrastructure and services (UN 2022; Dutt et al. 2020). While HICs have predominantly seen a shift in decision-making from government to multi-actor governance with wider public engagement, many cities in LMICs face a loss of governability, problems to formalizing processes and structures (e.g., land ownership in informal settlements), corruption, clientelism, autocratic management and a lack of a strong civil society (WBGU 2016; UN 2009).

Sustainable use of natural capital

As noted above, cities –as centers for economic activity and consumerism– not only drive global ecological challenges such as the massive generation of emission of greenhouse gases and waste but are also negatively affected by them in return (WBGU 2016). The world's excessive dependence on fossil energy sources has fueled urbanization, which in turn modifies the environment and creates new threats, including deforestation and slope instability (UN 2009). The negative impacts of anthropogenic climate change are already being felt across cities and regions and have the potential to affect urban populations in disastrous ways in future (Graybill et al. 2020). These impacts include rising temperatures and increased heat waves/urban heat island effects, increased air pollution, rising sea levels, coastal erosion, more frequent and severe extreme weather events such as hurricanes, floods and droughts, fluctuations in water availability and increasing water scarcity (UN 2024b; WBGU 2016). As the former UN secretary-general Ban Ki-Moon (2012) said: "Our struggle for global sustainability will be won or lost in cities."

Obviously, detrimental effects on hydrological regimes caused by climate change challenge the provision of healthy urban blue spaces while ensuring water security in the coming decades, particularly, though not only, in arid climates (Grace et al. 2023; Hunter

et al. 2023). In fact, "water is the primary medium through which we will feel the effects of climate change" (UN 2019b) and the risky nature of 'the blue' (e.g., flooding, drowning, disease) is amplified by the impacts of climate change and environmental degradation, particularly in LMICs (White et al. 2020; Grellier et al. 2017; Rietveld et al. 2016). With respect to increased extreme weather events, living close to water may cause severe anxiety and depression and climate change mitigation interventions such as flood control may lead to changes in the appearance of blue spaces, causing individuals and communities to lose blue spaces of high cultural and social meaning (Grace et al. 2023). Yet, urban freshwaters can play a critical role "(…) to address the negative health and environmental impacts of urbanization and climate change" (Higgins et al. 2019: 9). Encouraging approaches reflecting the idea of a 'One Blue' (Nicholls 2014) (in analogy to One Health) are evident in the rise of nature-based solutions, water-sensitive urban design/concepts like the Sponge City and initiatives such as the networks of Biophilic Cities or Cities with Nature (Beatley & Konijnendijk 2018).

In consequence, without the careful consideration of ecological concerns and sustainability-focused planning and policy, urban blue space risks are likely to intensify, with significant negative effects on public health (Hunter et al. 2023; White et al. 2018). Addressing the challenges of environmental change and sustainability is crucial for countries at all income levels, although in LMICs, urban water management faces the additional burden of limited infrastructure, unsafe or lacking WASH services and less stringent regulations that facilitate pollution (Rietveld et al. 2016).

Promoting a healthy long life

Probably one of the greatest human accomplishments over the past centuries has been a considerable gain in years of life, leading to more people spending more years at the older ages (Crimmins 2015). Globally, life expectancy at birth reached 73.3 years in 2023, an increase of 42.3 years since 1900 (UN 2024). Naturally, there are still major differences between countries; for instance, in India, life expectancy at birth for women (73.6 years) and men (70.5 years) is about 10 years less than in Germany (women 83.8 years, men 79 years) (ibid. 2024). Yet, assuming that age-specific mortality rates remain constant, in 2021, Indian women at age 60 were expected to live another 16.8 years and Indian men at age 60 another 15 years (German women and men at age 60 another 25.3 years and

21.3 years respectively) (ibid. 2024). The older population is the fastest growing age group worldwide (UN 2017). In 2020, there were 727 million people aged 65+ years and this number is expected to more than double, reaching 1.5 billion in 2050 (one in six people). All regions of the world, except Africa, will then have nearly a quarter or more of their populations at older ages (UN 2024; UN 2017). By about 2080, people aged 65 years or older will comprise 2.2 billion, exceeding the number of children under 18 years (UN 2024; UN 2015). Already by the mid-2030s, the number of people aged 80 years and over (then 265 million) will outnumber children aged one year or younger (UN 2024). While many LMICs are currently marked by a youthful population (and much attention is given to address this matter), aging in these regions takes place at a much faster rate than in HICs (UN 2017). For example, the world's second largest group of older people lives in India (140 million) and the average annual growth rate of the older Indian population is almost three times higher than the overall population growth rate (Bloom et al. 2021). The fastest growing share of older people (aged 60+ years) in the next years will take place in South America (+71%), Asia (+66%) and Africa (+64%) and by 2050, 80% of older people will be living in LMICs (UN 2015). Further, population aging mirrors urbanization as the older population is growing faster in cities than in rural areas, rising from 51% in 2000 up to 58% in 2015 (people aged 60+ years), with the oldest-old (80+ years) being most likely to be concentrated in urban areas (63% in 2015) (UN 2015).

Despite the remarkable success achieved in the pursuit of longevity, older people today do not necessarily spend the extra years in good health or in better health than previous generations did but experience high levels of (multi-) morbidity and disability (WHO 2020b; WHO 2015). In fact, the age at which most health problems occur has not increased noticeably and the lifespan-healthspan gap (life expectancy vs. healthy life expectancy) has yet to be bridged (Crimmins 2015). Further, good health in old age is distributed unequally, between and across populations (WHO 2020b). The overwhelming burden of disease and disability in old age (across the world) comes from chronic NCDs such as cardiovascular diseases, diabetes, chronic respiratory diseases (particularly in LMICs), mental disorders and dementia (WHO 2023; WHO 2015). Further health characteristics in old age that can contribute to the loss of functional ability are underlying (aging-related) physiological changes (in movement, sensory, immune and cognitive

functions) and geriatric syndromes (i.e., complex health states that are often not classified as disease, e.g., frailty, urinary incontinence, falls) (WHO 2015). While "good health adds life to years" as proclaimed in the in the UN Decade of Healthy Aging (2021-2030), negative individual and societal implications arise if the added years are spent predominantly in poor health, dependent on care and/or socially isolated (WHO 2020b). Despite the lack of success with regard to increasing the healthy years, aging is not "a period of inexorable decline and misery" (WHO 2015: 64) as often assumed. Research has widely shown that despite having health constraints, many older people maintain good physical and mental capacities and a high wellbeing and that the self-perceived health and subjective quality of life in old age often differ from objective measures ('wellbeing or satisfaction paradox') (Wettstein et al. 2016; WHO 2015). This indicates a great heterogeneity in old age stemming from complex factors both intrinsic and extrinsic to the individual (Ferrucci & Kuchel 2021).

The health conditions in old age influence the intrinsic capacity, i.e., "all the mental and physical capacities that a person can draw on and includes their ability to walk, think, see, hear and remember" (WHO 2020). The intrinsic capacity, combined with environmental characteristics (and its interactions), forms the functional ability (i.e., "having the capabilities that enable all people to be and do what they have reason to value"[18]) which in turn forms the central pillar of the concept of healthy aging, i.e., "the process of developing and maintaining the functional ability that enables wellbeing in older age" (for which being free of disease is not a requirement) (ibid. 2020). Creating (social and physical) environments that support and maintain the individual intrinsic capacity and functional ability and promoting healthy behaviors targeted at reducing risk factors for common NCDs is considered of vital importance to healthy aging (ibid. 2020; WHO 2015). Given that about 75% of the diversity in capacity and circumstances seen at an older age is the result of the cumulative impact of advantages and disadvantages across the life course, inequity (together with diversity) forms two key considerations of healthy aging (WHO 2020). In the past years, important policy developments guiding action on (healthy) aging have been e.g., the Madrid International Plan of Action on Aging

[18] According to WHO (2020), this includes the ability to meet the basic needs, to learn, grow and make decisions, be mobile, build and maintain relationships and to contribute to the society.

(MIPAA) (2002), the European Union Green Book on Aging (2021) and the WHO Global Strategy and Action Plan on Aging and Health (2016-2020). All of those policy instruments adopt a positive approach to aging and highlight the contributions older people can make to communities and societies and potential areas where policies can enable such contributions and thus, the significance of health in old age (WHO 2015). The latter resulted in the UN Decade of Healthy Aging (2021-2030) outlining four action areas for enabling healthy aging, including combatting ageism, creating age-friendly environments, providing integrated care and ensuring access to long-term care. With regard to creating age-friendly (or aging-friendly) environments, initiatives such as the WHO's "Age-friendly cities and communities (AFC) movement" or the "8 (to) 80 Cities" mark responses to the converging trends of population aging and urbanization. In their urge to adapt urban areas to older populations, such initiatives highlight the importance of the immediate living environment for older people and thus, for acting on the social determinants of health (Joy et al. 2020). According to the AFC movement, making cities inclusive and healthy for all ages also includes access to (co-designed) outdoor spaces such as recreational blue and green spaces which represent one of eight priority intervention areas[19] for cities to become age-friendly (WHO 2007). However, researchers noted that the implementation of AFC (and age-friendly policies in general) is challenged, among others, by the impacts of austerity policy (e.g., poor funding), the privatization of urban space and pressures arising from urban development. Furthermore, developing substantively age-friendly environments has not yet been moved forward (Joy et al. 2020; Buffel & Phillipson 2016). In fact, the WHO itself points to the outstanding effectiveness of current public health approaches to population aging as reflected in high rates of poor health among older people, marked health inequities, the misalignment of health and long-term care systems to older peoples' needs and the multiple barriers and disincentives to health and participation (WHO 2015).

As a result of urban population aging, older people represent a major user group of urban blue spaces and benefit from those supportive environments in terms of fostering

[19] In addition to (1.) Outdoor spaces and public buildings, other priority domains of urban life included in the AFC checklist are: (2.) accessible and affordable transportation including walkability, (3.) accessible and affordable housing, (4.) social participation activities, (5.) respect and inclusion including eliminating ageism, (6.) civic participation, (7.) accessible communication and information sharing, (8.) community supports and services that encourage health promotion, including nutrition, recreation programming and access to health services and home care (WHO 2007).

healthy aging (e.g., by promoting an active lifestyle and social participation). However, due to knowledge gaps and drawbacks in age-friendly urban design, older people are also at risk of being excluded from access to and use of blue spaces (Pitt 2019; Finlay et al. 2015).

Economic valuation of blue spaces/'blue health'

As noted in chapter 2.1, the presence of water has been considered economically advantageous ever since. Blue spaces unfold their economic value and competitive advantages in many ways, e.g., as highly preferred tourist and leisure destinations and places of residence promoting the local economy and increasing property values, by aquaculture/fishing industry, facilitating trade, enabling energy production and agriculture (Kistemann 2018). With respect to marine environments, the term 'blue economy' has been introduced to describe the "sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem" (World Bank & UN 2017: 6), which generated a new field of investment, as exemplary seen in the launch of a 'blue economy fund' by one of the world's leading asset managers, primarily investing in companies being directly or indirectly connected to the oceans through their products and services (DWS Group n.y.). While being originally understood as a holistic concept considering eco-system health, it is obvious that the 'blue economy' inherently involves conflicts due to different stakeholders' preferences and interests, e.g., opportunities of growth and development competing with the need for nature protection (Lee et al. 2020; Voyer et al. 2018).

The awareness of the economic power of 'the blue' has led to public and private actors driving urban blue space regeneration, most notably seen in the global planning trend for reclaiming urban coastlines and rivers ongoing for decades, coined as "waterfront revitalization" (Smith et al. 2022; Samant & Brears 2017; Breen & Rigby 1996). Similar to urban greening, urban blue space development is often linked to urban competitiveness and entrepreneurship as cities compete, among others, for global investment and skilled labor, prestige and cultural spectacles (Brückner et al. 2022; Short 2020; Feng & Tan 2017). "Because capital and skilled labor are so fluid, quality of life variables and manifestations of green living have become increasingly important in how cities compete with each other to move up the urban hierarchy" (Short 2020: 524). In this

way, blue and green spaces are valued for shaping a city's image and creating a more attractive place to live and work, which in turn enhances economic prospects (Feng & Tan 2017).

Particularly with regard to waterfront revitalization, the economization of blue spaces and the power granted to the private sector above those spaces has been subject to controversial discussions and has been extensively criticized in research as it entails the risk of a 'blue gentrification' (Kistemann 2018) and often leads to commercial-driven and socially exclusive developments (Brückner et al. 2022; Samant & Brears 2017). Yet, involving the private sector in urban blue and green space development has also been experienced as advantageous, e.g., by providing financial support and facilitating co-benefits such as a wider neighborhood upgrading (Brückner et al. 2022; Naumann et al. 2011). In addition, as noted by Short (2020), the shift towards a more entrepreneurial city has –as any political movements– its limits. However, this is not to ignore the critical implications arising from the commoditization and privatization of water. As noted by co-author Tony Clarke in the award-winning documentary "Blue Gold: World Water Wars" (2008): "Water, which is the source of life itself –instead of being common and universal to everybody because we all depend on it– profit is made out of the running of and delivery of water to people and communities. Those that have the ability to pay, will have access to the water, those who do not have the ability to pay, will go without."

Looking at health promotion in the 21st century, a seminal development has been its increasing privatization, with the business sector having embarked on a billion worth wellness industry ("wellness revolution") (Kickbusch & Payne 2003; Pilzer 2002). Together with the privatization of public services due to austerity-driven policy, this has led to the development of resort tourism and spa services, the rising privatization of the coast and beach and the widespread closure of public swimming pools (Atkinson 2019; Foley et al. 2019b; Smith & Puczkó 2009). Thus, despite positive effects on public health such as increased awareness for self-care and greater proactive engagement in health-promoting/preventive activities (e.g., hydrotherapy), the twofold economization of blue spaces and health has largely commercialized 'blue health promotion' which raises questions of blue health equity that need further investigation (Foley et al. 2019b; Smith & Puczkó 2009; Kickbusch & Payne 2003).

Stimulating health equity: “Blue health for all”

Over the past decades, urbanization, along with processes of globalization and economic restructuring, has led to the rise of income inequalities in many countries and spatial segregation and exclusion (based on income, migratory status or other factors) remain a common urban phenomenon (UN 2020; WBGU 2016). Urban inequalities are reflected, among others, in disparities in health and education and in (unfair, avoidable) differences in the exposures to environmental health resources/risks (“environmental (in-) justice”) (ibid. 2020b; ibid. 2016). This applies particularly to LMICs and emerging economies, where despite a rising middle class, rapid (and widely uncontrolled) urban growth means urbanization into poverty for many people, who are confronted with high rates of crime and informal employment (Dutt et al. 2020; WBGU 2016). As indicated in chapter 2.1, urbanization in LMICs led to inability to supply residents with adequate public services such as WASH and these countries are disproportionally affected by water-associated diseases (varying by income group) (WHO 2023b; Dutt et al. 2020). Yet, being contested landscapes that are associated with widening inequalities, urban blue spaces raise questions of justice also in high-income settings (Hunter et al. 2023; Foley et al. 2019b). In fact, blue space is inequitably distributed by nature and increasing the amount of and access to ‘the blue’ (e.g., by providing artificial waters or better access) poses unique challenges (Hunter et al. 2023). “The impacts of climate change, geopolitical unrest, pandemics, mass migration, hyperinflation and other crises can exacerbate water access inequalities. In nearly all cases, the poorest and most vulnerable groups are those that suffer the greatest risks to their wellbeing and livelihoods” (UN 2024b: 4). The adaptation of the UN New Urban Agenda target “City for all” (UN 2016) to “Blue health for all” (Wuijts 2017) seems a reasonable value to consider. As noted by the UN, “developing and maintaining a secure and equitable water future underpins prosperity and peace for all” (UN 2024b: 1).

With regard to the distribution of healthy blue spaces in cities, research has shown that inequalities in access and use occur with regard to age, gender, ethnicity and socio-economic status (Afentou et al. 2022). For example, Viinikka et al. (2017) –by mapping the distributive environmental justice of urban waters in Helsinki Metropolitan Area– found that high income and high educational background, Swedish language and high age

are factors more frequently related to living closer to water areas, while children, foreigners, and people with lower economic status tend to live further away from blue spaces. In their review on social inequalities in blue and green space provision in the WHO European region, Schüle et al. (2019) concluded that there is "(…) a consistent trend that socioeconomically deprived areas have fewer resources available than more affluent areas" (p. 7). Yet, inconsistencies exist, e.g., Haeffner et al. (2017) noted that in Northern Utah, people with high socio-economic status and white respondents generally lived further away from urban waterways (but were more familiar with it/showed greater usage). However, there are also inequalities relative to blue space quality: although communities might not be deprived in the quantity of blue spaces, those tend to have a poorer quality and are linked to safety concerns (Hunter et al. 2023). The quality of blue spaces (and cultural and individual factors such as personal values, the capability of not wanting to or feeling able to seek blue spaces) might even be greater determinants of non-use than the proximity to blue space (ibid. 2023). In this regard, researchers have highlighted the need for a stronger consideration of the wider socio-political environment, as e.g., social norms on body size ("the judging gaze of others") can be a perceived barrier to using blue spaces, turning them into "landscapes of anxiety" (Doughty 2019). As noted by Pitt (2019), "hydrophobia concentrates among society's least powerful" (p. 145) and social barriers of different kinds –e.g., ethnicity, class, disabilities, summed up as "exclusionary geographies"– rise concerns about therapeutic landscapes becoming privileged spaces. What stands out from research is that the restricted access to/use of high-quality urban blue (and green) spaces for substantial parts of the urban population has considerable consequences for their health and wellbeing, but that people from disadvantaged areas are likely to benefit the most from blue space exposure (Hunter et al. 2023; Wheeler et al. 2012). Since mental health benefits of blue space exposure have shown to be greater among more deprived communities, researchers have argued that the provision of blue spaces targeting disadvantaged populations could reduce mental health inequalities (Geary et al. 2023; Afentou et al. 2022; Georgiou et al. 2022).

As noted in the previous section, waterfront revitalization –often carried out as homogenized and business-driven flagship projects neglecting local community needs and cultural identities– has become a catalyst for further access to blue space, and thus,

blue health inequalities (Samant & Brears 2017; UN 2009). While urban blue space regeneration schemes do not necessarily result in socially exclusive developments and gentrification (dependent on several factors such as location and existing infrastructure), empirical investigations have shown that the risk is widespread and that if such processes occur, they have detrimental impacts on the health and wellbeing of residents, particularly those being marginalized (Grace et al. 2023; Brückner et al. 2022). "If public health and health equity are not included in these changes [regeneration of blue spaces], there is a significant risk of increasing socio-economic disparities and health inequalities" (Smith et al. 2022b: 10). With regard to the commoditization of health aggravating existing inequalities, public blue spaces in cities become even more important since the predominant private market access to 'blue health promotion' such as swimming pools, spa tourism and waterside yoga retreats leaves people with low purchasing power behind (Atkinson 2019; Williams et al. 2019; Smith & Puczkó 2009).

Finally, the perspectives/values outlined call for approaches to urban blue spaces that are environmentally sustainable, socially inclusive and equitable, accommodating the plurality of views and agendas and balancing state-led and market-led control (Samant & Brears 2017). At the same time, there is a need for a more robust evidence base relevant for policymaking (Hunter et al. 2023).

As this chapter has indicated, older adults –as users and beneficiaries of blue spaces in terms of supporting healthy aging in cities, the place where the majority of people will spend their old age– are of great practical relevance for healthy blue space research. Yet, as noted in chapter 2.3, the factors age and urbanity (both separately and taken together) have so far received relatively little attention (Zhang et al. 2022; Smith et al. 2021; Finlay et al. 2015; Gascon et al. 2015). This is not surprising insofar as the study of urban society and population aging has tended to be kept separate in research and policy, resulting in a relative 'invisibility' of older adults in urban development discourses (Buffel & Phillipson 2016). "Cities are, for the most part, spaces that are imagined and structured with a younger, working age demographic in mind. Older people are not, typically, incorporated into the mainstream of thinking and planning around urban environments" (Handler 2015: 12). Hence, while the challenges and opportunities of both major demographic transformations, population aging and urbanization, respectively,

have been well recognized, “the impacts of their convergence, however, are only beginning to be understood” (WHO 2015b: 3).

2.5 State of the art: The blue space-health relationship of older adults

As previously mentioned, little attention has been given to the role of age and aging in the blue space-health relationship. For example, a first systematic review of the existing academic literature on the health impacts of blue spaces in later life has been published only recently and concludes that although encouraging, the available evidence base (considering 22 studies) is limited and inconclusive (Wang & Sani 2024). Similarly, a review on nature-based solutions (urban blue and green spaces) for improved health among older people has provided inconsistent findings (Kabisch et al. 2017). This chapter summarizes the current scientific understanding, taking into account two key questions: How does age influence the exposure to and the perception and use of blue spaces and what are (specific) health effects of blue space exposure on older people?

With regard to the first question, health conditions that are associated with a reduction or loss of intrinsic capacity such as mobility or severe cognitive impairments are more common in old age, which can in turn hinder blue space access and use in later life such as the frequency of blue space visits, the types of blue spaces visited, and the activities undertaken. For example, older people seem to undertake rather moderate (e.g., walking) and sedentary behaviors at urban coastal parks (Aliyas 2019) and other types of urban blue and green spaces (Afentou et al. 2022; Garrett et al. 2019b; Finlay et al. 2015). As shown by Garrett et al. (2019b), regular blue space visits are more likely for older people living within a walkable distance. Particularly mobility impairments and frailty have been identified to limit nature experiences in later life, which is why blue space views (from at home or local streets) might be more important to older people than other types of interaction (Freeman et al. 2019; Coleman & Kearns 2015). In a study involving 72 New Zealand older adults living both in private and institutional settings, nearly all participants experienced age-associated changes in their ways of connecting with nature as living circumstances, health and mobility changed (Freeman et al. 2019). Yet, as highlighted by these and other authors, older people with limitations in physical and mental abilities still value to directly engage with nature and enjoying the sensory experiences first-hand. The

potential reduction of mobility and lifestyle changes at an older age is likely to increase the time spent in the neighborhood (Chen et al. 2022). As research has shown that the effects of neighborhood environment on health and wellbeing are greater for those spending a large proportion of time at home or within the neighborhood, nearby blue space might impact older people more than blue spaces being further away (Grace et al. 2023). In a study by Chen et al. (2022), for example, older people with poor mobility were more likely to stay at nearby blue spaces, while Pool et al. (2023) found the same pattern for older people without mobility constraints. In this regard, several authors have highlighted that the reliance of older people on neighborhood environmental resources can have detrimental health effects if it means being exposed to low-quality (polluted) blue spaces for a longer time, a risk particularly pronounced in LMICs (Chen et al. 2022; Chen & Yuan 2020; Lin & Wu 2021).

Older adults may also use (nearby and far away) blue spaces more than in previous phases of life due to more free time and opportunities to engage with nature (Freeman et al. 2019). In a study by Völker & Kistemann (2013), older people were observed using an urban riverfront more frequently during the week compared to other population groups. Further, older people (with high purchasing power) seem to be an important target group for residential developments by the water, which in turn can increase their blue space exposure. For example, in Helsinki Metropolitan Area, high age is more frequently associated with living closer to 'the blue' (Viinikka et al. 2017). Land-use changes involving blue spaces and their surroundings often come along with considerable effects on residents and blue space visitors (Grace et al. 2023). Hence, older people as potential long-term residents of a neighborhood and thus, with greater knowledge of/attachment to the local blue spaces, might feel more strongly about any environmental changes (ibid. 2023). In this regard, urban blue space regeneration projects –if carried out sensitively– have the potential to increase older people's blue space use, as exemplary seen in the restoration of an urban riverfront in Spain (BlueHealth n.y.).

Finally, particularly qualitative, but also some quantitative research has demonstrated that in addition to accessibility/walkability, feelings of familiarity/safety, the presence of facilities such as toilets and benches (level of comfort) and a high ecological quality are

of vital importance for older people to derive health benefits from blue spaces (Pool et al. 2023; Smith et al. 2022; Aliyas 2019; Garrett et al. 2019; Pitt 2019; Finlay et al. 2015). For instance, opportunities for blue health experiences in older study samples were felt to be reduced by dangers perceived in public (blue) spaces, e.g., encountering groups of young men or sparsely populated areas (Pitt 2019; Finlay et al. 2015). While attitudes to risk diverge and a high inter-individual variability in old age has to be generally considered, "(…) fear of harm is a significant dimension of hydrophobia because it can be an absolute barrier to accessing blue spaces" (Pitt 2019: 144). Yet, as shown by Garrett et al. (2019b), the importance of perceived safety varies significantly across geographic contexts. In contrast to other studies (e.g., in the UK), perceived safety was not related to blue space visits by older people in Hong Kong where public spaces are typically clean and street crime is low. In their study, perceiving blue spaces as having good facilities and wildlife presence significantly increased older adults' willingness to visit blue spaces and were predictors of recalled wellbeing (along with duration and activity intensity) (ibid. 2019b). In a study by De Bell et al. (2017), the importance of nature in underpinning health benefits from blue spaces was relatively greater for older people compared to younger groups, pointing to the significance of a good ecological quality of blue spaces. Conversely, Chen & Yuan (2020) found that the environmental quality requirements of older individuals at blue spaces were far lower than those expressed by young and middle-aged individuals during in-depth interviews; yet the authors did not specify the requirements. Drawing on older people's perceptions of local blue and green spaces in a coastal community in the UK (captured through interviews and photos), Pool et al. (2023) reported that participants valued easily accessible and welcoming local blue spaces they felt connected to, which were often smaller in size and could be encountered in everyday life, while further away blue spaces were not experienced and used in the same way. According to the researchers, the findings highlight that the provision of walkability is not sufficient to promote blue space use in later life (Pool et al. 2023). The authors identified two key factors that make blue spaces worth visiting for older people and provide them wellbeing: first, practicalities, i.e., accessibility and enabling safe mobility within the space –both, objectively and subjectively (being able to identify with the space and "feeling comfortable there psychologically")– and the provision of amenities such as benches, cafés, toilets and second, a personal meaning linked to the space (ibid. 2023).

With respect to the importance of having a sense of connectedness or identity with the blue space, Pool and colleagues exemplify that the presence of a bench represented not only a convenience for older people, but that it enabled them "(…) to appropriate the space for themselves for everyday purposes like snacking and picnicking, or quiet contemplation" (p. 10).

With regard to the second question, the effects of blue space exposure on older people's health and wellbeing can be classified into general health and wellbeing, physical health and mental health and wellbeing (Wang & Sani 2024). The underlying mediating mechanisms correspond to those explained in chapter 2.2: environmental quality, physical activity, social interaction and stress recovery/mental wellbeing respectively mitigation, instoration/capacity building and restoration.

General health and wellbeing

There are several cross-sectional studies using quantitative and qualitative methods, which suggest benefits of blue spaces for older adults' general health and wellbeing, including self-rated or perceived general health and perceived contributions to healthy aging. Interestingly, the majority of quantitative research comes from China. Taken together, these publications demonstrate heterogeneous results on older people's self-rated general health. In terms of positive effects, significant associations were found between greater neighborhood seawater coverage and living near the coast (Huang et al. 2022) and (coastal and inland) blue space views from home (Garrett et al. 2019b) and better self-rated general health. In the latter study, intentional blue space exposure (recreational visits) was linked to greater subjective wellbeing and a lower risk of depression (but not self-rated general health) in the case of longer visit duration (>60 minutes) and higher intensity activities such as running, swimming, cycling (ibid. 2019b). Controlling for physical activity levels suggested that health benefits for older adults arise not merely from increased exercise, but also from other mediating pathways (stress relief, social interaction) (ibid. 2019b). A recent study by Wang & Sani (2025) suggests that visit frequency mediates positive health and wellbeing effects from urban blue spaces with regular urban blue space visits (i.e., at least once a week) being associated with a greater likelihood of good self-reported health and wellbeing.

In contrast, other study findings were inconsistent. In Shanghai, Huang et al. (2019) found that older adults living in neighborhoods with higher surrounding greenness and higher proximity to both, green spaces and blue spaces, were more likely to report good health, but that residential surrounding blueness was not significantly related to self-rated health. Similarly, Chen et al. (2022) showed that residential freshwater blue space exposure was negatively associated with self-rated health through the mediating effect of stress due to poor water quality. Further, the findings did not support the mediating mechanisms of physical activity duration, social contacts and pollution (ibid. 2022). In the same vein, Lin & Wu (2021) reported only marginal effects of residential blue and green spaces (higher amount and closer distance) on self-rated health in urban and rural Chinese areas. Specifically, proximity to a major river (within 300-500m) or coastline (within 1-5km) negatively affected older people's self-rated health in cities, while living close (within 300m) to any types of larger waterbodies (>6.25ha) was associated with better self-rated health and parks did not exert any significant effects (ibid. 2021).

Looking at quantitative blue space research in later life in other geographical contexts, Aliyas (2019) and Vegaraju & Amiri (2024) found positive health outcomes of urban blue space exposure for older adults in Bandar Abbas, Iran and Washington, US, respectively. In the first study, coastal park users reported better perceived physical and mental health compared to green space users, while in the second case, older adults living closer to blue spaces showed better self-rated general health. In addition, a 100-meters (m) increase in distance to the closest blue space was associated with higher odds of reporting serious psychological distress (ibid. 2024). Finally, a review by Kabisch et al. (2017) concluded that (despite weak and somewhat inconclusive evidence) "there is a tendency for a positive association between urban green and blue spaces and reduced risk factors related to urbanization for children and the elderly as well as the promotion of health-related behaviors and subsequent positive health outcomes" (p. 370). Most studies included in the review highlighted air pollution and heat as dominating urbanization-induced health risks, other challenges were densification and noise (ibid. 2017). Health effects on older people under study included mortality (mostly related to cardiovascular and respiratory diseases), perceived wellbeing, mental health, cancer and respiratory diseases and significant associations were found for physical activity, cardiovascular mortality and

perceived general health (ibid. 2017). However, only one out of 27 papers in this review explicitly dealt with urban blue space (ibid. 2017). Along the same lines, a review by Finlay et al. (2023) found that parks/green/blue and open spaces are neighborhood environmental variables significantly associated with later life health outcomes (e.g., physical activity, mental health), but included only one study on blue spaces.

Despite researchers highlighting the cooling potential as a blue space effect particularly relevant for older people being a vulnerable group for heat-related health risks (e.g., Yung et al. 2019; Kistemann 2018), the empirical work supporting this pathway is so far scarce. A notable exception is Burkart et al. (2015) who found a mitigating effect of blue spaces on heat-related mortality in the older population in Lisbon, Portugal. With regard to urban green spaces, a review indicated that the evidence for protective effects on heat-related outcomes such as hospitalization or mortality among older people is so far weak (Kabisch et al. 2017).

Turning to the qualitative evidence, several studies have highlighted the value that older people place on blue spaces. Coleman & Kearns (2015) investigated the role of blue spaces in experiencing place, aging and wellbeing among residents of Waiheke Island, New Zealand. The study revealed a deep connection between the sea, island living and wellbeing in later life, e.g., many participants noted that interacting with blue space forms part of their daily routines; thereby providing a sense of familiarity and security (ibid. 2015). 'The blue' was widely perceived as a resource to assist an independent life (aging-in-place) and to help maintain older adults' wellbeing who showed strong emotional ties to the place despite the unique challenges the island living poses (e.g., potential isolation and lack of advanced care) (ibid. 2015). Positive place attachments (such as a 'place of paradise') were reported notwithstanding negative memories (e.g., the loss of loved ones) and positive memories of the past and symbolism evoked by 'the blue' (e.g., the sea as something larger than life, helping to put things into perspective) turned out to be a coping strategy in the experience of aging (ibid. 2015). Thus, the authors argued that blue space constitutes a "metaphorical resource" that provides sense-making (e.g., "crafting a sense of a present and future self during aging", p.216) and calming experiences for older people (even without directly engaging with it) (ibid. 2015). By representing "a symbolic

connection with the past and a fluid context for emotional wellbeing" (p. 210), blue space is not only a site for recreation in old age, but a resource for life itself (ibid. 2015).

With respect to 'the coastal blue', Costello et al. (2019) have shown that self-organized swimming groups are perceived to contribute to healthy aging by experiencing positive wellbeing effects from social connectedness and promoting self-efficacy and resilience. Further, blue space exposure was associated with better mental and physical wellbeing among older coastal community members in the UK (Pool et al. 2023). The interview findings highlight that older people are not just passive beneficiaries, but active seekers of blue spaces appreciating their restorative qualities, unique sensory perceptions and meaningful connections (e.g., evoking family memories) (ibid. 2023).

Finlay et al. (2015) interviewed 161 older residents in Vancouver, Canada to assess the impacts of (coastal and freshwater) blue and green spaces on later life health and wellbeing. Overall, the study showed that contact to nature plays an important role in older adults' everyday life (supporting the maintenance of a daily life structure) and that interacting with blue and green spaces considerably influenced their perceived mental, physical and social wellbeing (ibid. 2015). Among others, participants reported feeling motivated to be physically active, to enjoy the fresh air, to engage in social and multi-generational activities and to derive feelings of restoration, relaxation and a sense of spiritual connectedness with loved ones (ibid. 2015). Blue spaces being popular places for multi-generational enjoyment has been also noted in other freshwater blue space studies (e.g., Smith et al. 2022).

Finally, the results of qualitative studies in particular, such as those by Coleman & Kearns (2015) and Finlay et al. (2015), strongly support Conradson's argument of a therapeutic landscape being context-dependent and a relational outcome, i.e., "(…) that it is the experience of place rather than the place itself that is generative of wellbeing" (Coleman & Kearns 2015: 216). In both studies, older people noted that preferences for blue spaces and therapeutic landscape experiences are associated, among others, with embodied identities (e.g., gender, ethnicity, cultural background), individual perceptions, social interactions and (changing) abilities to engage with the place (e.g., mobility level, self-confidence) (ibid. 2015; Finlay et al. 2015). Hence, it is important to consider that older adults perceive blue spaces in very different or even contrary way: "the same place could evoke diverse reactions ranging from enjoyment to indifference to concern" (Finlay

et al. 2015: 104). This finally results in diverse blue space-health relationships of older people (ibid. 2015).

Physical health

So far, very little research has been carried out on the effects of blue spaces on physical health outcomes such as physical activity or physical functioning in older adults (Wang & Sani 2024). A population-based cohort study of people aged 50 years and above having a coronary artery calcium (CAC) screening (a measure for heart attacks or strokes risks) found that over 20 years, the prevalence of zero CAC, indicating low cardiovascular risk, was significantly higher in coastal cities compared to the rest of California (Lakshmanan et al. 2020). Additionally, cardiac risk factors such as obesity, smoking, diabetes, hypertension were significantly lower in coastal areas (ibid. 2020). A similar observation was observed in Croatia, where a cohort study revealed a distinct geographic gradient in longevity of individuals aged 90 years and above, with older individuals living in coastal areas being more likely to reach this age than those in inland areas (Masanovic et al. 2009). The study also found that risk factors such as overweight and high blood pressure were significantly less prevalent among these older adults (ibid. 2009). In Tianjin, China, Zhang & Cao (2025) showed that urban blue spaces shape older adults' walking behavior, with some people taking longer recreational walks and others opting for high-frequency, short-distance walking. The potential linkages between high exposure to blue spaces and healthy aging has been indirectly suggested by the phenomenon of "blue zones" –regions known for high concentrations of healthy centenarians, mostly in coastal regions[20] (the island of Okinawa in Japan, the peninsula of Nicoya in Costa Rica, the island of Ikaria in Greece, the Mediterranean island of Sardinia and the city of Loma Linda in California) (Buettner 2010). Research on centenarians in these 'longevity hotspots' found that lifestyle factors such as a coastal diet, regular physical activity, strong social ties, a sense of purpose in life and low stress are 'keys to longevity' (ibid. 2010). However, the role of surrounding blue space was not explicitly assessed and other writers have debunked the

[20] While those areas represent the original blue zones, municipalities can become a "certified blue zone" by providing reliable data showing a higher longevity compared to the rest of the country; thus, stimulating the implementation of environmental and policy changes promoting healthy behaviors (Blue Zones n.y.)

phenomenon of blue zones arguing that the investigations show fundamental faults[21] (Newman 2024). Finally, a longitudinal study in the UK showed that greater exposure to residential blue and green space was associated with a slower decline in physical functioning in older adults (such as walking speed and grip strength) over 10 years, with social interaction and mental health partially mediating the effect (De Keijzer et al. 2019).

Mental health and wellbeing

Several studies have investigated the impacts of blue spaces on the mental health and wellbeing of older adults, including outcome measures like depression, cognitive function, hospital admissions for neurodegenerative diseases and mental restoration (Wang & Sani 2024).

Cross-sectional studies in various cities in China have shown positive associations between blue space exposure and improved mental health for older adults. Put simply, those protective effects might be summarized as "more blue, less depressed" as in urban green space research (Stenfors et al. 2024). For example, in Beijing, street views of blue and green spaces were linked to a lower likelihood of geriatric depression (Helbich et al. 2019). In Guangzhou, residential exposure to freshwater blue space was associated with better emotional wellbeing of older people, mediated by environmental harm reduction (pollution), stress reduction and the facilitation of social contact, but not by promoting physical activity (Chen & Yuan, 2020). In contrast, in Suzhou, residential blue space exposure improved the mental wellbeing of older adults by stress relief and promoting physical activity and social interaction (Yang et al. 2024). Similarly, research in Baoji compared four types of natural environments and found that urban freshwater lakes were most strongly associated with self-reported mental restoration among older residents (Qiu et al. 2021). In addition, urban blue spaces were also more preferred by older adults (ibid. 2021).

The above-mentioned findings are consistent with cross-sectional data obtained in other countries such as Poland, where Jarosz (2022) found that older people using blue spaces such as the seaside, rivers experienced less stress and higher enjoyment. In Scotland, McDougall et al. (2021) showed that multiple metrics of residential blue space

[21] As argued in a paper pre-print by Newman (2024), the patterns of extreme longevity found in the blue zones could be influenced by faults, i.e., indicative of clerical errors (lacking or wrong birth certificates) and pension fraud.

availability are associated with lower prevalence of antidepressant medication and consequently, lower prevalence of mental ill-health among the older sample. The effects were most prominent for high neighborhood freshwater coverage (>3%) and communities in close proximity (<1 km) to the coast and freshwater lakes, whereas coastal proximity had a greater effect than freshwater coverage (ibid. 2021). Based on their analysis across cities in Australia, Cerin et al. (2022) provide evidence that good access to blue (and green) spaces (as well as low levels of air pollution) form part of 'cognition-friendly urban environments'. Specifically, the authors observed indirect positive effects of blue spaces on older people's cognitive function through cardiometabolic risk factors (e.g., waist circumference, HDL cholesterol, glycated hemoglobin) that might stem from the promotion of outdoor physical activity and higher levels of vitamin D uptake contributing to better cardiometabolic health and other mechanisms not examined in this study (e.g., social contacts, mental restoration) (ibid. 2022). As Moored et al. (2024) exemplary showed, quantitative-spatial healthy blue space research has to carefully consider the surrounding spatial context and the historical use of blue spaces as those can confound cognitive health benefits. In their study using both, 1 km radial buffers and U.S. Census tracts, greater blue space density was associated with a higher risk of mixed/vascular dementia (but not Alzheimer's disease) among community-dwelling older adults in Pittsburgh. This finding was explained by health threats due to historical industrialization (e.g., causing higher levels of air pollution) and the clustering of lower income neighborhoods along Pittsburgh's main rivers (ibid. 2024).

With respect to longitudinal research, results by Dempsey et al. (2018) from Ireland support the hypothesis that visual exposure to 'the blue' (rather than physical proximity) is associated with better mental health as older respondents with the highest share of sea view visibility showed lower depression scores, but distance from the coast was not significantly related. In a US-based cohort study of approximately 62 million older people, Klompmaker et al. (2022) found that natural environments have protective effects on the hospitalization due to neurodegenerative diseases. More precisely, blue space cover was associated with a decrease of hospital admissions for Parkinson disease (ibid., 2022). This view is supported by longitudinal research in the UK, which showed that greater exposure to blue and green spaces (at 300m and 1,000m buffers) is associated

with a decreased risk for psychiatric disorders (e.g., anxiety disorder) in older adults (Liu et al. 2024).

Blue versus green spaces

Despite similarities, researchers have argued that blue spaces provide distinct (therapeutic) landscape experiences compared to green spaces (Smith et al. 2021; Haeffner et al. 2017). While the evidence base focusing 'the blue' is increasing, many studies still encompass both types without differentiating health-related outcomes. Likewise, the aforementioned research involving older people only partially allows for a more nuanced perspective on blue and green spaces in later life.

With regard to (potential) distinct effects of blue spaces on older adults, qualitative findings by Finlay et al. (2015) suggest that blue spaces are particularly valued for mental health benefits (e.g., stress relief, spiritual wellbeing), while green spaces are highly appreciated for social interactions and physical activity. This is in line with results by De Bell et al. (2017) who found that older people were less likely to report spending time with family and friends as the single most important benefit of their freshwater blue space visit compared to younger respondents. Yet, it contradicts with studies identifying physical activity and social interaction as significant mediating factors of health outcomes from blue space exposure in later life (e.g., Yang et al. 2024; Chen & Yuan 2020). Like Finlay et al. (2015), Pool et al. (2023) argued that there are subtle differences between blue and green spaces in terms of their potential to promote mental wellbeing: "While both were clearly seen as restorative, the settings that were predominantly green, such as the parks, evoked feelings of peacefulness and calm; however, the blue space settings, such as the beach and the marina, were more likely to bring about talk of escape and holidays" (ibid. 2023: 10f).

Other studies have concluded that blue spaces may have greater effects on older people's health and wellbeing than green spaces. For example, Aliyas (2019) found that frequent urban blue space visits are associated with better perceived general health compared to urban green space visits and that blue spaces are considered more attractive and popular, thus resulting in longer stays than at green spaces. Yet, the findings may be confounded by the low percentage of green space in the city and the accessibility

difficulties reported by the older sample (ibid. 2019). Interestingly, in this study, participants with cardiovascular diseases were more likely to visit parks more often, while those having hypertension tended to visit blue spaces (ibid. 2019). In line with some previous research, the results of McDougall et al. (2021) suggest that residential blue space exposure may have a greater impact on the prevalence of antidepressant medication in older adults than residential green space availability. Conversely, Vegaraju & Amiri (2024) reported that particularly green space availability measures such as tree canopy and forest space are significantly related to better self-rated general health and lower serious psychological distress. Klompmaker et al. (2022) found that greenness (but not blue space cover) is associated with a decreased risk of Alzheimer disease and related dementia hospitalization. Along the same lines, Huang et al. (2019) showed that while older adults living in higher proximity to blue and green spaces were more likely to report good health, only higher surrounding greenness (but not blueness) was linked to better health. Finally, data by Garrett et al. (2019b) support the view of contrasting relationships between blue and green spaces as intentional visits to green, but not blue spaces were associated with higher odds of reporting good health.

While the contrasting observations call for future research to clarify possible varying health impacts provided by blue vs. green spaces, researchers have highlighted that older people appreciate the presence of greenery at blue spaces and place importance on hybrid (blue-green) environments (Pool et al. 2023; Qiu et al. 2021; Coleman & Kearns 2015; Finlay et al. 2015).

Blue space impacts on different groups of older people

On the individual level, factors such as age, cultural background, gender and income have been identified to moderate the health effects of blue spaces (White et al. 2020). The following section therefore assesses specific populations of older adults to the extent that the available studies have carried out stratified analyses.

With regard to **age**, Wang & Sani (2024) noted that a great diversity in the age metrics employed in blue health studies focusing later life. In their own review, the authors emphasized the importance of considering the process of aging and thus, expanded the search to studies involving individuals aged 50 years and over; yet, finally also included

studies with younger age thresholds (e.g., 40 years). It is striking that only one study included in the review sampled very old (>90 years) people. Some of the above-mentioned researchers have found significant variations in the blue space-health relationship by age. For example, in the study by Chen, Yuan & Zhou (2022), residential blue space and self-rated health was significantly associated in the group of 75+ year olds (fully mediated by stress reduction), but not in the younger age group from 60 to 75. In contrast, Yang et al. (2024) found that mental health benefits and effects on healthier lifestyles are greater for younger older adults. In their study, social interaction was found to mediate the blue space effects on mental health in the age group above 70 years (but not from 60 to 70 years), while stress relief had a positive correlation in both age groups, with an even higher mediating effect on the younger-olds (ibid. 2024). Similarly, Huang et al. (2022) reported stronger associations between blue space and self-reported general health for older participants aged under 80 years. In a study by the same authors, greater effects of residential greenness (amount) and proximity to blue spaces on self-rated health were observed for the youngest-old (60-69 years), while the middle-old (70-79 years) benefited more from residential blueness (Huang et al. 2019). McDougall et al. (2021) again showed that high freshwater coverage in the wider (as distinct from immediate) neighborhood was only associated with lower antidepressant medication prevalence among 50–64-year olds, but not for people aged 65 years and above. The authors consider a less frequent blue space visitation beyond 10 minutes walking time (as mobility is expected to decrease with older age) as a possible explanation which coincided with the definition of the wider neighborhood adopted in the study (ibid. 2021). Yet, in line with the results of the younger age group, decreasing coastal proximity was related to lower antidepressant medication prevalence also in those aged 65+ years (ibid. 2021). A study by Liu et al. (2024) provides evidence that the protective effects of residential blue and green spaces on the incidence of psychiatric disorders are greater for older people (aged 65+ years) compared to younger individuals (<64 years).

Differentiated results on potential **gender** differences in blue health manifestations in old age are scant and –just as for age– inconclusive. For example, there is some evidence that older men benefit more from surrounding blue spaces (Huang et al. 2022), greenness (De Keijzer et al. 2019) respectively (resp.) blue and green spaces (Liu et al. 2024) than older women, possibly reflecting a higher prevalence of unhealthy

behaviors (e.g., smoking, alcohol consumption, poor diet, and low levels of physical activity) in men compared with women (ibid. 2024). Yet, those results conflict with other studies such as those by Huang et al. (2019) (females benefit more from residential greenness) and De Keijzer et al. (2019) (stronger association between distance to blue and green spaces with physical functioning among women). This indicates the need for considering changes in risk factors across the life course, e.g., while older women tend to have more limitations in physical functioning than older men (despite having a higher life expectancy and a slower age-related muscle mass loss), sex differences in mental health have shown to decrease after the age of 75 years due to an accelerated decline in mental health for men compared to women (Stalling et al. 2024; Sialino et al. 2020).

Variations in the health effects of blue spaces for different **income groups/socio-economic statuses (SES)** among older people are the best-studied moderating variables and the available findings reflect the results from other age groups (e.g., Georgiou et al. 2022; see table 2.2 in chapter 2.2) in a way that older people with a low SES seem to benefit more from blue space exposure than those with a high SES. For example, a number of studies have noted stronger associations between blue space exposure and the respective health outcomes for older participants in deprived neighborhoods, lower-income households and lower-educated older adults (e.g., Yang et al. 2024; Chen et al. 2022; Chen & Yuan 2020; Dennis et al. 2020; Huang et al. 2019; De Keijzer et al. 2019). As stress reduction through blue spaces has been identified as a highly relevant mediating pathway for this group, Chen et al. (2022) argued that the disadvantaged position (in terms of resources) of lower-income older people leads to a high dependence on immediate neighborhood assets (such as blue and green spaces) to deliberately relieve stress. Similarly, Finlay et al. (2015) reported that most of their participants rely on walking for utilitarian and recreational purposes due to limited resources. Yet, as highlighted by Dennis et al. (2020) and Klompmaker et al. (2022), the quality of blue (and green) spaces plays a key role in deriving health benefits, which tend to be lower in deprived neighborhoods. Finally, Huang et al. (2022) showed that while living near the coast and greater residential seawater coverage are associated with better general health among both, older adults in private and public housing, the distance to freshwater blue space was related to better general health in older private housing residents only.

With respect to other groups of older adults, there is tentative evidence that **those having chronic diseases** might be particularly susceptible to mental health benefits from blue spaces (Liu et al. 2024; De Bell et al. 2017; Finlay et al. 2015). However, as noted earlier, difficulties in accessing blue spaces have been widely reported across studies with older samples, resulting in more frequent visits of blue and green spaces by older people being in better health (Enssle & Kabisch 2020). Only few studies have so far looked at potential differences between older **urban vs. rural** residents and the evidence base is inconsistent, ranging from stronger associations between blue space availability and health outcomes among urban participants (e.g., Huang et al. 2022) to exactly the opposite (e.g., Chen & Yuan 2020). Negative impacts of urban blue spaces on older people's health might particularly arise from being exposed to poor water quality (Lin & Wu 2021).

Overall, studies of the blue space-health relationship in later life are increasingly conducted with the aim to achieve healthy aging by mainstreaming aging into blue space planning and policy (Wang & Sani 2024). Thus, exploring blue health manifestations among older adults has become "a new entry point" to provide age-friendly environments (Yang et al. 2024). The small but growing evidence base indicates positive associations between blue spaces and older people's health and wellbeing (ibid. 2024; Kabisch et al. 2017). However, the blue space-health relationship in later life is not yet consistently observed (Chen et al. 2022). While the benefits provided by blue spaces are basically the same as for other population groups (see chapter 2.2), some seem to be particularly relevant for or appreciated by older adults, e.g., having a walkable destination around that supports maintaining a daily life structure, offering multi-generational enjoyment and providing a place for spiritual connectedness with loved ones (Finlay et al. 2015). Table 2.3 provides an overview of the effects of blue spaces on the physical, mental and social wellbeing of older people. Yet, reference is made to contrasting findings presented in this chapter.

Table 2.3: Summary of effects of blue spaces on health and wellbeing in old age (author's compilation adapted from Finlay et al. 2015)

Physical wellbeing	Motivated physical activity (recreation, purposeful exercise)
	Sense of improved physical/general health
	Slower decline of physical functioning
Mental wellbeing	Sense of improved mental health/emotional wellbeing
	Relaxation, stress reduction and improved resilience
	Feelings of restoration, renewal, rejuvenation
	Sense of spiritual connectedness with loved ones
	Reduced risk of depression/mental ill-health
	Sense of place (meaningful people-place connections)
	Promotion of cognitive function
Social wellbeing	Social interaction (incidental, intentional) and cohesion
	Pleasant collective experience of nature
	Multi-generational enjoyment
Others	Popular blue-green destinations
	Pleasant sensory perceptions
	Protective effects from environmental and urbanization-induced health risks (e.g., heat, density, noise)
	Contributions to healthy aging and aging-in-place (e.g., helping to maintain a daily life structure and routines, coping with strains of later life)

As outlined in chapter 2.3 for healthy blue space research in general, there are numerous limitations with regard to blue health studies in later life. Drawing on their review on blue space impacts in old age, Wang & Sani (2024) conclude that the high heterogeneity found in the studies –e.g., in terms of research design, age ranges, blue space exposure metrics, health outcome measures– hinders any comparative analysis beyond a narrative synthesis. Further, in assessing health outcomes, "most studies overlooked the specific physical and psychological characteristics of older adults" (e.g., relying on single-item self-reported general health) (ibid. 2024: 9). In this regard, the authors themselves fail to acknowledge the significance of considering a pronounced diversity in old age when for example writing: "As a special group in society, the elderly have limited physical and cognitive functions and are more likely to be affected by diseases that hinder adult health, such as non-communicable diseases and mental illness" (ibid. 2024: 9) or "The rational planning and design of blue spaces, from "macro" (e.g.,, oceans, lakes, and rivers) to "micro" (e.g., ponds, fountains, and streams), could create a healthy living environment for vulnerable populations, such as older people" (ibid. 2024: 9). Such stereotypes and generalizations about older adults' physical and cognitive limitations or being "a special or vulnerable group" fail to account for the significant inter-individual variability that exists in later life, including great variations in physiological function and resilience (Simm et al. 2024;

Kruse & Wahl 2014). As recommended by Wang & Sani (2024), both, subjective and objective health data obtained through different methods (considering e.g., functional ability tools) might be best suited to gain a comprehensive understanding of older participants' health status, which can actually capture any 'wellbeing paradox' widely seen in later life (Wettstein et al. 2016).

With regard to blue space exposure in later life, direct (sensory-based) contact has been far less investigated compared to indirect contact, e.g., considering the distance to blue spaces from participants' home or the amount of blue space in the neighborhood (Wang & Sani 2024). While there is currently no accepted standard in measuring blue space exposure, research has shown that the type of blue space exposure assessment matters to the investigation of 'blue health' and that there is some difference between the measurement of blue space availability and the actual use that might explain some of the inconclusiveness of the existing evidence base (ibid. 2024; Lin & Wu 2021; Huang et al. 2019). Despite the importance of walkability for many older people, distance –a commonly used exposure metric– seems to be a rather insufficient marker as blue space use and health outcomes are not necessarily related to blue space proximity (Völker et al. 2018). In the same vein, the water coverage ratio (measuring water availability from above based on satellite images) hardly reflects any ground-level exposures such as blue space visibility[22] that has been found to be associated with health benefits (Lin & Wu 2021). Thus, using availability metrics alone to understand whether or not older adults benefit from blue space may fail to capture the mechanisms underlying the blue space-health relationship and may not accurately reflect individuals' perceptions of these spaces (Lin & Wu 2021; Helbich et al. 2019; Kabisch et al. 2017). In other words: "Most research –and oftentimes policy– assumes that proximity and access to urban blue and green spaces are surrogates for use, and that having more urban blue and green spaces nearby is assumed to be good for all" (p. 736), yet this neglects the importance of other policy-relevant information such as the size or quality aspects (Hunter et al. 2023). As the quality of blue space plays a decisive role in older people's interactions with such spaces, measuring actual use rather than just availability might provide more accurate insights

[22] This is not to undermine promising research approaches trying to incorporate blue space visibility into planning tools such as Hellmanns et al. 2019 and Bolte et al. 2024 (for green spaces).

into the health outcomes associated with these spaces in later life (Lin & Wu 2021; Garrett et al. 2019b). Future research should further consider blue space exposure from a multi-sensory perspective (Wang & Sani 2024).

Finally, a general limitation applies to the fact that it is difficult to disentangle the effects of blue and green spaces, including for older people, to adjust for the individual and environmental-level moderating factors and to ascertain and quantify the mediating mechanisms underlying the relationship to health and wellbeing (Chen et al. 2022; McDougall et al. 2021; De Keijzer et al. 2019). As healthy blue space research continues, there is the need to clarify whether different types of blue space have different health effects on older people as blue space characteristics were not sufficiently described in most studies, e.g., differentiating between coastal and freshwater blue space only, but not indicating scale, color, quality or the surrounding environment (Wang & Sani 2024). Further, understanding the variability in health outcomes among different groups of older adults requires more nuanced research to identify specific vulnerable populations that may benefit most from blue space exposure to help progressing targeted environmental health interventions and reducing environmental injustices (ibid. 2024). Researchers then call for blue health studies in later life that include more application-oriented and longitudinal designs and expand to developing urban settings in LMICs (Cerin et al. 2022; Huang et al. 2022; De Keijzer et al. 2019; Garrett et al. 2019b; Kabisch et al. 2017).

2.6 Synopsis and research aim and questions

Water is indispensable for life and has been considered as a resource for health and wellbeing ever since. In addition, urban development has been linked to and shaped by the presence of waters, including the use of water as an important element of landscape design in early and modern cities. While the therapeutic use of ‘the blue’ concentrated on its chemical and physical properties in ancient times (which still continues), research in recent decades has increasingly paid attention to blue spaces as public health resources in terms of being places for health-promoting activities and providing health-protecting effects. As a consequence, healthy blue space research emerged as a discrete research strand that incorporates different theoretical and methodological approaches to assess the effects of blue spaces on human health and wellbeing. Generally, four salutogenic

pathways have been identified to mediate the blue space-health relationship: ecosystem services and environmental quality, increased physical activity, stress recovery/mental wellbeing and social interaction/improved social capital. Although with different emphasis, those mechanisms are supported by a growing and increasingly differentiating empirical work. The blue space-health relationship is influenced by various moderating variables on the individual and situational level, while the blue space exposure is affected by personal, local and societal actions, interventions and changes. Despite scientific progress, many knowledge gaps remain, calling –among others– for more research on freshwater blue spaces in the urban context and in LMICs, on moderators such as sociodemographic factors alongside studies focusing on experience and actual usage of blue spaces (experiential approaches).

As one of several major global development trends affecting blue health futures, aging urban populations shape the reality of the 21st century, coming along with great societal impacts. One of the most pressing questions is how to ensure healthy aging and to promote health and wellbeing in later life as health is central to the experience of old age and the opportunities it brings about. Currently, the increasing longevity does not align with the expansion of healthy lives, calling for actions to add health to years. Creating age-friendly environments is considered as a key action area for healthy aging, i.e., developing and maintaining the functional ability that enables wellbeing in old age. In view of the existing evidence base, older people seem to benefit from blue space exposure in terms of positive effects on their physical, mental and social wellbeing. Given the positive associations of blue spaces with health in later life, increasing older people's access to and use of 'the blue' as part of age-friendly environments might represent an effective public health intervention to promote healthy aging. Yet, more research is needed to ascertain those linkages and to clarify pending questions.

Research aim and questions

This dissertation seeks to gain insights into how older people in different geographic settings experience and use urban blue spaces, if they perceive urban blue spaces as 'potentially therapeutic landscapes' (Conradson 2005) and to explore which factors influence their blue space-health relationship. By analyzing how the local urban blue

space provision meets older people's demands and needs and how those are considered and reflected in the respective urban blue space planning and design, recommendations for action are derived to inform about a health-enabling blue space provision for aging urban populations. Three main research questions guide this PhD study:

1. **How do older people in Ahmedabad and Ruhr Metropolis experience the urban blue space-health relationship?**

Sub-questions:

- How do older people in Ahmedabad and Ruhr Metropolis engage with urban blue spaces in their daily lives and what factors influence their use?
- How do older people in Ahmedabad and Ruhr Metropolis feel when spending time at urban blue spaces? What do they like/dislike?
- Do older people in Ahmedabad and Ruhr Metropolis perceive urban blue spaces as potentially therapeutic landscapes, i.e., derive health-related benefits? Why or why not? Which dimensions of a therapeutic landscape (activity space, experienced space, social space, symbolic space) can be identified?

2. **How does the urban blue space provision (i.e., the quantity, quality and accessibility of urban blue spaces) in Ahmedabad and Ruhr Metropolis meet older people's demands and needs?**

Sub-questions:

- How do older people in Ahmedabad and Ruhr Metropolis assess the quantity, quality and accessibility of urban blue spaces?
- What are older people's demands and needs concerning urban blue spaces? What makes urban blue spaces age-friendly and health-promoting landscapes for them?
- Which fits and misfits can be identified, and what changes are needed?

3. **How are health interests and older people's demands and needs considered and reflected in the respective urban blue space planning and design?**

Sub-questions:

- How have urban blue spaces in Ahmedabad and Ruhr Metropolis been developed and managed, what uses are provided, and for whom?

- How do relevant stakeholders in Ahmedabad and Ruhr Metropolis perceive the health potential of urban blue spaces for older people?
- What factors influence whether current policies succeed or fail to provide health-promoting urban blue spaces for older people in Ahmedabad and Ruhr Metropolis?

Given the exploratory nature of this study, a predominantly qualitative research design was chosen by merging a multiple (comparative) case study and a participatory action research (PAR) approach ("multicase PAR") (Fletcher et al. 2015).

3 RESEARCH DESIGN AND METHODOLOGY

The research design of this PhD study combines a multiple (comparative) case study and a participatory action research approach, whereby the latter was basically used as an overarching methodology (photovoice) for data generation. As shown in fig. 3.1, recommendations for action are based upon investigating both, the demand and supply side, in an integrated manner.

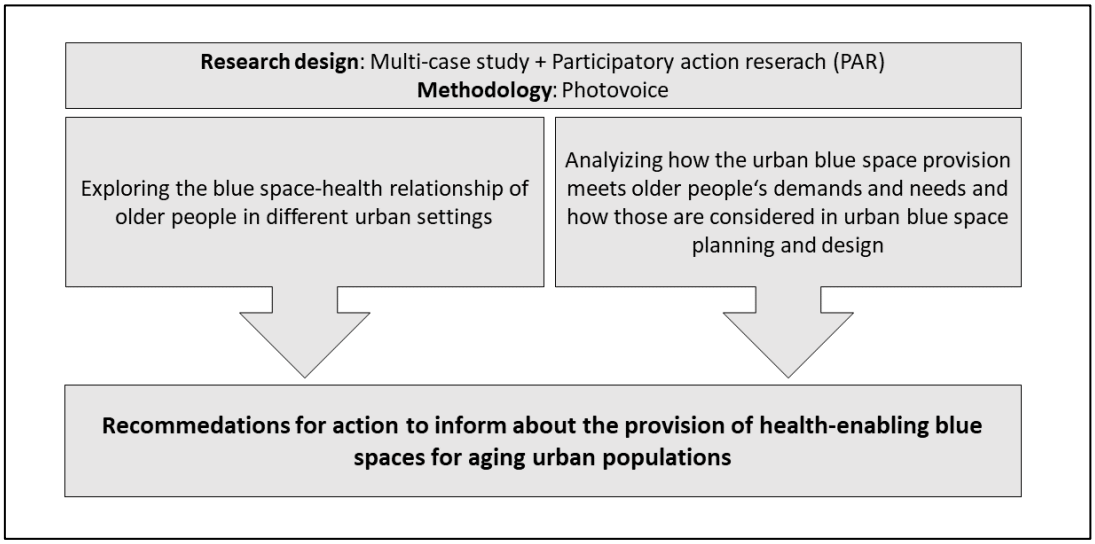


Figure 3.1: Overview of the research aim, design and methodology (author's compilation)

The following chapter explains the methodological procedures: first (chapter 3.1), the reasoning for employing a multi-case study design, second (chapter 3.2), the selection of cases, third (chapter 3.3), the adaptation and use of the photovoice methodology and fourth (chapter 3.4), the strategies applied for data analysis.

3.1 Multiple case study

Despite the methodological and philosophical variations of case study research that have evolved over time, key contributors to its development agree that the approach is particularly suited if seeking an in-depth understanding of complex and context-

dependent phenomena[23] (Harrison et al. 2017). Indeed, the focus on one or multiple cases investigated in their real-life settings represents 'the essence' of case study research (Groat 2013). It "(…) involves studying a case in relation to the complex dynamics with which it intersects and from which the case itself is inseparable" (ibid. 2013: 421). This 'embeddedness in the context' is evident in the case of the urban blue space-health relationship of older adults. As explained in chapter 2.2, the linkages between blue spaces, health, and wellbeing are not a clear and straightforward cause-effect connection. Rather, a multitude of factors exist that influence how blue spaces are perceived and used, which blue spaces are preferred and whether or not health benefits are obtained from blue space exposure. Therefore, the blue space-health relationship needs to be understood as a multifaceted entity of people-environment interactions that is hardly separable from the unique (real-life) contextual conditions in which it operates. In addition, blue health studies –as any investigations of environmental perceptions and aesthetics– face the challenge to handle the duality of objective and subjective qualities of spaces, i.e., the fact that landscapes are experienced subjectively, based on physical features (Hurtubia et al. 2015; Völker & Kistemann 2011; Heft 2010). Following this, a case study approach seemed appropriate to gain insight into the urban blue space-health relationship of older people and its underlying mechanisms in different geographic settings while being able to deal with the complexities that evolve when studying 'blue health'.

A further advantage –but often neglected aspect– of case study research is that due to the in-depth understanding provided, it suits diverse theoretical purposes that range from building to developing to testing theory (Ridder 2017). The different stances on theory contribution are linked to different positions about the generalizability of case studies, i.e., "(…) the extent to which case study outcomes are intended to tell the researcher something that is solely about the case itself (…) or (…) something beyond the case" (Roller & Lavrakas 2015: 297). Multi-case studies are considered as "external case study designs" (ibid. 2015), as their emphasis is rather instrumental, aiming to enhance the

[23] A common definition of case study research has been provided by Yin (1994): "A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 13). With the aim to make case study research more applicable to environmental design research, Groat (2013) suggests a slightly changed definition by adding the words "historic" and "settings"; thus including contemporary and historic phenomena and settings as potential objects of case studies.

understanding of a broader phenomenon (ibid. 2015; Stake 2006). In such studies, the researcher looks for similarities and differences between cases that are categorically bound together (Stake 2006), thus, enhancing "the opportunity to theorize" (Ridder 2017). At the same time, "case studies and multi-case studies are usually studies of particularization more than generalization" (Stake 2006: 8), which is why the approach is well suited to accommodate to "(…) the diversity of individual encounters to blue spaces, and thus the various manifestations of blue health" (Brückner et al. 2021: 11).

Given the variations in case study research, there is no universal procedure model. However, the use of existing tentative theory and already developed instruments and coding schemes has been approved by several scholars (e.g., Yin 2013 and Stake 2003) to guide the data collection and analysis. This study draws on this recommendation.

3.2 Selection of cases

"In multi-case study research, the single case is of interest because it belongs to a particular collection of cases" (Stake 2006: 4) –which is why Stake (1995) calls multiple case studies "collective case studies". With the aim to improve the understanding of the target collection[24], individual cases are examined that share certain characteristics or conditions and that reflect examples or manifestations of the phenomenon under study (Stake 2006). As such, purposive sampling is typical for case study research and has been applied in this work (Ridder 2017). However, since this PhD study belongs to an overarching research project[25], the selection of cases was limited to predetermined urban areas among which the cities Ahmedabad in India and Ruhr Metropolis in Germany were chosen.

In addition to the fact that the case selection was subject to organizational issues that could not be influenced by the researcher, the decision was further based upon existing knowledge in the field and other factors (e.g., convenience due to available

[24] Stake (2006) prefers to use the generic word "the quintain" to describe the collective target, "whether it is a program, a phenomenon, or a condition" (p. 6), but admits that the term is unlikely to be commonly accepted. In this study, "the quintain" or target collection is the urban blue space-health relationship of older people.

[25] This PhD study has been conducted as part of the graduate school "One Health and Urban Transformation – Identifying risks and developing sustainable solutions" with the four research areas Accra (Ghana), Ahmedabad (India), Ruhr Metropolis (Germany) and São Paulo (Brazil).

language skills). As such, choosing a case in the Global South was intended to follow the call of various scholars for comparative studies on 'blue health', across countries "with different characteristics in terms of climate, living conditions and culture" (Gascon et al. 2015: 4374), but particularly including LMICs. As noted in chapter 2.3, the current evidence on 'blue health' might suffer from an inherent "cultural bias" caused by the dominance of studies conducted in HICs and "accounts from voices of difference" are urgently needed (Foley et al. 2019b; Gascon et al. 2017). Nevertheless, European cities represent important cases in urban studies due to their extraordinary impact on urban development worldwide (McCarthy et al. 2020). Generally, the versatility of case study research allows selecting distinct cases, as Stake (2003) explains: "[Cases] may be similar or dissimilar, redundancy and variety each important. They are chosen because it is believed that understanding them will lead to better understanding, perhaps better theorizing, about a still larger collection of cases" (p. 138).

Finally, the cases selected represent two major manifestations of "the urban now" (Short 2020) and thus make interesting cases from the perspective of urban geography: on the one side, the slowly growing or even shrinking European city with a rising share of older adults and an increasing multi-cultural population composition (McCarthy et al. 2020); on the other side, the explosively growing South Asian city with a still young, but accelerating aging population and a "duality of prosperity alongside poverty in the midst of a vibrant mosaic of language, ethnicity, and faiths" (Dutt et al. 2020: 363). Despite the contrast, the cities selected also show similarities related to the research topic such as intense urban blue space regeneration activities over the last years.

In the following, both cases and their respective development contexts are presented, with a focus on considerations possibly relevant for the local blue health futures. In each city, a main research site was selected which is also presented in the respective subchapter.

3.2.1 Ahmedabad

Located in the North-west of India, Ahmedabad (in local language: "Amdavad") is the most urban and populous district in the state of Gujarat (Samanta et al. 2016). The city itself consists of about 5.6 million inhabitants and belongs to the fastest growing urban

agglomerations in India (Directorate of census operations 2011). While still being a young population (district median age in 2021: 29.3 years), national and state-level projections indicate that the share of the population aged 65 and above (currently representing the smallest population group, 6.6%) is going to rise explosively in the coming decades (NCP 2020; UN 2017b; Samanta et al. 2016). Life expectancy in Gujarat is currently 68.9 years for men and 73 years for women (NCP 2020). As distinguishing features of population aging in Ahmedabad and Gujarat, recent data point to a less ruralization compared to the national average and a potentially slower feminization of aging due to a male child preference[26] and a high masculine urban migration (UN 2017b; Samanta et al. 2016).

Being one of the most progressive states in India, Gujarat –and there particularly Ahmedabad–, ranks higher in human development than the national average (Samanta et al. 2016). The city has been an economic center with a strong textile industry during the British era ("the Manchester of the East") and is reckoned as a celebrated growth model in recent times, driven by high levels of capital investment, market-based urban development approaches, public-private partnerships and rapid infrastructural development (Samanta et al. 2016; Spodek 2011). Nowadays, the city still houses many industries such as information technology and pharmaceutics but has also seen an expansion in the educational and research sector (ibid. 2011).

Despite the success, however, scholars have noted an increasing informalization of work with gender-based wage differentials and a loss of livelihoods following urban regeneration projects such as Sabarmati Riverfront and Kankaria Lake and conclude that "(…) a schism in access and opportunities between the rich and the urban poor is likely to remain" (Samanta et al. 2016: 186). Spatially, this is reflected in a more affluent Western part and –divided by the River Sabarmati– the dense and rather deprived Eastern zone including industrial areas, the historic walled city ("Old Ahmedabad") and slums (Mahadevia 2014). Inequalities of services between the two such as the provision of well-

[26] The District Human Development Report 2016 revealed that Ahmedabad has achieved little progress regarding gender inequalities: Although improvements have been made over the past years, Ahmedabad's sex ratio ranks among the lowest in the state, which "(…) points to a pervasive culture of patriarchy and undervaluing the girl child" (Samanta et al. 2016: 31).

maintained sewer facilities and recreational spaces have been subject to ongoing criticism (Desai 2018; Spodek 2011).

Ahmedabad is a socially diverse city: according to the census of 2011, 81.4% of the population are Hindu, 13.6% are Muslim, the remaining being Jain, Christian, Sikh, Buddhist or others (Samanta et al. 2016). The city has been the site of recurring communal violence in the past; the last severe Hindu-Muslim riots (one of the worst nationwide) happened in 2002 (Spodek 2011). Although Hindus and Muslims used "to live in somewhat separated neighborhoods" (ibid. 2011: 13), the riots intensified socio-spatial segregation, e.g., leading to the development of Muslim ghettos such as Juhapura with more than 250,000 inhabitants (ibid. 2011). In this context, it is noteworthy that Ahmedabad and Gujarat experienced the spread of militant Hinduism in politics ("Hindutva") long before it gained national reach; involving that ethno-religious nationalism today endangers the traditional Indian principles of multiculturalism and secularism and leaves minorities such as Muslims in a vulnerable (disadvantaged) position (Kabir 2020; Anderson & Jaffrelot 2018; Spodek 2011).

The government of Gujarat has rolled out several programs aiming to promote public health and healthcare facilities are available throughout the city (Samanta et al. 2016). However, the per capita health expenditure ranks below national average, and the private sector plays an important role in health care (ibid. 2016). Despite its general prosperity, Ahmedabad performs poorly on several health indicators such as maternal health and infectious diseases related to poor hygiene practices as well as vector-borne and water-associated diseases are still widely distributed (ibid. 2016). At the same time, environmental health risks have been identified as key public health concerns and Ahmedabad was the first city to implement a heat preparedness plan in South Asia (Knowlton et al. 2014).

Ahmedabad lies within a hot and semi-arid region and has a monsoon climate. In addition to the Sabarmati River –the main source for water supply–, the city has a number of blue-green spaces; however, (uncontrolled) urbanization and littering has led to increasing deterioration, drying up and shrinkage of the urban lakes (Yatoo et al. 2020; Patel et al.

2018; Bal et al. 2013). Fluctuations in water availability due to the dependency on monsoon and falling groundwater table and poorly maintained infrastructure reinforce the problem (Yatoo et al. 2020). For example, a storm water drain network initiated in 2002 to revive some of the lakes has failed so far, likely due to broken and missing links (Times of India 2019, 2022). Scholars expect that with ongoing urban growth and lacking policy action, Ahmedabad's already existing water stress could turn into a water crisis in close future (Patel et al. 2018). The park space per person in Ahmedabad (0.25 square meters (sq m)) lies far below the minimum amount (9 sq m) recommended by the WHO (2012).

Two authorities are involved in urban planning: the primary planning authority Ahmedabad Urban Development Authority (AUDA), responsible for the creation of a comprehensive development plan for the entire metropolitan area; and the Ahmedabad Municipal Corporation (AMC), responsible for civic administration, provision of infrastructure and services, and the preparation of area-specific land use plans within their mandate (Munshi et al. 2019). In the development plan for 2013, AUDA has outlined strategic objectives to develop a green infrastructure network including investments in parks, groves, green streets, and the city's water resources (Mell 2017). Scholars have rated it as a "positive sign of strategic foresight" that not only connectivity, but also accessibility and multi-functionality have been considered as key principles of green space development (ibid. 2017). Yet, while fostering environmental resources is considered crucial for Ahmedabad's resilience to climate change and sustainable urbanization, researchers have also highlighted that "(…) green infrastructure management is not a primary issue for developers or government in India" (p. 5) and that economic imperatives might hinder integrated approaches to blue and green space management (ibid. 2017). For example, it has been strongly questioned whether economic goals have undermined social and ecological interests in the regeneration of the Sabarmati Riverfront as the project was linked to large resettlements of the urban poor and the creation of paid green spaces (Desai 2018; Mell 2017). Further criticism revolves around organizational weaknesses including a difficult relation between AUDA and AMC, a lack of transparency, strategy, and collaboration in the decision-making process and shortcomings of existing planning instruments (Munshi et al. 2019; Mahadevia et al. 2018; Mell 2017; Bal et al. 2013).

Main research site: Parimal Garden

Parimal Garden is one of the oldest and most visited parks in Ahmedabad, located in the upper-middle-income neighborhood Ambavadi in the Western city center (UNM Foundation 2018). It stretches about 38.704 sq m with a large Lotus lake being at the heart of the park (ibid. 2018). Parimal Garden has fallen under a corporate social responsibility (CSR) initiative of the pharmaceutical and energy company Torrent Group in 1995 during which the park was subsequently refurbished and brought to its current design. As fig. 3.2 shows, features of the park include a playground, exercise equipment, a gym, lawns and an amphitheater. Recently, a new regeneration plan with focus on re-planting and repairing derelict sites has been set up which should be implemented right after the completion of this study (ibid. 2018.)

Parimal Garden was chosen as a main research site for several reasons: given its popularity across age groups, it was considered likely to successfully sample older people there (compared to other urban blue spaces) and the park provides a sufficient level of safety and convenience for older study participants and the research team.

Figure 3.2: Site plan of Parimal Garden (by kind permission of UNM Foundation 2018)

3.2.2 Ruhr Metropolis

Ruhr Metropolis is a polycentric urban agglomeration consisting of seven cities in its core in the Western German state North Rhine-Westphalia (LÖGD NRW 2006). With more than 5.1 million inhabitants, it is one of the biggest conurbations within Europe (Marx 2020; RVR 2018). Despite regional exceptions and a high influx of migrants and refugees during the past years, Ruhr Metropolis has been facing a shrinking population trend for many years, and it is projected that in 2030, the population will fall below 4.8 million (ibid. 2018). This goes along with a pronounced population aging: The share of the local population aged 65 years and above will rise up to 28% (about 1.4 million people) by 2030 (RWI 2011). In 2018, the median age in Ruhr Metropolis was 46 years (Bonny 2020). Although regional differences exist, life expectancy in Ruhr Metropolis is below (up to 3 years) the state average (82.8 years for women, 78.3 years for men) which itself ranks slightly lower than the national average (LZG NRW 2018, 2020). Explanations discussed in scientific literature include effects of the local population composition and contextual effects, e.g., local environmental impacts (LZG NRW 2018).

The city of Essen was chosen as the main research site for this study. Compared to other cities in Ruhr Metropolis, Essen has one of the lowest youth populations and a slightly rising population trend (City of Essen 2019; Bonny et al. 2016; Amonn et al. 2011). The city might be considered as a forerunner of the region's structural change given its awards as European Capital of Culture in 2010 and European Green Capital in 2017 (Raskob 2017). However, there is generally a great similarity between the cities in Ruhr Metropolis as their boundaries often even merge within the same street (RVR 2018). This similarity has also been confirmed in cluster analyses (e.g., Dahlbeck & Neu 2014). The cities are united administratively by an association committed to the development of the metropolitan region (Regionalverband Ruhr, RVR) that takes over cross-city tasks, e.g., regional planning and infrastructural projects like the Emscher Park and the cycle path network (RVR, 2018). Further, an economic alliance (Business Metropole Ruhr) exists to support regional economic development (ibid. 2014).

Due to the regional deposit of coal, Ruhr Metropolis evolved as the industrial heart of Germany and fueled the country's post-war economic miracle with its strong mining and

steel industry (RVR 2018.). From the end of the 20th century onwards, the metropolis experienced an internationally recognized structural change induced by investments in the education and research sector and large infrastructural projects, e.g., the creation of green spaces and the reconfiguration of industrial sites to cultural facilities (ibid. 2018). Today, Ruhr Metropolis is a leading green technology and energy industry location and houses a strong service, health care and retail sector (ibid. 2018). Particularly because of its polycentrism deemed advantageous, scientists consider Ruhr Metropolis as a global blueprint and counter draft to mega cities that have to fight against environmental and infrastructural problems and rising ungovernability (RVR 2018; WBGU 2016). Yet, despite the successful transition and a distinct image change, unemployment and poverty rates remain higher than the state average and the labor market situation is particularly unfavorable for immigrants (RVR 2018; Bonny et al. 2016).

Ruhr Metropolis has been known as 'Germany's melting pot' given its long tradition with immigration since the beginning of industrialization and particularly during the mid-20th century due to recruitment agreements with South European countries (Marx 2020). The metropolis continues to become home for a variety of cultural and ethnical groups; 13% of the population are non-German (RVR 2018). Most recently (2017-2019), Syria, Bulgaria, and Romania represent the most common origin countries; while Turkish migrants still form the largest community in relative terms (Marx 2020; RVR 2018). The proportion of non-Germans aged 65+ years is only half as high as the proportion of older adults in the total population, despite an upward trend (Amonn et al. 2011).

Originating from the coal and steel past, social segregation is a major challenge in Ruhr Metropolis, reflected in working-class neighborhoods and social deprivation prevailing in the Northern city areas as opposed to the South (Amonn et al. 2011; Strohmeier & Bader 2004). Given the interlinkage of economic, social and environmental factors, the overall population health status in Ruhr Metropolis lags behind the state average (Dahlbeck & Neu 2014; Bardehle & Klapper 2006; LÖGD NRW 2006).

Green and open space development in Ruhr Metropolis began already in the late 1920s; however, it was marked by North-South-inequalities (Augustin & Schwinning 2017). In the process of structural change, large investments were made into the creation and

restoration of blue and green spaces, such as the renaturalization of the open sewer canal Emscher and its tributary streams (1992-2020) (Emschergenossenschaft 2012). As seen in the masterplan and subsequent action program "ESSEN. New ways to the water" for creating blue-green corridors (integrating approaches to storm water management), the Emscher renaturalization provided impulses for creating new ecological and urban qualities (Augustin & Schwinning 2017; Raskob 2017). Since 2007, more than 500 single interventions involving investments of about 48 million Euro have been carried out, e.g., the development and regeneration of green spaces, ponds, and lakes, the creation of cycle and pedestrian paths, the decoupling of roof downpipes, and the renaturalization of streams (Augustin & Schwinning 2017).

Looking at other cities in Ruhr Metropolis, the city council of Duisburg outlines in its strategy "Duisburg2027", how water shall become the leading theme for urban development and how the identity-establishing potential of blue spaces could be used for attractive housing, commerce, and leisure areas; making Duisburg "a place of maritime flair" (City of Duisburg 2011). Over the last decades, various interventions to tackle social and environmental problems and inequalities in the Northern urban areas were implemented; facilitated by the availability of brownfields, the search for re-uses of buildings due to urban shrinkage, and funding initiatives (e.g., the federal urban development program "The Socially Integrated City") (RVR 2018; Augustin & Schwinning 2017; MWEBWV 2010). In Essen, substantial improvements in the accessibility, connectivity, and quality of blue and green spaces were achieved: green and open spaces (including waterbodies) make up more than 50% of the municipal area (Germany's third greenest city) and almost all inhabitants (99.7%) can reach a public green space within 300m of their home (Augustin & Schwinning 2017).

However, not all green and blue space interventions in Ruhr Metropolis are considered successful, as the examples of Lake Phoenix in Dortmund and the city port "Ruhrbania" in Mülheim show. While Lake Phoenix is associated with discussions about the deconstruction of local identities, user conflicts, social polarization and gentrification, a citizens' initiative in Mülheim criticizes the alleged misspending of public money and the undermining of democratic principles in the decision-making process (MBi 2018; Frank & Greiwe 2012).

Unless local matters are subject to the provisions of federal state law or federal law, municipalities in Germany are in responsibility of planning and urban development; thus, the city councils are the most important decision-making bodies in that regard (MWEBWV 2010). Yet, the central and state governments also exert some influence by providing a legal framework and funding programs (ibid. 2010). Further, urban development policy in Germany is embedded in the European context, e.g., the Leipzig Charter on Sustainable European Cities (2007) and its update "The New Leipzig Charter" (2020) as a guiding framework for national urban development, and the regulations relative to respective EU funding schemes (ibid. 2010).

Main research site: Lake Niederfeld

Lake Niederfeld, located in the neighborhood Essen-Altendorf, is a prime example of the recent urban regeneration initiatives in Northern Ruhr Metropolis (Augustin & Schwinning 2017). The 2.2 hectares (ha) lake is surrounded by a 3.4 ha green space and was established in 2014 (ibid. 2017). With the aim to achieve new urban qualities, to change the neighborhood image and to balance the local population composition, the lake was designed as a place-making feature that should transform the neighborhood and contribute to a high residential value (Augustin & Schwinning 2017; Busmann n.y.). In conjunction with the municipal housing company Allbau AG, the blue-green space development was linked to the renovation and partial renewal of the adjacent outdated residential estate with high vacancy rates; leading to the creation of more than 80 upscale, energy-efficient flats (Augustin & Schwinning 2017). Lake Niederfeld is connected to a wider green network by foot and cycle paths (e.g., the "Ruhr cycle highway"); offering quick connections to larger recreational spaces and the city center (ibid. 2017). Given its high deprivation, the neighborhood Altendorf became part of the federal urban development funding program "Socially Integrative City" which involved the setup of a neighborhood management (MWEBWV 2011). Several measures were implemented to ensure public participation, e.g., workshops with the local community, regular public walks along the construction site, activation of private owners to upgrade the surrounding housing stock, and the creation of a citizens' group taking over the maintenance of the green space (Augustin & Schwinning 2017; Busmann n.y.). Fig. 3.3 shows the setup of the area. In addition to the residential usage, some commercial developments followed,

e.g., gastronomy, a hostel, multi-generational living, a day care center for people in need of care and a bike rental shop.

Lake Niederfeld was selected as a main research site since it offers comparable conditions to Parimal Garden in Ahmedabad such as the same urban blue space type (artificial lake), a mixed (residential and commercial) surrounding, and a sufficient level of amenity and safety for older study participants and the research team.

Figure 3.3: Site plan of Lake Niederfeld (by kind permission of the city of Essen)

3.3 Photovoice methodology adapted to the study

Choosing a case study design primarily refers to "what is to be studied" but does not yet reflect a methodological choice: "By whatever methods, we choose to study the case" (Stake 2003: 134). Often, the emphasis lies on qualitative methods such as document reviews, interviews, and observation, but quantitative and mixed methods case studies are possible (Ridder 2017).

The following reasons formed the rationale for combining a case study design with a PAR approach: First, PAR enables the documentation of local realities, as aimed for in this study, by focusing on the lived experiences of people and, in contrast to conventional (investigator-driven) research, not removing valuable contextual information (Baum et al. 2006). As such, it matches with the property of case study research to be sensitive to complex and context-dependent phenomena such as 'blue health'. Given its foundation in local knowledge and experiences, participatory research is particularly useful to bring out (varied) views that are typically not or hardly available for researchers and decision-makers and can provide important insights for policy (Wright et al. 2018). Thus, PAR can be expected to capture older people's blue space/health experiences well and to accommodate to the heterogeneity in old age. Second, PAR advocates for the empowerment of study participants and engaging them as co-producers of knowledge (Baum et al. 2006). By doing so, it takes up similar demands (e.g., active collaboration, public participation) emphasized in recent research and policy related to aging and health (Dizon et al. 2020; Buffel & Phillipson 2016; Kickbusch & Gleicher 2012). In fact, photovoice –despite being rarely applied– has been recommended as a tool for participation in the planning of urban green spaces and as a research method to gain a deeper understanding of particular blue and green space experiences (Grace et al. 2023; Hansen et al. 2017).

The participatory action and arts-based research methodology photovoice (VOICE as an acronym for **V**oicing **O**ur **I**ndividual and **C**ollective **E**xperience) is defined by its developers as "(…) a process by which people can identify, represent, and enhance their community through a specific photographic technique" (Wang & Burris 1997: 369) and has been originally applied in public health research to advance needs assessments. Put simply, study participants are given cameras and questions/prompts related to the overall

research question and are asked to reply through photography and the narrations beyond (ibid. 1997). The visual image is used as an instrument to create immediate evidence and as a participatory means to promote knowledge sharing (ibid. 1997). In its original sense, photovoice aims at (i.) enabling people to record their everyday realities and community's strengths and concerns, (ii.) the promotion of critical reflection and dialogue, and (iii.) reaching decision-makers and inducing policy change (ibid. 1997).

The potential benefits of photovoice for healthy blue space research have been discussed in Brückner et al. (2021) and refer in large part to the rationale for adopting a PAR approach mentioned above. In addition, the authors claim that the methodology suits for blue health studies because of the following reasons:

- The high flexibility and adaptability of photovoice allow to integrate different approaches and theories to healthy blue space research, to link demand and supply side assessments, to collect diverse parameters of the blue space-health relationship, and –given its open-endedness– to rank first participants and their perceptions and experiences of whatever kind, as outcomes are not pre-defined (Brückner et al. 2021).
- Given that photovoice was originally developed for voicing out the needs of marginalized groups, it qualifies "to hear a fuller set of voices" in resp. for more inclusive healthy blue space research (Foley et al. 2019b). For example, it offers a low-threshold way to engage older people with different capabilities "(…) and mobilize their expertise, skills and knowledge and to stimulate co-production in developing age-friendly initiatives" (Buffel & Phillipson 2016: 98).
- By collecting firsthand experiences from the active, engaged user of blue spaces, photovoice can shed light on the underlying mechanisms of the blue space-health relationship, e.g., pointing to blue space properties that are perceived as health-enabling or -limiting features (Brückner et al. 2021). In public space research, images have shown to be more accurate representations than text, as "(…) they explicitly show the physical features of the scenario to the respondent" (Hurtubia et al. 2015: 461).
- Photography can facilitate the articulation of environmental perceptions and blue health experiences since it allows participants to express themselves in a non-

verbal way (Brückner et al. 2021; Glaw et al. 2017). For researchers, the photographic responses add additional layers of meaning to the data (Glaw et al. 2017). For example, the exceptional power of images might help to better identify health-enabling characteristics of blue spaces and to better inform landscape design (Brückner et al. 2021).

- Photography works as a "can-opener" by enabling access to communities and building rapport, as people usually want to see the results and feel motivated to collaborate (Collier & Collier 1986). The feedback opportunity of photography (handing out images) is usually considered as a gratifying experience (ibid. 1986). In addition to such tangible benefits, study participants can benefit from positive wellbeing effects associated with participatory arts experiences (Brückner et al. 2021).

This photovoice study was guided by the eight-step-procedure by Latz (2017) which includes: (1.) identification of place, people, and study purpose, (2.) invitation of participants, (3.) education of participants, (4.) documentation, (5.) narration, (6.) ideation, (7.) presentation and (8.) confirmation (see fig. 3.4). The procedure represents an adaptive design guide that can be modified to the aims and specifics of any photovoice study (Latz 2017). The following chapters 3.3.1-3.3.6 outline how the first five steps were implemented. Step six and subsequent ones, which represent the data analysis, are addressed in chapter 3.4.

Ethical approval for this study was obtained from the ethics committee of the Center for Development Research (ZEF) on 18 August 2018 and by the ethics committee of the Indian Institute of Public Health Gandhinagar (IIPHG) on 31 January 2019 (see annex no. I). The study took place from January 2019 to May 2019 in Ahmedabad and from September 2019 to April 2020 in Ruhr Metropolis, allowing comparable climatic conditions (spring in India, summer/autumn in Germany). The methodological steps described in the following apply for both. Variations in the procedure, if any, are explicitly mentioned in the respective chapters.

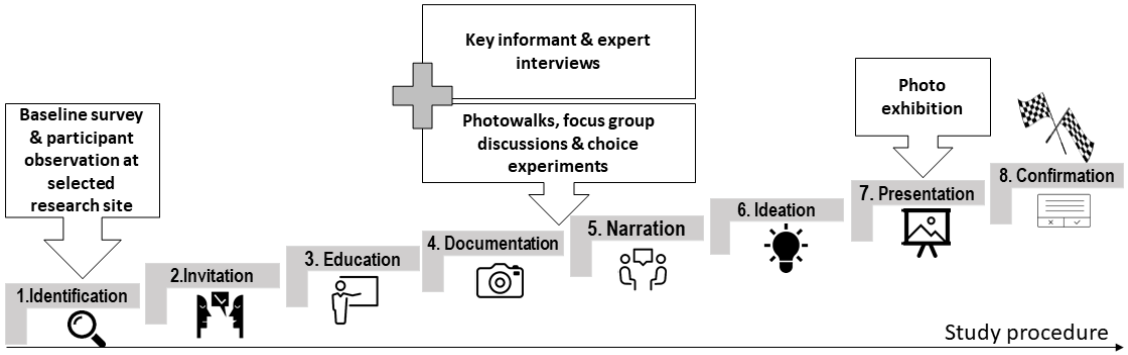


Figure 3.4: Photovoice in eight steps applied to this study (author's compilation according to Latz 2017; first published in: Brückner et al. 2021: 7)

3.3.1 Participant observation

A participant observation (PO) was initially conducted to get familiar with the selected main research site, to gain an understanding of its functioning, the users and their behaviors. Since blue spaces were selected that are known to be used by older adults, the PO aimed to seek information particularly on older adults' blue space use. An adapted version of the park observation tool SOPARC ("System for Observing Play and Recreation in Communities") by McKenzie & Cohen (2016) was used to structure the observation (see annex no. II). The tool has been recommended for the evaluation of blue space use and the levels of physical activity conducted therein (Gascon et al. 2017). The systematic approach allows to immediately develop analytic categories of the observational data.

Prior to the PO, the main research site was divided into designated scan areas and, if required, smaller sub-target areas. The observation period was scheduled over one week to include working days and weekends with an additional one-day field entry to set up and test the observation tool. According to the opening hours (only in Ahmedabad) and the user behavior of older people (information gained on the field entry day), three daily observation periods (morning, afternoon, evening) were defined. In each observation phase, the principal investigator conducted at least one rotation of scans in every target area. Due to the heat at daytime and the closing of Parimal Garden in the midday hours, the morning observation period there started much earlier and the other two periods later than in Essen. The daily assessment –recorded in observation protocols– included information on the local weather, a range of characteristics for each scan area ("target area conditions") and the most common activities undertaken.

3.3.2 Baseline survey

The PO was linked to a baseline survey at each main research site since face-to-face recruitment has shown to be a successful strategy in photovoice studies (Latz 2017). In addition, the survey aimed at gaining deeper insights into the urban blue space-health relationship of older adults. Over the week, trained research assistants (RAs) randomly sampled older blue space users. In Ahmedabad, one female and one male RAs were employed to prevent potential problems related to gender sensibility. The questionnaire design was based on a literature review about the factors influencing people's blue space-health relationship and included questions eliciting information on socio-demographics, the individual health condition, the individual exposure to, the experiences and uses of blue spaces (including the main research site and blue spaces in general). It also asked whether people would be up for participating in subsequent photowalks. The questionnaires and the informed consent forms can be found in the appendices, see annex no. III and no. IV. All documents were available in German, English and Hindi.

3.3.3 Photowalks

After the baseline survey, participants willing to take part in further research activities and meeting the eligibility criteria[27] were invited for so-called "photowalks", i.e., semi-structured, individual walking interviews ("go-alongs") to different blue spaces in the city. The aim of this method was to explore in greater depth themes from the questionnaire by allowing the participants to give information that is more elaborate. In addition, go-alongs were expected to facilitate the researcher's understanding of local knowledge and to better unravel the underlying mechanisms of the blue space-health relationship.

Prior to the start of the photowalks, selected participants were informed about the setup of the walk and its aims, were introduced in how to use a disposable camera, and were given the opportunity to request clarification (education step). The concurrent realization of documentation and narration in conjunction with the researcher team through the method of photowalks enabled to expose older participants to different and unfamiliar urban blue spaces and to assist them, e.g., with taking pictures and walking.

[27] Generally, people were included who are aged 65 years and older, retired, and have their usual place of residence in the respective city. For the photowalks, it was further required to be in a stable health condition that allows doing some moderate physical activity, e.g., walking at least half an hour without mobility aid.

The combination of both steps also turned out to be the most practical way since participants mostly disagreed to engage several times in the study due to time limitations. The photowalks took place with the principal investigator and one research assistant. In Ruhr Metropolis, the participants did the photowalk together. Fig. 3.5 shows the routes planned in each city, both starting at the respective main research site. The distances between each destination were done by car. However, in Ahmedabad, almost all photowalks were limited to the main research site since 3 out of 4 participants were not willing to visit other urban blue spaces.

Figure 3.5: Photowalk routes in Ahmedabad (top) and Ruhr Metropolis (bottom) (author's compilation)

Participants were asked to bring pictures related to blue spaces of their private collections. In addition to the auto-photography (participants taking pictures) done during the go-alongs, existing pictures were used to stimulate further narration. The documents related to the photowalks, i.e., the interview guidelines and the photograph release forms, can be found in the appendices, see annex no. V and no. VI.

3.3.4 Focus group discussions

Including members of different social groups is a well-known challenge in participatory health research and without due attention to differences, studies can reproduce social inequalities (Wright et al. 2018). Since the baseline survey and the photowalks in Ahmedabad turned out to be biased towards middle-and-upper-class older Hindus, mainly men, additional focus group discussions were planned with different (minority) populations of older adults to include different voices and perspectives in this study. Focus group discussions (FGDs) were chosen as a method commonly used in photovoice projects and qualifying for hard-to-reach and vulnerable populations (Latz 2017; Roller & Lavrakas 2015). Recruitment strategies involved reaching out to gatekeepers of communities of interest and joining regular gatherings of the target group. Finally, in Ahmedabad, two FGDs were conducted with a senior citizens' association of Muslim men and a mixed gender and religious senior citizens' yoga group meeting regularly at another park than the main research site. A similar procedure was applied in Ruhr Metropolis, resulting in two FGDs with older migrants (from Russia and Turkey). To make it most convenient for the participants, all FGDs took place in-person at their usual gathering places (see fig. 3.6). Procedures included an introduction to the research project, a questionnaire (a shortened version of the baseline survey combined with a stated preference choice experiment, see chapter 3.3.5), and a semi-structured group discussion about the importance and use of urban blue spaces, the local blue space provision and design and potential suggestions for urban planning and policy. The documents (questionnaires, guiding questions) can be found in the appendices, see annex no. VII and annex no. VIII.

Figure 3.6: FGDs in Ahmedabad (top) and Ruhr Metropolis (bottom) (Source: author's personal collection)

3.3.5 Stated preference valuation/Choice experiment

To delve deeper into older adults' blue landscape preferences and to support the qualitative data gained from the interviews and FGDs, a stated preference valuation using images was integrated in the data collection: for photowalk participants, in a separate meeting after the photowalks (in which they also got a copy of their pictures), and for participants of the FGDs, as a second part of the questionnaire (see annex no. VII). Most prominently used for investigating people's preferences and willingness-to-pay for non-market goods, stated preference methods "(…) rely on information on consumer choices that are made in experimentally-controlled hypothetical settings" (Hanley & Czajkowski 2019: 249). Assuming that there is value in the choices people make, the respondents' hypothetical choices can be used as data to elicit their preferences (ibid. 2019).

In this study, a choice experiment involving a ranking exercise and stated preference questions was applied. Participants of the photowalks and the FGDs were given pictures of different urban blue spaces in the respective city (see fig. 3.7) and were asked "How attractive do you find the blue landscapes presented to you?" The series of ten images then needed to be ranked according to individual preferences (from least to most attractive). Participants were also asked about their feelings about the least and most preferred urban blue space using a verbal version of the Self-Assessment Manikin (SAM)

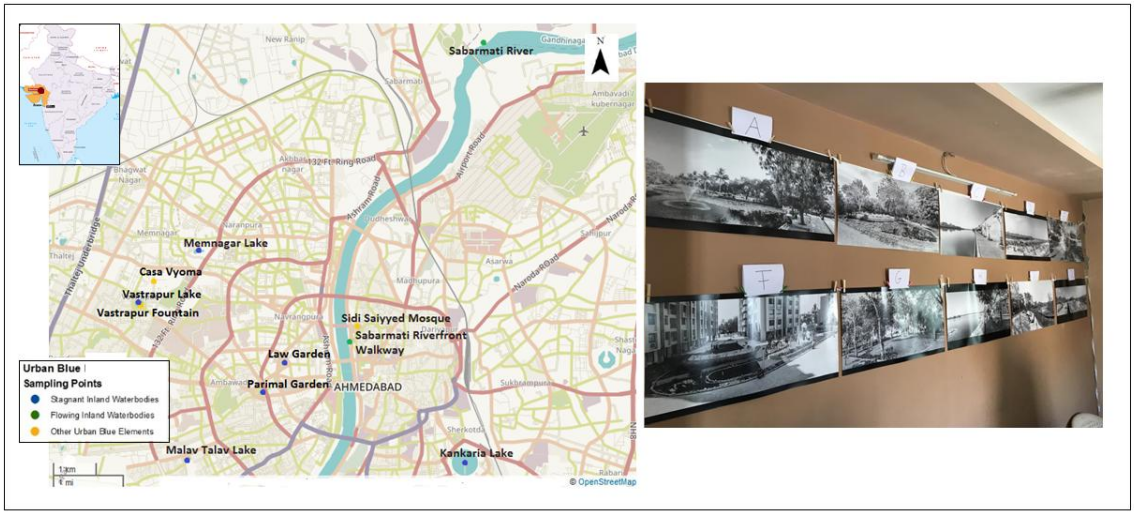
five-pointer scales by Bradley & Lang (1994) and adapted by Geethanjali et al. (2017), see table 3.1. The SAM technique enables participants to self-evaluate the subjective emotional state associated in response to a stimulus (e.g., a photo) along the two major affective dimensions of pleasure (valence) and emotional arousal[28] (Bradley & Lang 1994).

Table 3.1: SAM scales for valence and arousal rating (adopted from Geethanjali et al. 2017)

Valence rating				
Unpleasant	Unsatisfied	Neutral	Pleased	Pleasant
Arousal rating				
Calm	Dull	Neutral	Wide-awake	Excited

In a second step, participants had to choose one urban blue space they would be most willing to visit among pre-defined picture sets. The four choice sets each included at least two and up to four images of similar urban blue spaces (artificial ponds, rivers, water features, lakes). The blue spaces were pictured during decent weather conditions by a professional photographer and then converted into black-and-white images since the color blue is known to confound photo ratings by people's general preference for blue (White et al. 2014). Blue spaces were selected that represent different types and provide different qualitative attributes; however, in Ahmedabad, because of the limited availability of water, blue spaces had to be selected that were not or hardly filled (but known to be filled during the monsoon season). In Ruhr Metropolis, not all FGD participants could fill in the questionnaire due to insufficient language skills and limited capacities of the translators.

[28] Taking up the common distinction of three components of emotions, the SAM scale originally covers three rating dimensions: valence (or pleasure) (the pleasantness of a stimulus), arousal (the intensity of an emotion provoked by a stimulus), and dominance (the degree of control exerted by a stimulus) (Warriner et al. 2013; Bradley & Lang 1994). This study –in line with various other investigations in emotion research– focuses on valence and arousal only as dominance has not been investigated to the same extent as the other dimensions (Sutton et al. 2019).



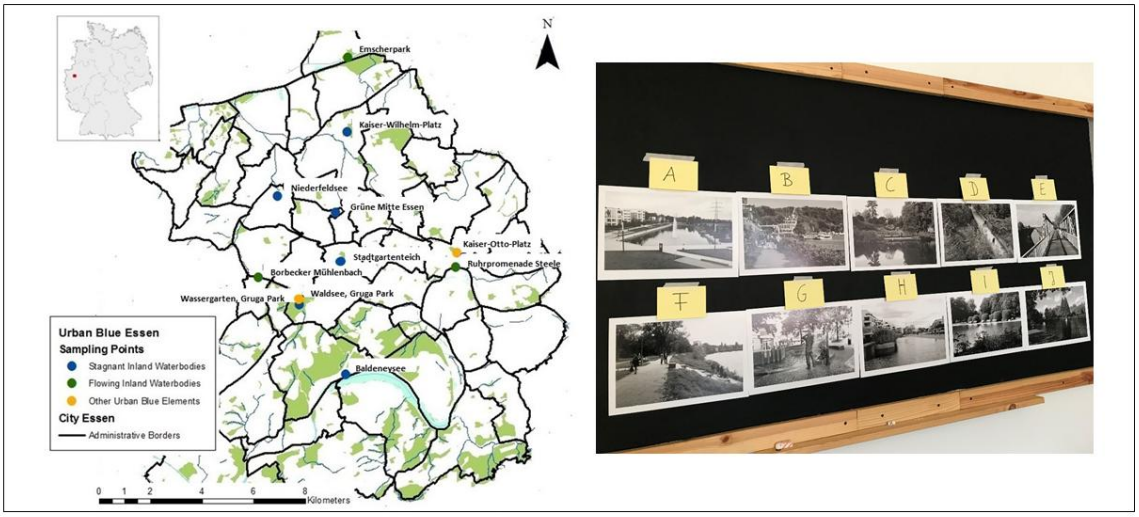


Figure 3.7: Blue spaces sampled for the choice experiments in Ahmedabad (top) and Ruhr Metropolis (bottom) (author's compilation)

3.3.6 Key informant and expert interviews

Semi-structured interviews with key informants and experts were conducted to elicit further information about the urban blue space-health relationship of older people in Ahmedabad and Ruhr Metropolis, but also and particularly to explore factors of the supply side, e.g., questions related to the local urban blue space provision. The identification of key actors was facilitated in parts by stakeholder workshops carried out before the actual data collection and by networking in each city during the data collection. Table 3.2 shows the types of actors finally involved as key informants and expert

interviewees. The interview guideline (see annex no. IX) was adapted to each stakeholder group. Overall, themes of the interviews included:

- Perceived qualities and health effects of urban blue spaces (relative to older adults)
- Situation of older people, older people's health and policies on aging
- Assessment of the current urban blue space provision (with regard to the suitability for older adults)
- Goals, strategies, potentials and conflicts in urban blue space development and experiences with integrated planning approaches (particularly the consideration of social and health aspects)
- Planning and implementation processes of the main research sites

Most of the interviews took place in person, in the case of Ahmedabad, partly with a research assistant for support in translation. Participants were informed about the project and –if recording was possible– gave their written consent. In Ruhr Metropolis, some interviews had to be changed to phone interviews because of the coronavirus outbreak, which also represented the premature end of data collection in Germany since remaining actors were not available anymore, particularly actors from the public health service and local authorities.

Table 3.2: Stakeholders involved in key informant and expert interviews (author's compilation)

Stakeholder group	**Issues of concern / key knowledge on…**	**Sample size**		**Interviewees' pseudonyms**	
		Ahmedabad (n = 20)	**Ruhr Metro-polis (n = 13)**	**Ahmedabad**	**Ruhr Metropol is**
Urban planning and policy (e.g., municipal and regional authorities, landscape architects)	- Planning approaches, governance structures and processes of local urban blue space development - Age-friendly and health-promoting landscape design of blue spaces	6	2	AT & NT; IG; JP; HT; VK & AB; MAB	SR; BS
Public health (e.g., local authorities, NGOs)	- Health status of and health promotion for older adults - Health potentials of urban blue spaces - Planning for improved health	2	/ (*)	YP; BS	/ (*)
Representations of older adults (e.g., NGOs/advocacy groups)	- User behavior and perceived qualities of blue spaces - Experiences, needs, and challenges associated with older adults' blue space use - Participation of older adults in urban planning - Local policies on aging	3	4	AM; AD; RS	AS; YA; IG & HC; DP
Others (e.g., water management association, scientific experts, private sector representatives)	- Existing evidence on urban blue spaces and health of older adults and the local urban blue space governance - Functioning of the main research sites	9	7	SC; SM; HA & MA; DP; NS; TS; PS; RD; MB	SO; KV; DW; SS; JH; JS & EH; HK

(*) Due to the start of the COVID-19 pandemic in Germany in February/March 2021, interviews with the public health service could not be conducted

3.4 Data analysis

The following procedures were applied to organize and edit the data collected: The daily observation protocols were condensed to one summarizing observation protocol outlining the meaningful patterns and themes identified in the data for each case study. Recorded interviews were manually transcribed by the principal investigator. For other conversational data, the principal investigator (in parts together with research assistants) took notes during the interviews and FGDs. All personal names have been replaced by pseudonyms to protect confidentiality. Photographs from the photowalks were developed (as printouts and digital pictures) immediately after the last walk and integrated as digital images into the interview notes. The questionnaires from the baseline survey and the stated preference valuation were converted into Excel-files for basic descriptive statistics. Table 3.3 gives a summarizing overview of the methodological steps described in the previous chapters and the type of data generated. All data are available in the digital appendices.

Due to the blended research design in this study, the guidelines and specifications for both, data analysis in case study and in photovoice research, guided the analytical approach. However, neither case study nor photovoice research comes with uniform, firmly prescribed analytical procedures (Latz 2017; Ridder 2017). Drawing from recommendations in multi-case study research (e.g., Stake 2006; Yin 2013), data analysis was first conducted for the individual cases ("within-case analysis"), resulting in separate case reports (see chapter 4.1 and 4.2). The data collected in each methodological step were analyzed independently, each providing knowledge about case-specific patterns and themes. To answer the research questions outlined in chapter 2.6, the various analysis strands were integrated considering how the results of one method correlate with and support the results of another (or not). The following matrix (see table 3.4) shows which data were available to answer which research questions.

Table 3.3: Summary of methods applied in the study (author's compilation)

Method	Key objectives	Type of data	Sample size	
			Ahmedabad	Ruhr Metropolis
Participant observation	To get familiar with the main research sites and gain an understanding of their functioning, the users and their behaviors	Observation protocols	n/a	n/a
Baseline survey	To gain insights into the urban blue space-health relationship of local older adults and to sample photowalk participants	Questionnaires	n = 29	n = 26
Photowalks	- To explore in greater depth the themes from the baseline survey - To record older adults' experiences in situ (while interacting with blue spaces)	Interview notes, photographs	n = 4	n = 2
Focus group discussions	To maximize the variety of perspectives of older adults (record voices of minority groups)	Notes	2 FGDs with 13 and 11 persons	2 FGDs with 14 and 11 persons
Stated preference valuation	To investigate in-depth older adults' blue landscape preferences	Questionnaires	n = 28 (photowalk + all FGD participants)	n = 17 (photowalk + 15 FGD participants)
Key informant and expert interviews	- To elicit further information about the urban blue space-health relationship of older people - To explore factors of the supply side	Interview notes and transcripts	n = 20	n =13

Table 3.4: Matrix of research questions and available study data (author's compilation)

	PO	Survey	Photo-walks	FGDs	Choice experiments	Interviews
RQ 1: How do older people in A. and R.M. experience the urban blue space-health relationship?	x	x	x	x	x	(x)
RQ 2: How does the urban blue space provision (i.e., the quantity, quality and accessibility of urban blue spaces) in A. and R.M. meet older people's demands and needs?		x	x	x	(x)	
RQ 3: How are health interests and older people's demands and needs considered and reflected in the respective urban blue space planning and design?			(x)	(x)		x

(x): Data contributed in part/indirectly to answer the research questions

The analysis procedure in each case study is specified as follows: For the participant observation, a summarizing observational protocol was done in each case study following a standardized structure based on the SOPARC assessment (1. Observation schedule, 2. Characteristics of the target areas, 3. Assessment of the target area conditions, 4. Activities undertaken, 5. Particularities). As mentioned earlier, descriptive statistics was used to describe the samples of the baseline survey and the stated preference valuation and their characteristics. The photos from the photowalks participants were synthesized for each photographic prompt and question; thus, enabling a comparative overview.

Qualitative coding was applied to derive information from the notes and transcripts of the photowalks, the FGDs, and the key informant and expert interviews. Different coding strategies were applied to structure the data into themes and patterns. For the photowalks and the FGDs, structural coding (Saldaña 2013)[29] was used as a first coding step and involved sorting larger text passages of all transcripts and notes into sections according to the interview questions and prompts (using excel files). The method

[29] Another term used for this coding approach is "utilitarian coding" (Saldaña 2013); while Bazeley (2013) talks about "theoretically derived a priori codes or theoretical codes" when "naming broad topic areas coming from the research questions and sorting text passages into these categories" (p. 170).

was chosen, as it is appropriate particularly when having multiple participants, in standardized or (semi-) structured data collection (in which the text can be clearly divided thematically) and in exploratory investigations (Bazeley 2013; Saldaña 2013). To move to the second cycle coding –and particularly in studies with a variety of data types and when various information have to be derived from the data– eclectic coding (Saldaña 2013) is recommended and involves "(…) using a repertoire of [first cycle coding] methods simultaneously (ibid. 2013: 188). The choice of coding methods is usually purposeful and follows from the needs of the study (ibid. 2013). In this study, coding methods were selected[30] that aim at the issues raised in the research sub-questions and therefore provide guidance what to search in the data, e.g., activities of older adults undertaken at blue spaces, their emotions and perceptions in relation to blue spaces and causes for (not) deriving health benefits from blue space exposure. As Bazeley (2013) notes, "this procedure ensures that coding links with important research questions and can be done without inhibiting to capture fresh ideas" (p. 170). To refine the coding and to develop more analytical categories based on thematic similarity, focused coding was applied as a second cycle coding method (Bazeley 2013; Saldaña 2013).

For the key informant and expert interviews, the strategy "read, reflect, connect" by Bazeley (2013)[31] was used to get a first overview of the data which resulted in initial memos of each interview, compiled in an excel sheet. In a second step, holistic coding (Saldaña 2013) was applied to explore basic themes of the interviews (by coding larger units of data within the entire excerpt). This was followed by focused coding themed through the lenses of the research sub-questions to categorize the analytic work further. Finally, in the process of writing up the individual case reports, all codes were described in the context of analytical writing, which involved indicating their relevance, variations, dimensions and parameters (Bazeley 2013).

[30] The final choice included a set of the following methods (see Saldaña 2013 for more information): affective methods (versus coding, values coding, emotion coding, evaluation coding), elemental methods (in vivo coding, process coding), grammatical methods (attribute coding) and procedural methods (causation coding). With regard to the participatory and co-productive generation of knowledge in photovoice, in vivo coding (applying codes by using the participants' words verbatim) was prioritized wherever possible.

[31] The strategy involves I. Reading through the transcript / notes to capture a sense of the overall content, II. Reflecting (or "writing as you read") to record first analytic thoughts and III. Connecting information within and across data (Bazeley 2013).

Following the individual case reports, similarities and differences between the cases were investigated ("cross-case analysis") and situated against the existing evidence base (see chapter 5.1). According to the eight-step procedure by Latz (2017), step six (ideation) forms the data analysis in photovoice studies: within the participants' narrations, thematic strands are developed (either with or without participants), typically by using analytic methods of qualitative research. The photovoice data are analyzed for (at least) two purposes: to generate knowledge and –in the spirit of PAR– to impact policymakers and to shape action (Latz 2017). Consequently, there are at least two audiences to be considered (ibid. 2017). The last two steps of photovoice (presentation, confirmation)[32] go beyond the actual data analysis and are closely linked to the aim of shaping action, trying "(…) to "sustain the project's energy and broaden the reach of the participants' voices" (ibid. 2017: 5). As such, the steps can follow after the completion of a project, e.g., a dissertation (ibid. 2017). Despite an exhibition was originally planned in this PhD study, the implementation had to be cancelled not least because of the restrictions due to the COVID-19 pandemic.

[32] The presentation step "(…) typically takes the form of an exhibition" (p. 5) which includes various forms such as museum installations, posters, websites and usually involves the photovoice participants as well as decision-makers (Latz 2017). In the subsequent confirmation step, researchers should aim to understand the success of the exhibition, e.g., how the presentation has been perceived, if the message was clear and if the project goals have been achieved (ibid. 2017). It is during or shortly after those two steps where policy action might occur (ibid. 2017).

4 RESULTS

This chapter consists of the two case study reports Ahmedabad (chapter 4.1) and Ruhr Metropolis (chapter 4.2). Both reports are structured according to the research questions and sub-questions outlined in chapter 2.6. While the first and second research questions primarily aimed to assess the demand side (e.g., environmental perceptions, needs and preferences of older blue space users), the third section of each case report –related to the third research question– deals with the supply factors. For general information on the urban blue space governance in both cities and on the main research sites, see chapter 3.2.1 (Ahmedabad) and chapter 3.2.2 (Ruhr Metropolis). Each report contains a summary of the main results.

4.1 Case report Ahmedabad

Description of the sample

In total 53 older adults were involved in the study (see table 4.1), the majority of them were male (n=40), young-to-middle old, i.e., 65-79 years (n=49) and Hinduists (n=32); the remaining were Moslems and Jains. Considering the information available on the educational background, profession, place of residence, income and income sufficiency, the sample consists of older adults with a relatively high socio-economic status (middle-class). Most participants (n=47) responded to living together with at least one other person; one third (n=17) stated that they were living in a multi-generational household with children under 18 years. Most of the older adults have lived in their neighborhoods for several years: 38 participants for more than 10 years, 12 participants for more than 5 years. Over half of the surveyed (n=34) own a private vehicle (car or two-wheeler).

More than three quarters (n=42) described their general health status as good, very good or excellent. Half of the respondents (n=27) reported having (at least) one chronic disease, out of which the majority (n=23) were men. Yet, most (n=22) of those suffering from a chronic disease reported having a good or very good general health status. Mental wellbeing and physical activity levels were assessed only from the baseline survey participants. Out of those older adults, nearly all (n=26) scored ≥50% in the WHO-5 measure of wellbeing, indicative of not suffering from depression. The majority reported having an active lifestyle, with 27 participants doing recreational walking on 5-7 days

over the last seven days and 16 persons being physically active (moderate-to-vigorous activity) on 4-7 days over the last seven days.

Table 4.1: Overview of the study population in Ahmedabad (author's compilation)

	n	Female (%)	Male (%)	n (%)	Age (years)
Baseline survey / Parimal Garden sample	29	6	23	27 2	65-79 80+
Photowalkers (part of the Parimal Garden sample)	4	1	3		
	Mrs. Pame, 70 years; Mr. Madhu, 73 years; Mr. Pram, 68 years; Mr. Nani, 76 years				
FGD Law Garden	11	7	4	9 2	65-79 80+
FGD Juhapura	13	/	13	13	65-79
Total	**53**	**13 (24.5%)**	**40 (75.5%)**	**49 (92.5%)** **4 (7.5%)**	**65-79** **80+**

For information on the key informants and experts interviewed and their pseudonyms see table 3.2 in chapter 3.3.6.

4.1.1 The urban blue space-health relationship of older adults in Ahmedabad

4.1.1.1 Older adults' engagement with blue spaces in daily life and influencing factors

Residential exposure / Access to urban blue spaces

While many participants (n=23) stated that private or public transport is needed to reach the nearest blue space, the results remain inconclusive regarding the residential exposure of older adults to urban blue spaces. The multiple-choice question was often answered contradictory, e.g., living in easy walking or cycling distance and not being able to regularly reach any blue space or being in need of private or public transport to reach the nearest blue space and being able to walk to Parimal Garden and the reverse.[33] Yet, the results of the baseline survey confirm that many older adults are dependent on private transport to urban blue spaces as almost half of the sample (n=14) reported coming to the main research site Parimal Garden by auto/cab or private vehicle (the other half, n=15, by walking or cycling).

[33] Living within easy walking or cycling distance to the next blue space was ticked by a quarter of all participants (n=13) out of which almost all belong to the samples of Parimal Garden and Law Garden. Almost one in five participants (n=10) noted being unable to regularly reach any blue space, out of which the majority belong to the senior citizens' association of Juhapura. Yet, more than half of them reported that they visit any blue space at least once a month.

Visit frequency and types of blue spaces used

The results of the observation, the baseline survey and the FGDs show that older Amdavadis regularly use urban blue spaces. While slightly over half of the FGDs participants (n=13) stated to visit any blue space at least once a month, the majority of the baseline survey participants (n=25) reported coming to Parimal Garden daily, mostly in the early morning. Three quarters of them (n=19) indicated spending an extended amount of time in the park, i.e., between one and two or more than two hours per visit. For many older adults of the Parimal Garden sample (n=13), the park is the single used blue space in the city. Moreover, as brought forward by the photowalk participants, visiting Parimal Garden represents an established daily routine that they have pursued for many (i.e., more than 20 or even more than 30) years. The most mentioned other blue-green spaces used were Sabarmati Riverfront, Law Garden and Kankaria Lake. This corresponds with the answers of the FGD participants who noted to use the Sabarmati Riverfront, Law Garden, Kankaria Lake, Sarkhej Lake and different swimming pools (the last two were mentioned only by members of the senior citizens' association Juhapura).

Activities undertaken

As shown in fig. 4.1, the top four main activities forming the reasons to come to Parimal Garden are (1.) aesthetic pleasure/watching the scenery and walking; (2.) stress relief, relaxation and restoration; (3.) purposeful exercise and fitness; and (4.) social interaction/spending time with family and friends. The answers differed slightly among female and male park users: for older men, the top three reasons for coming to Parimal Garden are (1.) aesthetics, (2.) walking and exercise and (3.) relaxation while for older women, those are (1.) relaxation, (2.) socializing and walking and (3.) aesthetics.

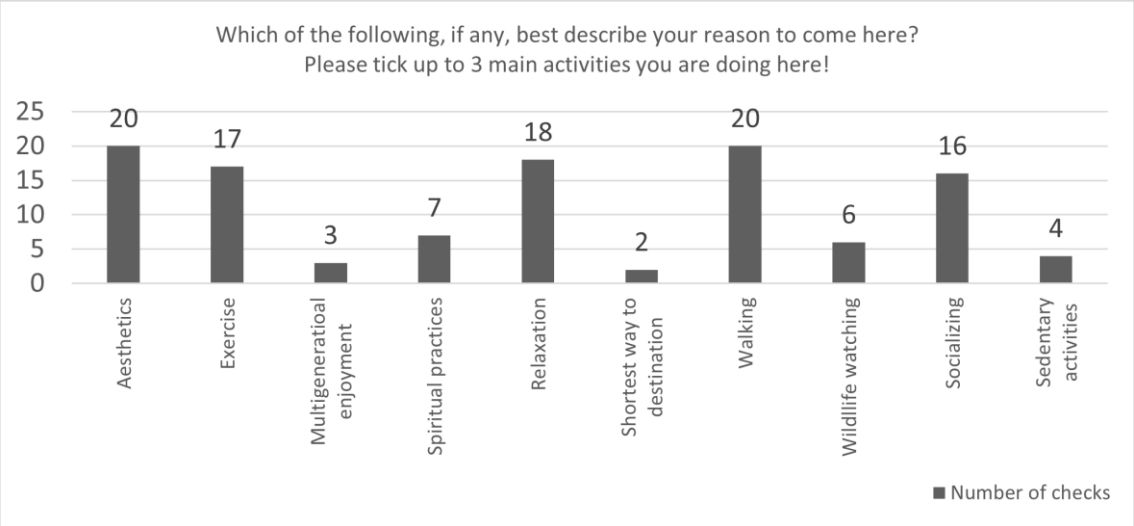


Figure 4.1: Reasons for visiting Parimal Garden (author's compilation)

The results of the PO and the FGDs confirmed that many older people use Parimal Garden and other blue spaces intentionally for moderate physical activity (e.g., individual exercise, walking, participation in organized yoga exercises), social activities (e.g., spending time with family and friends) and for aesthetic enjoyment, contemplation and relaxation/mental restoration (e.g., sitting in silence, watching the scenery, enjoying life). At Parimal Garden, only few older adults (and mostly older men) were observed in the afternoon and evening; then doing mostly sedentary activities, e.g., sitting on benches and chatting. The lakeshore in particular was used for watching the scenery, feeding fish and for group exercises. Overall, only few older adults mentioned seeking blue spaces for water-dependent uses such as swimming. Other reported –and rather irregularly conducted– activities include attending performances and showing guests around (blue spaces as a tourist attraction).

Factors influencing blue space use

As anticipated by several interviewees (e.g., MB, TS) and as reflected in the observation and the baseline survey (small number of female participants), gender occurred as a possible influencing factor in older adults' blue space use, with older women visiting blue spaces less frequently than older men. According to the scholars MB and TS, probable reasons are high levels of gender-based violence in Indian cities that make (older) women feel insecure and the patriarchal society in which men used to visit public spaces for social interaction and leisure since antiquity while women only pass by or go there for economic

activities. Yet, the interviewees stated that urbanity has to be considered: While female villagers are hardly seen at blue spaces, women who migrated to the city would use blue spaces (*"You may find old women sitting together, but you have to be really able to recognize that they might be migrant population, who are now health-conscious"* (MB)). Several interviewees pointed to an ongoing fundamental change in the way people perceive and interact with blue spaces due to urbanization. Many Indian villages adjoin a lake, which is primarily used for functional purposes such as bathing, irrigation or washing the cattle and which could still be seen at the urban peripheries. While social interaction (incidentally) happen and particularly older men would typically sit nearby as guards, *"no village really celebrates the lake"* (PS). Due to the uncontrolled and massive urbanization, cities such as Ahmedabad grew out of villages merging in the urban peripheries and many of the lakes were *"encroached and abused"* (MAB). The urban culture would not allow a comparable (direct) access to the water anymore. In this regard, the interviewee MB pointed to an interesting phenomenon linked to the socio-economic background of the urban population and the two kinds of blue spaces prevailing in the city. For upper-middle-income people (who often migrated to the city), 'developed (well-maintained) blue spaces' fulfill recreational needs, but they would not link those spaces with their basic needs anymore, *"(...) because most of the people know that their drinking water is coming from somewhere else"* (MB). For lower-income and poor people, 'undeveloped blue spaces' (those in a poor condition and hardly carrying water) are areas to squat; fulfilling their basic need to settle somewhere. She argued that the two populations would relate differently to waterbodies: *"So the people, who are really poor, who come from the countryside, I say, the sense of linking water with their daily needs is still there. If the water is good, and if they allow to access that water, they might use it"* (MB). She exemplified seeing children from slums using a fountain to bath there and *"just enjoy life"* (MB) whereas for upper-middle-income people, blue spaces would be *"just technical bodies"* (MB).

> *"So, the role of the waterbody has changed, the function has changed and even the psychological relation, my spiritual relation with the waterbody, has changed. I may go to see a waterbody now as an urban elite, but I will not wet myself. That is a big change. (...) So, they [poor people] have a psychological link, but they do not actually get physical access to the waterbody. There is a link, but there is no access (...). Whereas in the higher, the elite or the middle-class (...), they have*

> *physical access to the waterbody, but psychologically sounded, they are disconnected. It is a very interesting phenomenon, which is going on"* (MB).

In addition to the differences between rural and urban culture, a number of participants pointed to cultural particularities (potentially) influencing the perceptions and uses of blue spaces. In the Indian context, this includes religion and spirituality linked to nature (e.g., certain rivers considered sacred[34], use of water as part of religious rituals) and to public space use (e.g., importance of spiritual get-togethers), conservative behavior rules in the public sphere and a comparatively low popularity of watersports such as swimming.

Further influencing factors of blue space use reported by the study population include season/weather (e.g., limited blue space use during monsoon, change of visiting time during summer) and personal beliefs and values (e.g., living in solitude, which Mr. Madhu seeks at his visits to Parimal Garden). Although many participants noted that the individual health status and health-related concerns (e.g., fear of falling, mobility impairments) impact their blue space use (e.g., causing to stay at home or limiting the visit to selected blue spaces or areas), the results remain inconclusive to what extent chronic diseases restrict older people's blue space visits: Out of the 27 individuals with chronic conditions, 21 persons stated to visit blue spaces regularly. Due to the limitations of the intrinsic capacity that might arise in old age, blue spaces, on the one side, can become a meeting place for older people while on the other side, become partly or entirely inaccessible. For example, Mrs. Pame explains that for her and her friends, Parimal Garden became *"a place where we can get together"* especially after some of them could not access houses with steps anymore. This counted even if Parimal Garden holds some shaky pathways and hilly areas that became inaccessible for her and others. In the case of Mr. Nani, health constraints led to a very limited radius of action, which hinders him visiting blue spaces where he used to go. Yet, living close to Parimal Garden and the familiarity with the place gained over many years still allows him to go there daily.

[34] For example, the interviewee MAB noted that sacred rivers function as sites for pilgrims. The interviewee MB noted that almost every Hindu household would keep a small bottle filled with the water of the River Ganges at their home, whereas other blue spaces are considered completely unimportant.

Health and social issues among older adults in Ahmedabad

The key informants and experts widely agreed that NCDs such as diabetes and heart diseases are a major health issue among older adults which causes a huge burden for the health budget and challenges the country to adapt to it with much fewer resources than HICs, including *"(…) less patients' knowledge on rights and regulations and less health awareness"* (YP). Despite the ongoing epidemiological transition, infectious diseases continue to pose a health problem to which older people are susceptible. A third major health issue are mental illnesses, although those remain largely underdiagnosed and not monitored (*"a quite unknown burden yet"* (BS)).

A recurrent theme in the interviews was the ongoing transformation of older adults' living arrangements, which was considered to have significant impacts on their health and care. While many Indian older adults still live in multi-generational households, this traditional form of housing increasingly erodes as younger generations move away. Some participants expressed the concern that this erosion will worsen older adults' social and intergenerational connectedness and thus, their health and wellbeing (e.g., *"Where do we find that socializing spots elsewhere?"* (JP); *"They become aliens"* (AD); *"Socialization gives mental peace (…). You get rid of depression, of negative emotions"* (JP); *"There is growing realization among older persons that they are more often than not being perceived by their children as a burden"* (AM)). Yet, another participant, SC, a manager of Ahmedabad's first retirement home, noted that social norms are changing and that living separate from the family is no longer linked to the fear of being stigmatized. New forms of housing would not only be increasingly accepted but would also provide benefits such as a barrier-free environment and improved mental wellbeing.

Naturally, the available free time affects the use of blue spaces. Many older people stated being busy on weekends, thus not visiting Parimal Garden. Contrary, having much free time, having things to do in the surrounding or special occasions (such as having guests) were reported to influence the use of other, further away blue spaces, e.g., the Sabarmati Riverfront. Those older adults living with their children abroad for several weeks per year reported that being unfamiliar with the living environment causes them to stay at home and not use blue-green spaces in the way they do in India.

The availability, accessibility and quality of blue spaces were influencing factors mentioned directly or indirectly among many participants and consist of several parameters, e.g., the vicinity of the blue space to the place of residence, private vehicle ownership, the availability of parking and public transport, the affordability of cabs, the provision and conditions of the amenities and the perceived safety.

The sample of oldest-old participants (defined as those aged 80+ years) was too small to assess whether the visit frequency of blue spaces changes with older age. Yet, some key informants and experts argued that older adults would have a distinct relationship to blue spaces compared to younger generations. For example, the interviewee AD noted that older people have a different attitude towards blue spaces, as many of them had to fetch

water in their youth. Similarly, the architectural scholars MB and PS stated that many older adults (but also indigenous people) would remember the traditional interaction with blue spaces in Indian villages. Having this experience still in their (subconscious) mind might contribute to older people having distinct emotions to waterbodies (*"They are still able to link water to serenity and peace"* (MB); *"They would feel comfortable to watch the blue scenery and 'having the lake behind me'"* (PS)). In other words, MB claimed that for many older adults, blue spaces are more *"a belief space"*–that just to be surrounded by it can make a difference. *"Even if this lake is dirty, which is near my house, you will still find villagers sitting by the waterbody. There has to be a tree under which they are going to sit (...), not really accessing the water per se. But they do link. If you ask them, they will be able to link"* (MB). The gerontologist TS considered the possibility that older people –given that they have more free time and a different leisure behavior– might have *"a different kind of attachment"* to blue spaces than many younger people who tend to spend their free time meeting friends in the mall. This view was echoed by other interviewees such as BS and AB & VK who noted that older adults are among the main users of urban blue-green spaces.

Further analysis shows that the experience of aging acts as a certain influencing factor of blue space use, including biographic events related to blue space use and experiences with blue spaces gained in younger years. The photowalk participants narrated how certain biographic events led to (unintentional) changes of the perception and use of blue spaces over their life courses. For example, as the quote below illustrates, while Mrs. Pame could not enjoy blue spaces in her younger years as she was living in a city with few public spaces, marrying her husband and moving to Ahmedabad enabled her to get to know a better standard of public space provision, which finally made her using those spaces regularly. Mr. Nani reported a similar experience when he and his wife moved to Ahmedabad.

> *"After coming to Ahmedabad, Gujarat, I see that there [in Maharashtra], they spend less attention to public spaces, there are not many of them. That is a good thing about Gujarat, compared to other places; Gujarat has the advantage of having public spaces on their agenda. They are taking care of children, of the elderly. (...) When my husband was alive, we once started to come here, there is this yoga activity going on. So we both thought it would be a good if we join that and then we joined it" (Mrs. Pame).*

Another interviewee, Mr. Madhu, referred to positive experiences with blue spaces in his childhood as he enjoyed living close to a river in a sparsely populated area. Now living in a densely populated city in old age, for him, blue and green spaces serve as places to rediscover this tranquility. The loss of a partner exemplifies another biographic event with potential impact on older adults' blue space use. Commenting on the time after her husband's death, Mrs. Pame said that instead of settling back to Maharashtra or moving to one of her children, she chose to stay in Ahmedabad mainly because the habit of visiting Parimal Garden determined the wish to age in place: *"But I thought no, I will be living in Ahmedabad only, because living in Ahmedabad means being able to come to this place every morning, starting my day here. I cannot think of my life without coming to this place."*

4.1.1.2 Older adults' feelings related to blue spaces and their (dis-)likes

The results of the baseline survey and the FGDs indicate that many older people have positive feelings about blue spaces and place a high value on them within the urban context. The majority of older adults (n=36) somewhat or strongly agreed that having blue spaces around is an important reason in choosing the place of residence; with the highest agreement rate (76.9%) found among members of the senior citizens' association Juhapura (Parimal Garden sample: 65.5%, Law Garden group: 63.6%), and with higher agreement rates among older men than among older women (75% vs. 46.2%). When asked whether the Lotus lake at Parimal Garden is an important reason to come to the park in the first place, a majority of 18 of the baseline survey participants somewhat or strongly agreed. A recurrent theme among the older adults was the importance of water for sustaining life. For example, Mr. Pram commented, *"Water is just life for all of us, we cannot survive without it"* and others stated, *"Water is very important in our lives"* (P2.1), *"Water is essential for humans and all creatures and all life. (...) If there are water resources, there is life, greenery, everything is there"* (P1.4), *"Blue spaces are very essential for a healthy and a sustainable life"* (P1.3). The participants alluded repeatedly to the importance of and general preference for having blue and green spaces in close vicinity to the place of residence (e.g., "*If there is no green or blue, it is not pleasant"* (Mrs. Pame)).

The importance of green spaces and the linkages with blue spaces emerged as a major theme from the analysis. In both FGDs, a common view was that blue and green spaces are interconnected, particularly because water is a prerequisite for any greenery. As some interviewees put it: *"Where there is a blue space, there will be a green space, so we prefer both accordingly"* (P1.3), *"When there is water, there is greenery; the reverse is not true"* (P1.5), *"One is nothing without the other"* (P 2.4) and *"If there is water, there is a garden"* (P 2.3). The photowalk participants echoed the appreciation for green spaces and diverse plantings (e.g., trees, flowers) and expressed a general preference for blue-green spaces, with an emphasis on a considerable proportion of greenery (e.g., *"It would need a garden in which a blue space is placed. I prefer gardens, no fountains"* (Mr. Madhu)).

The results of the stated preference valuation enable to derive in-depth information about older adults' blue landscape preferences. As shown in table 4.2, the participants generally preferred landscaped (developed) and well-maintained blue spaces of different types/sizes (pond, lake, river). In view of what has been written before, it is worth noting that not all of those are blue-green spaces, but also spaces featuring predominantly water (e.g., Kankaria Lake, Sabarmati Riverfront). Least preferred were blue spaces that are undeveloped, natural (e.g., Sabarmati River), not or hardly filled with water (e.g., Malav Lake) and/or badly maintained and polluted (e.g., Memnagar Lake). One exception was the picture E (Vastrapur Fountain): Despite depicting a functioning fountain filled with water, it was ranked quite low, even less attractive than the broken fountain at Sidi-Saiyyed-Mosque (picture G).

While many blue spaces were ranked similarly across the three groups, e.g., picture B (Law Garden) and picture A (Parimal Garden), some blue spaces varied in their ranking across the three groups, most notably the pictures C, E, G and I. Those blue spaces were perceived ambivalently. For example, while both FGDs quite liked the Sabarmati Riverfront (rank 1st and 2nd), the photowalk participants found it less attractive (rank 5th). Conversely, the fountain at Sidi-Saiyyed-Mosque was ranked second by the photowalk participants but was rather disliked by the FGD participants. While members of the senior citizens' association Juhapura quite liked the Malav Lake, the participants of the Parimal Garden and Law Garden samples rather disliked it.

Table 4.2: Results of the stated-preference valuation in Ahmedabad (author's compilation)

Rank	Urban blue space	Points (by groups and total)	Feelings associated with picture
1.	A (Parimal Garden)	Total: 201 Photowalkers: 35 (1st); Juhapur: 90 (2nd); Law Garden: 76 (1st)	Pleasant, calm (2*); pleasant, excited (2*); unpleasant, dull; pleased, calm; pleased, n/a; pleasant, n/a; pleased, wide-awake
2.	H (Kankaria Lake)	Total: 191 Photowalkers: 35 (1st); Juhapur: 90 (2nd); Law Garden: 66 (3rd)	Pleasant, calm (3*); pleasant, excited (2*); neutral, wide-awake; pleased, excited; pleasant, n/a
3.	C (Sabarmati Riverfront)	Total: 184 Photowalkers: 19 (5th); Juhapur: 91 (1st); Law Garden: 74 (2nd)	Pleased, excited (2*); pleasant, excited; pleasant, n/a
4.	B (Law Garden)	Total: 162 Photowalkers: 24 (3rd); Juhapur: 72 (3rd); Law Garden: 66 (3rd)	Neutral, neutral
5.	F (Casa Vyoma)	Total: 135 Photowalkers: 20 (4th); Juhapur: 58 (6th); Law Garden: 57 (5th)	Pleased, wide-awake; pleasant, excited; pleasant, n/a
6.	G (Sidi-Saiyyed-Mosque)	Total: 134 Photowalkers: 26 (2nd); Juhapur: 59 (5th); Law Garden: 49 (6th)	Pleased, calm
7.	E (Vastrapur Fountain)	Total: 130 Photowalkers: 19 (5th); Juhapur: 52 (8th); Law Garden: 59 (4th)	Unsatisfied, dull (2*); unpleasant, dull; pleasant, calm (2*)
8.	I (Malav Lake)	Total: 107 Photowalkers: 9 (8th); Juhapur: 61 (4th); Law Garden: 37 (8th)	Unpleasant, dull (3*); neutral, excited
9.	J (Memnagar Lake)	Total: 98 Photowalkers: 15 (7th); Juhapur: 55 (7th); Law Garden: 28 (9th)	Unpleasant, dull (4*); pleased, n/a; pleased, neutral
10.	D (Sabarmati River)	Total: 80 Photowalkers: 18 (6th); Juhapur: 24 (9th); Law Garden: 38 (7th)	Pleasant, excited; neutral, neutral; pleasant, wide-awake; unpleasant, dull (3*); pleasant, calm; pleased, excited; unpleasant, calm; pleasant, n/a

Blue spaces ranked low regarding their attractiveness were not necessarily associated with negative feelings on the valence and arousal rating scales. For example, while many participants chose the pictures J and D as their least preferred blue spaces, some still associated neutral or positive feelings to it (e.g., "pleasant, excited", "pleased, neutral"). Yet, the emotional responses generally followed the pattern that least preferred pictures were linked to rather negative and most preferred pictures to rather positive feelings.

When being asked about the comparative willingness to visit different blue spaces (by choosing one picture among two or more options in pre-defined picture sets), the results basically corresponded to the overall ranking according to the perceived attractiveness. This can be clearly seen for the first three choice experiments in which the participants chose to (hypothetically) visit those blue spaces that were rated more attractive (A over B; C over D; F over G over E). In principle, this also applied to the fourth picture set for which the majority of participants chose to visit Kankaria Lake (picture H). The exception here was that more people were willing to visit Memnagar Lake (picture J) than Malav Lake (picture I) whereas picture I was rated more attractive than picture J. Yet, for each picture set, a minority of participants chose to visit blue spaces that they previously ranked less attractive than the alternative options.

As the excerpts from the photowalks show (see fig. 4.2), older people experience various positive emotions of blue space exposure such as relaxation, peace of mind and happiness.

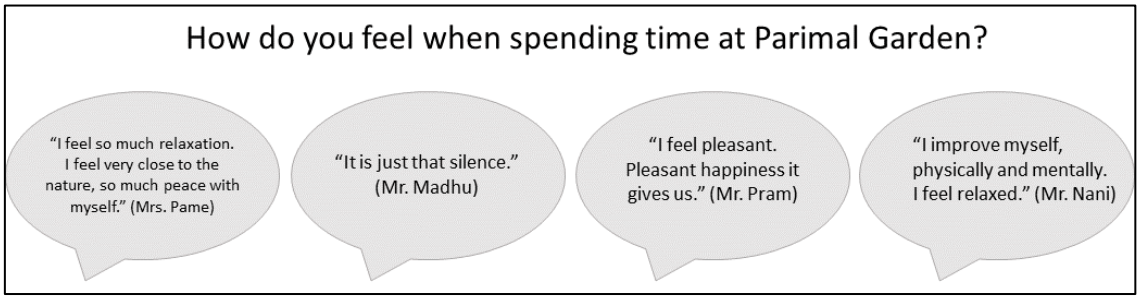


Figure 4.2: Photowalk participants' feelings at Parimal Garden (author's compilation)

All four interviewees shared the view that going to Parimal Garden represents a beneficial (daily) routine that they have pursued for many years; although the reasons that make Parimal Garden special compared to other blue and green spaces differed, as shown in fig. 4.3[35]. For Mrs. Pame, it is the vicinity to home, the provision of *"almost all I need"* in the surrounding and the familiarity with the street vendors, for Mr. Nani the Banyan tree, for Mr. Madhu to be able to find solitude and tranquility and for Mr. Pram the provision of activities and relaxation.

[35] All photos of the participants are available in a larger size in the appendices (see annex no. XI).

Figure 4.3: Participants' photos of what makes Parimal Garden special to them (author's compilation)

Almost all participants took pictures of the lake scenery to describe how they feel about the presence of water (see fig. 4.4). The pictures were linked to positive narrations such as inspiration (*"It is inspiring, the lake with the lotus"* (Mr. Pram)) and aesthetic pleasure (*"See the scenery, the flowers. It is so beautiful, how great. And there are so many different colors, the Lotus, these are roses. In India, you have different casts and different flowers [laughs]"* (Mr. Nani); *"The water gives an additional attractiveness to the place", "[at Law Garden] It makes the place more pleasant. It adds to the beauty of the site, it would not be so nice if the pond would not be there. There would be no Lotus, no water plants"* (Mrs. Pame)). In addition, the participants' narrations contained references to emotional and spiritual bonds to water and blue spaces, including a sense of place. As Mr. Madhu commented, there is a *"psychological need"* of humans linked to water for experiencing a *"feeling of vibration of existence."* Another interviewee referred to the identity-establishing agency of the Lotus lake:

> *"I think of Lotus when I see the water here. It is not the season, but when I come here [standing on the bridge], I think of all the pink Lotus…you know the whole*

water surface is fully pink; and the fish and the greenery. I send pictures to my friends and they would ask me 'Where is that from?' You can say that is Parimal Garden for me: Water and Lotus" (Mrs. Pame).

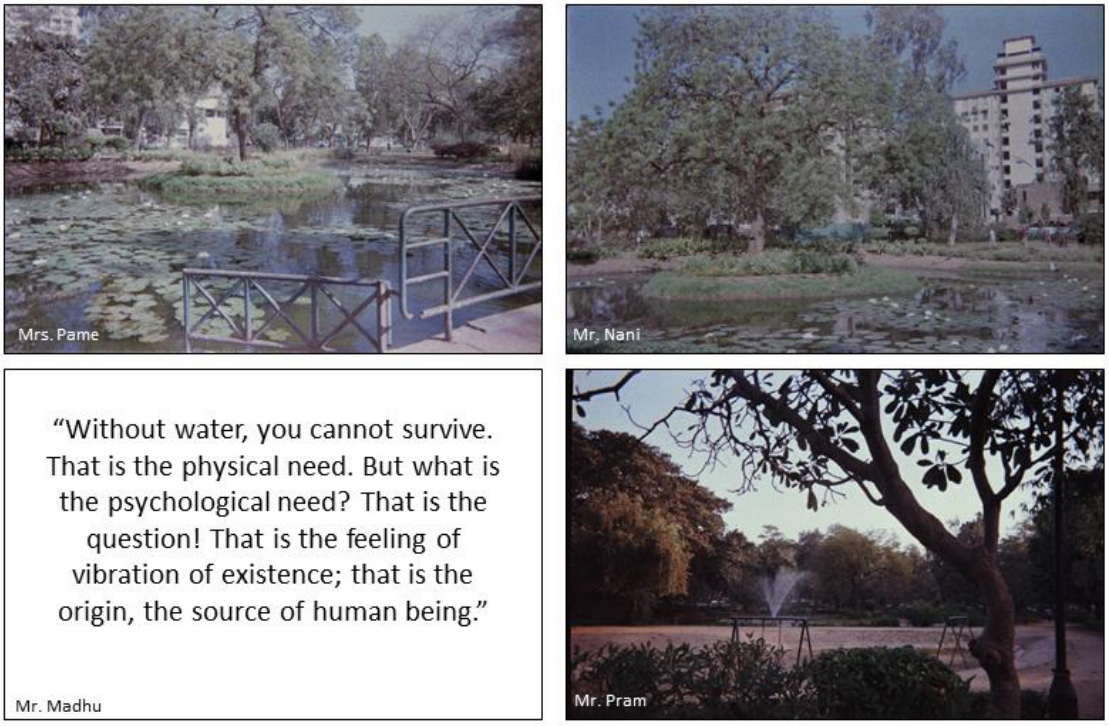


Figure 4.4: Participants' photos of their feelings about water and blue spaces (author's compilation)

The participants were asked to bring pictures that show their relationship to blue spaces. Interestingly, both participants doing so (see fig. 4.5) chose pictures related with good memories of social interaction at blue spaces (spending time at Parimal Garden together with wife, visiting blue-green spaces on family travels in India and abroad). For example, Mr. Nani recalled: *"It was maybe in 1993. She [his wife] was in a laughing mood, a symbol of a full heart. I felt very completed [positioning himself to reproduce the picture]."*

Figure 4.5: Participants' photos of their relationship to blue spaces (author's compilation)

In contrast, painful memories can be associated with blue spaces as for example Mrs. Pame stated: *"I would walk around [after losing her husband] but he was not there among so many faces."* She adapted to living alone and highlighted that blue spaces offer not only a possibility to go out (*"I am living alone, my children are all out, so what do I do; sitting and waiting for someone to accompany me is not sensible")*, but also function as places for intergenerational enjoyment by watching children playing or going there with their own grandchildren (*"For them, it is even more fun"* (Mrs. Pame)); a view that was echoed by several other older adults.

The participants were asked to take pictures showing which landscape elements affect how they feel at Parimal Garden and what their favorite places are. As fig. 4.6 and fig. 4.7 show, the answers partly overlap. For example, the old Banyan tree[36] located at the lakeshore was depicted by Mrs. Pame and Mr. Nani as a landscape element affecting how they feel and as a favorite place by Mrs. Pame and Mr. Madhu. The feelings generated by it can be quite evident, meaning that the tree and its surrounding are

[36] The Banyan tree is the National Tree of India representing longevity and eternal life because of its expanding branches. The tree is also supposed to be a 'wish fulfilling tree' and having medical properties (Ministry of Environment & Forests 2022).

aesthetically pleasing (e.g., Mrs. Pame: *"That tree is phenomenal"*, *"(...) I really like this. And then, I just feel this place, look at all the greenery [taking pictures]"*), but also rather complex, e.g., in the case of Mr. Nani who associated the tree with good memories, including situations in which he relied on its spiritual qualities (*"a wish fulfilling tree"*). As described earlier, the lake with the spout/the lakefront (including the lawn where the laughing yoga takes place) is another feature affecting how older adults feel at Parimal Garden (e.g., Mrs. Pame: *"I like to stand on the bridge and watch the activities of the fish, just look at them. I do not feed them. And there are Lotuses. That is another good point"*) and for some, a favorite place. Further elements are the *"openness of space"* that Mr. Madhu likes to look at when sitting on a bench (associated with experiencing silence), having good company (Mr. Nani) and the ease-of-use/accessibility (Mrs. Pame, not photographed). Mrs. Pame and Mr. Pram took pictures of benches as their favorite places –for Mrs. Pame because it is *"a good place to sit"* (yet highlighting she could also sit on the lawn) and, for both, a meeting place *("These benches where my friends meet"* (Mr. Pram)*; "When I come to meet my friends on Wednesday, I know where to meet them"* (Mrs. Pame)).

Figure 4.6: Participants' photos of landscape elements affecting how they feel at blue spaces (author's compilation)

Figure 4.7: Participants' photos of their favorite places at Parimal Garden (author's compilation)

The participants depicted/stated features liked during the photowalks (see fig. 4.8) which give additional information as to why Parimal Garden/other blue spaces are valuable places for them, including the amphitheater where e.g., music performances take place, public toilets, a playground and, in front of Parimal Garden, a temple and food stalls/street vendors. Linked to the atmosphere that is created by the lush greenery, the flower planting and the Lotus lake, Mr. Madhu and Mrs. Pame called attention to the presence of wildlife (e.g., birds), which would make blue and green spaces *"more interesting"* (Mrs. Pame)). Both noted feeling close to nature; Mr. Madhu even feeling immersed in nature. He commented: *"If you stay here [points to a hidden corner behind the stone pergola] for one hour, you feel that only five minutes have passed. Then you feel where you are. You are one with it, you are lost; this is real life*."

Figure 4.8: Participants' photos of features considered noteworthy (author's compilation)

Concerns regarding the general availability, accessibility and maintenance of blue spaces were widespread across the study population and participants were unanimous in the view that older adults face diverse challenges in using blue spaces. These themes are approached thoroughly in chapter 4.1.2.

It is noteworthy that all photowalk participants felt that Parimal Garden hardly contains features that are disliked or places where they feel uncomfortable. As shown in fig. 4.9, for Mrs. Pame, it is a place where she would not choose to sit, e.g., close to the entrance gate as it is too crowded and busy. For Mr. Madhu, it is the area around the brick pillars which used to be planted with roses before it was redeveloped (*"I used to love sitting there and spending time. The flowers added to the vibrations of the garden, but now I do not go to the other side.").*

Figure 4.9: Participants' photos of uncomfortable places at Parimal Garden (author's compilation)

4.1.1.3 Older adults' perceptions of blue spaces as therapeutic landscapes and causes for (not) deriving health-related benefits

In the following, the results of the previous chapters are synthesized with further findings from the analysis related to whether and why older adults (do not) gain health-related benefits from blue space visits.

Three quarters of the older adults (n=40) reported obtaining health benefits from visiting blue spaces, with the highest agreement rate (n=11) found among members of the senior citizens' association Juhapura (n=23 within the Parimal Garden sample, n=6 within the Law Garden group). Benefits were experienced more among older men (n=33) than among older women (n=7). Out of the 27 older adults with chronic diseases, the majority (n=19) reported obtaining benefits from blue space visits.

In response to what the most important benefit is, almost half of the participants (n=25) ticked psychological benefits (e.g., stress relief, feeling of restoration)/improved mental wellbeing. Hardly less participants (n=24) checked physical activity/sense of improved physical health and a minority of 10 participants ticked social interaction as the most important benefit (almost exclusively in combination with another benefit). This was found to be similar for older men and for older women. Roughly every fourth participant (n=14) reporting to experience benefits ticked two or more options, even though the question asked to select only one possible answer. Closer inspection of the data shows that members of the senior citizens' association Juhapura perceived all types of benefits equally important (n=5 respectively), while among the other samples, physical

health benefits (Law Garden) and mental health benefits (Parimal Garden) were rated as the most important benefit of blue spaces. Turning to the qualitative data on salutogenic effects of blue spaces, the results support that older adults perceive blue spaces as places relevant for promoting and protecting health and wellbeing within the urban context.

With regard to mental wellbeing, many participants linked blue spaces to emotional benefits and positive aesthetic and restorative experiences. In fact, aesthetic pleasure/watching the scenery and stress relief, relaxation and restoration were among the most common reasons for visiting Parimal Garden. A striking result in this matter is that the aesthetic enjoyment was strongly linked to the Lotus lake, its surrounding vegetation/wildlife and the distinct atmosphere/visual quality it creates. For the majority of those surveyed, 'the blue' is an important reason to come to the park in the first place. Generally, water was perceived as an appealing landscape element, particularly when embedded in green space. In relation to the aesthetical value of blue spaces, voices of the FGD participants included e.g., *"very nice pond (P.18)"* and *"it [Sabarmati Riverfront] looks good (P1.6)"*. Aesthetic experiences of blue spaces were also reflected in the positive affective states (measured in valence and arousal) reported in the stated preference valuation, e.g., ratings of high pleasure for the blue landscapes most preferred. Interestingly, even the least preferred blue spaces partly evoked positive valence and arousal ratings, pointing to a widespread perception of blue spaces being intrinsically attractive and having mood-enhancing/stress-reducing qualities. This is supported by further positive emotions described by the participants such as *relaxation*, *feeling close to nature*, *good inspiration*, *peace of/relief for mind*, *happiness*, *sense of physical and mental improvement*. The comments below illustrate the restorative experiences older adults can gain from blue spaces:

> *"See, this is the age of tension, stress and suffering. When we are going to blue spaces (...) we are having some relief for the mind and we are getting less tension at these places. So for mental and good health, blue places are very much essential (...), are having a very useful purpose for our tensed mind (...). And when we are looking at the riverside or the pond, that water is flowing and we are having some peace of mind and can get happiness. So it is essential for this purpose"* (P1.4).

> *"Many happenings surround your house –that is not in your control, because people are living so close together. But here, you are alone. One can stay in a place; there are no constraints as in the city. There is no radio, no newspaper, no*

> *one to talk. (…) There are opposite my home open spaces, grey spaces, where boys are playing. But there is no nature and atmosphere, no loneliness"* (Mr. Madhu).

The analysis revealed that many older adults hold strong emotional bonds to blue spaces. For example, the data from the photowalks show that participants have established a strong sense of place to Parimal Garden, involving to feel being (positively) dependent on/attached to the park (e.g., *"I cannot think of life without this place"* (Mrs. Pame), *"If I am not able to come here for two days, because of all that work, I miss my friends, my exercise. Then I need to come directly the next day"* (Mr. Pram)). Of interest here is that many older people have developed a long-standing routine of visiting Parimal Garden (mostly "a morning activity") which contributes to structure their daily life (e.g., *"And when I wake up at 5am, I just drink a lemon water with honey and I come to Parimal at 6am"* (Mrs. Pame)). The perceived benefits of visiting Parimal Garden are so significant that several participants are willing to accept costs for maintaining a car or for daily cab rides or donated benches. While the Lotus lake acts as a meaningful place-defining feature, the sense of place was further linked to other landscape elements such as the Banyan tree and intangible characteristics such as the perceived ease of use, familiarity, tranquility, triggering positive memories, and the close vicinity to home. The participants widely agreed that within the Indian culture, only certain waterbodies have a spiritual/religious value, e.g., the River Ganges. Yet, spiritual benefits might also be experienced at other blue spaces like Parimal Garden, as Mr. Madhu commented: *"At the time I am here, there are imaginary effects of natural vibrations"*. In this regard, some older adults mentioned ashrams and temples as other health-promoting places in the city, *"(…) because we get mental peace there"* (P2.7).

With regard to physical wellbeing, older adults amongst all samples noted that blue spaces function as popular places for conducting (regular) physical activity. This includes particularly water-related (e.g., walking along the lake/river) and water-independent activities (e.g., exercise, yoga) which also ranked among the most popular activities undertaken at Parimal Garden. A small number of participants reported using blue spaces for water-dependent activities (e.g., swimming). Some older adults noted a sense of improved (physical) health (e.g., *"My health is improved. I can walk without*

complications four to five rounds, although having chronical diseases. And if there is time, I sit here and enjoy life" (Mr. Pram)).

Although social interaction was not rated as the most important benefit from blue space visits, nor among the top three reasons for coming to Parimal Garden, many older Amdavadis highlighted the positive social interaction they experienced at blue spaces, including intergenerational enjoyment, spending time with the family, meeting friends, attending socio-cultural performances and showing guests around. Almost all photowalk participants valued the good social relations experienced at Parimal Garden, be it with friends, members of the exercise/yoga groups or other park users, which was also observed by the principal investigator and confirmed by several interviewees. Further acknowledged were the voluntary efforts of a group of (older) adults (informally known as the "Parimal Family") who organize socio-cultural activities and help to take care of the park. A variation of the perceived benefits for social wellbeing occurred with regard to the individual differences in social needs (i.e., the need of humans for having beneficial interactions and relationships with other people). For example, for Mr. Madhu, blue spaces act as places where he intentionally seeks solitude as this would make him feel good. Despite meeting friends at Parimal Garden, he considers the social interaction to be rather insignificant, as the statement below illustrates:

> *"I meet a few, very rarely, and rather in the evening, and we discuss issues, spiritual matters and politics. But they do not listen. People listen only to their own interests. (...) We just have very few meaningful talks nowadays. (...) Nowadays it is very difficult to find people who listen. No one has time. Everyone is into self-centered activities"* (Mr. Madhu).

For most of the study participants, however, a sense of connectedness and solidarity among blue space users prevailed. As Mrs. Pame noted, social cohesion is nurtured because older people share the (morning) ritual to come regularly/daily to Parimal Garden for recreation and feel relaxed being there:

> *Mrs. Pame: "People generally come here for relaxation. They are not in a hurry; they are enjoying the surrounding."*
> *PI: And did you ever experience any conflicts among the different user groups?*
> *Mrs. Pame: "No. See, these yoga people for example. We talk to each other, not about cars or houses; there are no jealousies. They are simple people, and we are*

> *related by the yoga. And then when you come to the park, you see all the people and greet "Hi, how are you?" The place creates belongingness for people."*

A number of older adults pointed to the benefits provided by blue spaces for the environmental quality in the city, which in turn would contribute to their health-related quality of life. In this regard, blue spaces were linked to positive sensory perceptions such as *fresh air, cool winds*, *"feeling cleanliness"/decrease in the level of pollution, being apart from "the hustle and bustle of the city"/silence*. Two participants deemed the clean air provided by urban blue spaces health-preserving and life-prolonging: *"When you come in the morning that is the best time to come. If you inhale that air, O2, you always stay healthy"* (Mr. Nani). *"When we walk on the road we breathe in all the pollution from petrol and fuel, but when we go to these places [blue spaces] we don't breathe it, which increases our life span"* (P2.5). Several older adults referred (indirectly) to the supporting and provisioning ecosystem services of blue spaces, including the provision of water as a prerequisite for any life, cultural development and greenery/biodiversity, for evaporative cooling, for groundwater recharge and thus, the provision of sufficient drinking water (*"(...) because we cannot depend on rainwater always"* (P1.1).

Interestingly, while the participants reported various beneficial effects of blue spaces, it was observed that speaking of health or direct health effects in the context of blue spaces was not familiar for most older adults. As the two excerpts show, the blue space-health relationship was described as indirect/invisible and not necessarily attributable to certain features of the space:

> *[In response to the question, how Parimal Garden visits would affect/improve the individual health:]*
> *Mrs. Pame: "I do not know. It is hard to describe. I do not know what happens inside me. You know, but I feel it affects me. I find it very hard to pinpoint elements; it is a general perception that comes out of everything which is here. There are birds, there are flowers, and there is lush greenery. I mean it is hard to say if this particular thing was not there, it would not be the same thing, something like that. So I would say some total of everything."*
> *Mr. Madhu: "I am not much body conscious. The body itself is a disease and heals by itself. When I sit here, I am free of thoughts and if my friends come, then we talk. (...) I mean at the time when I am coming, there is open space, no one is there."*

Less than half (n=13) of the baseline survey participants reported to associate potential harmful effects or health risks with urban blue space visits. The most frequently checked were attack risks from animals (particularly street dogs) and fallen branches/trees (n=8), disease vectors and risk of infections (n=3) and allergies and other health risks such as heat shock (n=2). Less frequently ticked were feelings of discomfort, natural hazards (e.g., floods) and greenhouse gases and particulate emissions (each n=1); while no participants checked accidents and injuries, criminal and illegal activities and feelings of fear and danger. The fear of being exposed to disease vectors and the risk of infections when visiting blue spaces (exacerbated during the monsoon season) also surfaced prominently in the photowalks and the FGDs. Other negative aspects that many older adults linked to blue spaces were sensory experiences stemming from pollution and a bad maintenance, e.g., olfactory pollution, littering (causing negative aesthetics) and broken features. Unmaintained grounds were associated with the risk of falling, e.g., *"We fall in the lawn as there are holes sometimes and lot of stones. And the insects bite us"* (P2.5).

4.1.2 Matching of older people's demands and needs with the blue space provision in Ahmedabad

4.1.2.1 Assessment of the actual urban blue space provision

The participants were asked to rate the living conditions of their respective communities. What stands out in table 4.3 are the high agreement rates for good access to urban green spaces (n=38), for feeling respected and socially included (n=38) and for being a pleasant place to walk (n=31), while the participants least agreed/mostly disagreed that their community provides good access to urban blue spaces (n=23). Surprisingly, members of the senior citizens' association Juhapura widely agreed that their community provides good access to urban blue and green spaces, although the neighborhood belongs to the areas with the least blue and green cover in Ahmedabad. Not surprisingly, they were the most agreeing that their community has many urban stressors. Overall, more than half of the participants (n=27) agreed that their community has many urban stressors and almost half of the participants (n=25) somewhat or strongly agreed that major barriers to walking exist.

Table 4.3: Participants' rating of their living conditions in Ahmedabad (author's compilation)

Question	Results		
	Somewhat or strongly agree n (%)	Somewhat or strongly disagree n (%)	Agreement rates per group (%)
My community provides me with good access to urban green spaces (e.g., parks, gardens, forests, lawns).	38 (71.7%)	9 (17%)	Parimal Garden: 82.8% Juhapura: 61.5% Law Garden: 54.5%
My community provides me with good access to urban blue spaces (e.g., rivers, streams, canals, lakes, ponds, pools, fountains).	23 (43.4%)	23 (43.4%)	Juhapura: 61.5% Parimal Garden: 48.3% Law Garden: 9.1%
There are many urban stressors (e.g., (air) pollution, traffic congestion, noise) in my community.	27 (50.9%)	19 (35.8%)	Juhapura: 76.9% Parimal Garden: 55.2% Law Garden: 9.1%
Overall, my community is a pleasant place to walk.	31 (58.5%)	13 (24.5%)	Parimal Garden: 75.9% Juhapura: 46.2% Law Garden: 27.3%
There are major barriers to walking in my neighborhood that make it hard to get from place to place.	25 (47.2%)	19 (35.8%)	Parimal Garden: 41.4% Juhapura: 38.5% Law Garden: 18.2%
I feel respected and socially included in my community.	38 (71.7%)	7 (13.2%)	Parimal Garden: 86.2% Juhapura: 61.5% Law Garden: 18.2%

While concerns about the general availability (quantity) and accessibility of blue spaces were expressed across all samples of older adults (and in several interviews), the senior citizens' association of Juhapura –in contrast to the aforementioned quantitative results– was particularly critical of the issue. Members illustrated that in the same way a hungry person could not think about any special meal but has to eat what is available, they are forced to settle wherever there is space and cannot opt for places with blue or green surroundings. One participant commented: *"As like this, the story goes on with us, we can only choose a house and if we get a house at a cheap rate, we select it. We do not have a choice"* (P1.2) and another echoed: *"We are compelled to stay whatever place we get to live in"* (P1.3). Their current living situation was described as follows: *"Swimming pools should be provided in our area. Seven Lakh [700,000] population people are living in Juhapura. Not a single swimming pool, no garden, no library, nothing. Water scarcity is so much here"* (P1.4). As the comments below illustrate, participants felt that the government would not keep pledges, would do nothing to reduce the existing environmental injustices and would not take up any of their suggestions.

> *"See the municipal or the Panchayat body [an elective village council in India] or the government, they are taking the decision to build these resources of blue waters like lakes or swimming pools and we are always giving our opinions and suggestions to them. Due to political pressure by this and that, they are not providing sufficient elements to particular areas. So, we are giving our suggestions and our representatives are also there in some municipal or Panchayat bodies, but unfortunately, we are not getting those facilities of blue water resources"* (P1.4).

> *"If you can make a presentation to some of the authorities, they can be brought to the notice that the development plans are very unjustified, lopsided and politically motivated. They develop only certain areas or communities whereas certain areas are totally ignored. The population is very big and large as our Sir said –there is no lake, no swimming pool, no public garden in this area where almost seven lakhs [700,000] people are staying. The development is lopsided"* (P1.3).

When asked about potential improvements of the urban blue space provision related to regeneration projects such as the Sabarmati Riverfront or Kankaria Lake, many older adults agreed that these projects have improved their access to blue spaces of high quality and that those provide beneficial effects. Appreciative voices about this type of blue spaces included *"neat and clean and the perfect arrangement [Kankaria Lake]" (P2.2)*, *"best place for enjoyment [riverfront]" (P2.1)*, and *"has everything nearby and that is why it [Kankaria Lake] is great"* (P2.5). Another participant said: *"Earlier, Kankaria used to be so dirty. Today they take a fee of Rs. 10 and when one looks at it, it is so clean and amazing. People used to shit there earlier; I have seen and now look at it!"* (P2.6). Contrary to this, others criticized that these projects did not promote any meaningful encounter with blue spaces or even worsened the existing blue space provision. For example, several participants complained about the access restrictions to Kankaria Lake (by charging entry fees) and Sabarmati Riverfront (by not offering any direct traffic connection to Juhapura, leaving the area *"cut off"*). As one older man put it: "*The Riverfront is a closed place. (...) We have to move across the pollution to enjoy there. I dislike it"* (P1.6). While Mrs. Pame likes to visit the riverfront from time to time, she pointed to the drawbacks that came along with its regeneration: "*And I should not think about all the poor that had to be displaced out of the city. They were living close to their working place. Now they are so badly connected."* She and another participant wondered whether these places are now underused (e.g., *"I think more people should come here. In a way, it feels nice, it is not too crowded, but what sense does it make when there is no one?"* (Mrs. Pame).

With regard to the quality of the existing (and partly regenerated) urban blue spaces, many older adults criticized the government's inability to maintain these spaces. On closer inspection, several dimensions of the maintenance problem emerged from the analysis:

(i.) Environmental and water pollution

Many older adults claimed that a lot of urban blue spaces are heavily polluted and lack water (e.g., *"If you see places like Malav Talav and Vastrapur Lake, they are all dried up*" (P2.5), *"Chandola Lake is there. It has been dried totally"* (P1.4), *"Vastrapur Lake, now it is without water and has become very ugly and dirty"* (P1.3)). Some participants criticized that after the regeneration of the Sabarmati Riverfront, the water pollution continues right where the 'new' riverfront ends. Talking about this issue with the Juhapura sample, one older man reported *"All the entire drainage water of Ahmedabad is being poured here only. This type of activity should be far away from the city"* (P1.1) and another noted that *"Factories are disposing in the river; I told you to visit it. So dirty and so bad smell is coming and mosquitos and flies are everywhere; you must contact the authority there"* (P1.4). The excerpt below illustrates similar concerns expressed in the group discussion at Law Garden:

> *P2.10: "When we visit a foreign country the water there is…"*
> *P2.3: "Like glass."*
> *P2.10: "Yes, like glass. Pure water. Best water. Be it Europe or anywhere, water is sparkling."*
> *P2.3: "There are clean cities and clean water abroad."*
> *P2.10: "If you notice the lake here, it is filled with filth and I do not like to go even though the others say they go."*
> *P2.10: "A lake means drinkable water. Can you drink water from any lake? You will be frightened to do so. I do not wish to say anything negative, but the truth is important to be spoken…"*
> *P2.2: "He [P2.10] is right in what he says."*

(ii.) Lacking maintenance of blue space features

Maintenance difficulties also came up in discussions about blue spaces that are in good condition such as Parimal Garden and Law Garden, albeit to a much lesser extent. For example, some participants noted the presence of broken features such as play equipment, fountains, benches and shaky pathways and grounds due to broken curbs or uneven lawns. A remarkable example –given the high investment involved in the regeneration project

and its national and international celebration– was photographed by Mrs. Pame at the riverfront (see fig. 4.10). She narrated:

> *"One day, when I came here, and we wanted to take the lift, but it was not running. I asked the security guy if he can activate the lift to bring us downstairs. [She switched into Gujarati and reported that according to the security man, the elevator has never worked since installment –1.5 years– and that he was hired to prevent that the lift is misused.] So what sense does that make, what is the idea of closing it at all? You know, it happens often in India: They implement facilities, but then… If I think about old people, how to get to the water?"* (Mrs. Pame).

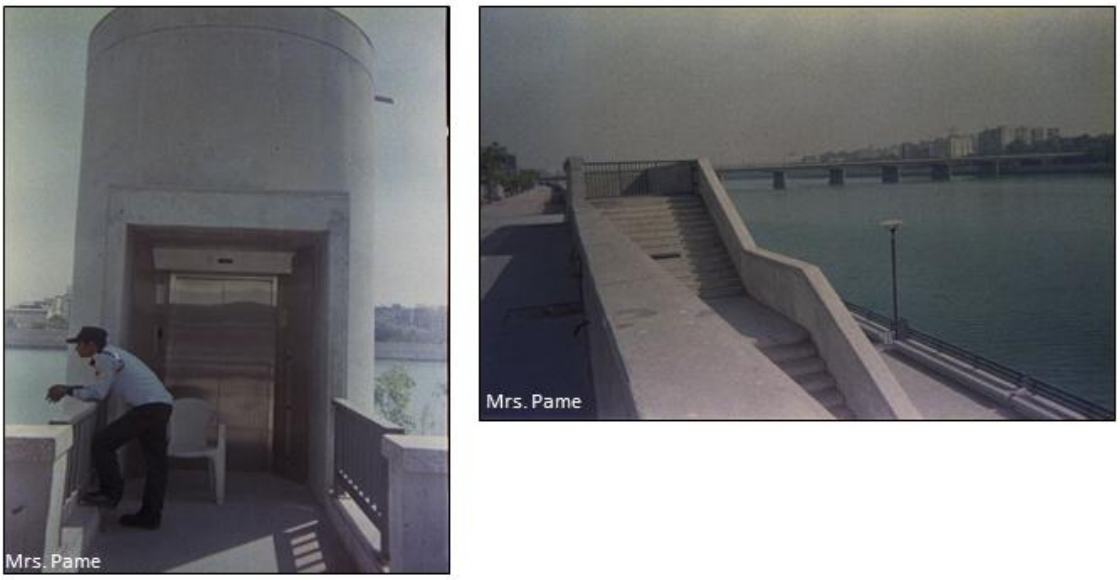


Figure 4.10: Mrs. Pame's photos at the Sabarmati Riverfront (author's compilation)

During her photowalk, Mrs. Pame further noted that unmaintained blue spaces like the broken fountain at the Sidi-Saiyyed-Mosque would reduce the aesthetic appeal of the city's sights: *"What struggles me is that the location is so good: it is central, close to the city, next to an important piece of architecture, a beautiful mosque. Because of being next to it, it should look more beautiful. It could add to the beauty of the mosque."*

(iii.) Misuse of blue spaces

For a number of participants, littering by the public and the lacking valuation of public spaces is another reason for the poor condition of many blue spaces (in- and outside of Ahmedabad). Comments to this issue included: *"People do not have the value for that. I have seen that many times, (…), they are overused that places"* (Mr. Pram), *"Sometimes*

I come [to Parimal Garden] and I see people who misuse the place, smoking and so on, and I feel sorrowful. You just have to see what people are doing here. No one really comes to observe nature here, to see the differences in the trees" (Mr. Madhu). The group discussion participants at Law Garden were unanimous in the view that people would litter blue spaces despite regular cleaning, e.g., throwing plastic waste and bottles in the pond at Law Garden and leaving garbage everywhere. Some alluded to the pollution of rivers such as the Ganges in the context of religious rituals, e.g., flower offerings that are thrown in the water. One participant noted: *"This increases the pollution levels. Human beings only create pollution"* (P2.5). Ultimately, they agreed that people's behavior at public spaces must change to prevent that maintenance efforts are undermined. As one participant put it: "*We must also contribute. If we keep throwing trash everywhere, what will happen?"* (P2.11).

(iv.) Diffusion of responsibility

Talking about the environmental pollution happening at the Sabarmati River and at other blue spaces, the participants discussed the responsible parties. In addition to the private sector (factories) and the public, the government was considered responsible for the pollution itself (e.g., "*Do you know in the riverfront, the government still throws the factory water in it*?" (P2.10)) or at least for not prohibiting and controlling it effectively. Several participants alluded to municipal employees refusing to work and a widespread corruption, as the following excerpts illustrate: *"Now we are sitting at Law Garden, look at the benches there. There are 25 sweepers, security and watchmen and money too; the government pays enough salary but look around the employees do not do it"* (P2.2); *"The corporation has given 20 crores [200 million] contribution but the places do not look good. There is large amount of corruption. Look at the benches, it is broken and no one repairs it"* (P2.1). Similarly, Mr. Nani highlighted that during the early years of Parimal Garden, the municipality did not provide any amenities: *"(...) it was empty, nothing was there. See all these benches have been donated [shows name tags on the benches next to him]."*

(v.) Other maintenance difficulties

Several older adults argued that the lack of natural water resources and the general water scarcity in the region present further difficulties in the maintenance of blue spaces. For example, Mr. Pram noted that despite a general preference for blue spaces, the local geographic conditions would not allow for extensive blue space development and any new blue spaces in Ahmedabad *"(...) would be difficult to maintain."* He explained: *"In our India, only in the Himalaya region is where you can get a lot of water. We [wife and interviewee] go there. We always prefer spaces where water is, but it is not possible on this site. We have no storage of water to maintain ponds"* (Mr. Pram). Some members of the Juhapura group pointed to an upcoming water crisis on local and global level (*"There will be wars for the waters"* (P1.3)) due to the increasing demand but decreasing availability of water. At Juhapura, they noted a rising water scarcity because of the population growth, the depletion of drinking water resources and a generally limited availability of water caused by the monsoon climate. Finally, some participants felt that high costs (particularly in the case of artificial waterbodies) and a limited municipal budget are other factors challenging the development and maintenance of blue spaces. *"Ultimately, all depends on how much you can spend for maintenance of all this"* (Mr. Pram).

There were some negative comments about the extent of landscaping and infrastructure development (e.g., the commercial infrastructure at Kankaria Lake *"which diffuses the beauty of the lake"* (P1.1)) and thus, a limited possibility to experience nature (e.g., *"I like to spend some time at a place with nature and lakes. In cities, you cannot find these places, just Kankaria Lake is there"* (Mr. Pram), *"You destroy nature by structuring it!"* (Mr. Madhu)). However, the results remain inconclusive whether these are just expressions of varying landscape preferences or whether and to which extent this affects the experience of blue space benefits in the urban context. Some of those participants noting to prefer more natural places still regarded urban blue spaces favorably (e.g., *"Sabarmati is one of the best places in Gujarat"* (Mr. Pram); *"Even if this is structured [points towards the lawn areas], do you see the surrounding, the trees, do you listen to the tune? That is nature!"* (Mr. Madhu)).

4.1.2.2 Older people's demands and needs in relation to blue spaces; features perceived as age-friendly and health-promoting

As indicated in the previous chapters, all participants expressed a desire for living close to accessible and well-maintained urban blue spaces. Given the high importance placed on greenery, trees and flower planting, this desire is closely connected to a demand for green spaces. In fact, based on the qualitative results, many older adults seem to prefer blue-green environments; while on the other hand, the outcomes of the stated-preference valuation also pointed to a high preference for spaces featuring predominantly water. Broadly speaking, two divergent landscape design preferences emerged from the analysis: "as natural as possible" vs. more landscaped blue(-green) spaces.

In the baseline survey, participants were asked which aspects and elements (out of a given list) they consider important to their visit to any urban blue space. According to the total checks of "important", "quite important" and "very important", those are the provision of amenities, security, age-friendly access and design, ample free space, maintenance, nature (vegetation, animals) and soundscape (each being checked by more than 25 of the participants). The presence of people and weather were considered less or not important. The analysis of the qualitative data confirmed that these features make a blue space valuable for older adults. More precisely, the participants noted the provision of barrier-free pathways, facilities (e.g., washrooms, drinking water stations, first aid stations, seating options), shade (in- and outdoor options), wheelchairs, vegetation (flowers, greenery) and insect control. The physical accessibility (availability) of blue spaces was a particularly prominent theme in the data. Many participants were concerned about the inconvenient access which is currently caused by the lack of area-wide public transport options and sufficient parking space, the dependence on a private vehicle or cabs (if not living close-by) and poor and harmful traffic connections. As Mrs. Pame put it: *"Coming to those places through that traffic must be considered. If it is dense, does it make sense to come here? You should forget the inconvenience you have to come here once you have reached. If you have all that still in your mind, you think, 'Why not going to your private balcony?'."*

Based on the discussions and interviews with older people, these features can be understood as 'feel-good factors' that are likely to impact whether blue spaces are perceived as health-promoting.

The analysis revealed considerable overlaps between what older adults perceive as age-friendly and what makes blue spaces valuable and potentially health-promoting to them. As seen in fig. 4.11, the aforementioned features were also depicted (and stated) in response to the question what age-friendliness means to the participants: facilities such as benches, toilets, drinking water stations (should be disabled-friendly), sufficient parking space, the provision of shade, socio-cultural offers (e.g., music performances), insect control and accessibility (barrier-free landscape design, solid pathways, non-slippery, even grounds, provision of wheelchairs). In addition, participants mentioned the provision of playgrounds/fountains for children, assistance and shuttle services for older adults and disabled people, separate cycle paths and ensuring silence.

Figure 4.11: Participants' photos on age-friendliness of blue spaces (author's compilation)

The analysis shows that the age-associated change of functional abilities can come along with particular landscape design requirements or preferences (to what is individually perceived as age-friendly). For example, Mr. Nani reported being in need of higher benches (*"See, I am an elderly; I need a bench, a higher bench to sit. This one, I donated*

many years ago. On the high bench, you can move your legs up and down"), while Mrs. Pame stated that arranging multiple benches together would allow older adults *"(...) to meet and chat, to come together."* Mr. Pram noted that *"(...) for those who are very old, who cannot walk properly, they should be able to reach the water edge, have sitting options there. So proper walking pathways for all age groups so that they would go outdoors, sit at the pond and enjoy."*

4.1.2.3 Fits, misfits and changes needed

Based on the analysis of the observation, the baseline survey and the photowalks, Parimal Garden exemplifies a remarkable fit with regard to older Amdavadis' demands and needs in relation to blue spaces and the actual urban blue space provision. The overwhelming majority of the baseline survey participants (n=26) rated the overall appearance and quality of Parimal Garden as good, very good or excellent and almost all participants (n=28) considered it as an age-friendly place without reservations. In addition, all participants regarded Parimal Garden as a quite (n=17) or extremely (n=12) safe place. The photowalk participants highlighted that there are hardly any uncomfortable places nor significant barriers they would face (e.g., *"It is accessible. There are no stairs; no climbing is needed. And there is no noise even if the park is in the city"* (Mrs. Pame)) and that the park transformed successfully from an abandoned to a well-maintained blue space (*"At the beginning, there was no water. It was totally abandoned, there were dogs and in the evening, people came there. I called it lovers' land [laughs]"* (Mr. Nani)). The participants noted only minor issues that should be improved, including more parking space, more drinking water stations and cleaner washrooms.

Other good practice examples of urban blue spaces mentioned by older adults amongst the samples are the Sabarmati Riverfront, Kankaria Lake (yet, both were considered difficult to access and too commercial by several participants) and –in the past– Malav Lake and Vastrapur Lake (currently lacking water and being polluted).

In contrast to older adults' preference for accessible, age-friendly, well-equipped and well-maintained blue spaces around their place of residence stand the existing environmental inequalities, the perceived obstacles to accessibility of blue spaces and the immense maintenance backlog. Based on the analysis, many older people are only able

to regularly visit blue spaces if they are living close-by and healthy enough to walk/cycle or if being able and willing to afford a private vehicle or regular cab drives. As Mrs. Pame put it: *"The car also needs to be maintained and is costly, but one does not count that, right? [laughing]. (...) They [older adults] do not come [to the riverfront] unless you have a private vehicle. It is too far away."* In response to where they would like to live, one out of three FGD participants (n=8) checked they would like to live in a community with more blue and green spaces, a quarter (n=6) in a community with more blue spaces and a minority of 4 people in a community with more green spaces. This also applied to large parts (13 out of 15) to those who rated the current access to blue and/or green spaces as good.

While a number of older adults called for an improved access to urban blue (and green) spaces particularly in Eastern Ahmedabad and in Juhapura, the majority indicated having reservations about the development of new blue spaces due to the already pressing maintenance backlog (e.g., *"They should give more area for the water space if budget allows that, but they must be able to maintain it. They are not even able to maintain it all now"* (Mr. Pram)). Some participants clearly suggested to focus on maintaining the existing ones (e.g., *"They should not make new spaces; they should maintain rather the existing ones"* (Mrs. Pame); *"Rather than building new ones; if they just preserve and keep the ones in existence clean, it is best and enough"* (P2.5)), others on developing green spaces instead (e.g., "*Yes, there are benefits, but if you go and sit by the lake it stinks. What would you do sitting in front of such lakes? It is better to say a garden is better"* (P2.10)). Some felt that the actual blue space provision must be seen in the context of general urban development needs. Thus, compared to other (high-income) countries, the local urban blue space provision would lag behind: *"Generally, India is lacking such places of beautiful nature compared to Western countries, U.S. or Europe. We have more green spaces, not so much blue spaces. In that sense, we are behind these countries; architecture here is not at that point"* (Mr. Pram); *"India still has a long way to go. Look at the facilities abroad!"* (Mrs. Pame). In their view, compared to other Indian states, however, Ahmedabad and Gujarat would be forerunners and have attained success in the provision of public and blue spaces in recent years.

When asked about potential policy recommendations, the majority of participants pointed to the aforementioned demands and needs and the misfits outlined above. Hence, they called for improved approaches to blue spaces involving a better maintenance and a greater sensitivity for water in general (e.g., *"It is better to look out for the water resources"* (P1.4); *"Maintenance and security need to be ensured (...). It must be protected, for example against dryness, so not having those grey spaces"* (Mr. Pram)). Many participants argued that the municipality should fulfill its responsibilities and that corruption should be effectively prevented. Some older adults suggested to improve the sewage management (e.g., *"We should stop all pollution and make natural water resources"* (P1.1)) and to counteract the misuse of blue spaces by targeting people's behavior in public spaces, e.g., by introducing restrictions on plastic use and a ban on food consumption at blue spaces. While only one participant suggested to introduce further fees for blue spaces (at least on weekends), several older adults agreed on being willing to pay a fair portion of the federal tax for blue space provision if corruption would be effectively prevented and maintenance ensured.

4.1.3 Reflection and consideration of health interests and older adults' demands and needs in urban blue space planning and design

4.1.3.1 Blue space development and management in Ahmedabad

Two broad themes emerged from the analysis of the interview data: public and private sector approaches to blue space development and management.

Within the public sector, blue space development and management involves new governance approaches to the city's lakes due to the disruptive power of urbanization and the provision of other blue (-green) spaces.[37] According to HT, a former representative of the metropolitan planning authority AUDA, today's urban planning would aim to ensure that the traditional settlement patterns remain intact; that designated lakes would be reclaimed and developed as lakes with a surrounding park. This understanding would be present across planners, government and administration. Both authorities, AUDA and

[37] Interviewees such as TS also referred to initiatives of the public sector to clean water for lower-income dwellings (projects related to WASH) that have gained policy attention in urban India in recent years. However, this study did not delve into this topic.

AMC, have undertaken efforts to recharge the lakes with water in recent years. Those included projects to divert water in the underground strata of the lakes to uplift the groundwater table, to interlink all lakes by using the natural gradient from north to south and to fill the lakes with treated sewage water.

Generally, several interviewees noted that integrating blue spaces into urban planning (i.e., in the macro level development plans and town planning schemes) is statutory. For example, the Gujarat Town Planning and Urban Development Act would impose that lakes must be retained and that 5% of any land development has to be reserved for greening purposes.

The provision of other blue (-green) spaces involves exceptional projects such as the Sabarmati Riverfront regeneration and artificial ("landscaped") blue spaces e.g., lakes and ponds in parks and fountains. According to the AMC representative JP, the garden department is responsible for developing blue-green spaces. The current amount of blue-green cover is 4.9% and the department has set up the target *"(...) to achieve 12% green spaces in the city in the next five years"* (including landscaped blue spaces). JP explained the governance processes as follows: Every department develops specific goals that are put forward to the municipal commissioner whose task it is *"(...) to give equal importance to each and every plus point"* (JP) and to finally reconcile the goals in line with state and national guidelines. As the interviewee put it: *"The key role of the commissioner is that he can order the planning department for converting other purpose reserved area to transfer it to green space"* (JP). The central power of the municipal commissioner would be controlled, e.g., the state government has to approve the TPS. Consequently, the commissioner would act according to the overarching goal to improve urban development (*"His main aim is to plan better Ahmedabad"* (JP)). A common concern expressed by the key informants and experts (including the municipal representatives) is the unequal distribution of blue-green spaces, in particular between Eastern and Western Ahmedabad, but also at the urban peripheries (e.g., Juhapura: *"A lot of the Muslim areas are in the southern periphery –and they have very few garden spaces, if at all in fact. (...) A lot of it is also informally developed, because of successful riots since the mid-80s, so it is not very planned development (...) and this is a large Muslim population"* (RD).

Private sector approaches to blue space development and management include CSR practices targeting public blue spaces and blue landscape design initiatives in different (semi-public) settings (e.g., firms, housing complexes, retirement homes).

According to the interviewee HT, AUDA introduced the concept of CSR agreements targeting green spaces (that can contain smaller blue spaces) once they recognized that the planning and design was too complex for the public sector (*"When we originally designed a small neighborhood park, we started realizing what we need further"* (HT), referring to the installation of amenities). He reported that more than hundred parks were handed over to a public-private-partnership model to the dairy cooperative AMUL who were allowed to run a few kiosks in some of the parks ("AMUL gardens").

Integration of health interests into urban blue space planning
The municipal representatives were rather vague about the integration of health considerations into urban blue space planning. During the interview, BS first mentioned that the responsibility for the planning and the landscape design of blue-green spaces mainly lies within the garden department together with the planning and engineering departments (*"Generally, the planning department, our engineering department, our garden department, they are having group meetings and at the end of the day, they will decide, 'In this place, we are going to develop a garden'"* (BS). Yet, later on, he stated only two departments (alternating between the garden, the engineering and the planning department). After asking once again, he noted that the health department could make suggestions to the garden department. JP pointed to the governance processes mentioned above: theoretically, the health department – as well as the garden department – could set the goal to achieve a certain amount of public or blue-green spaces. According to him, interaction between both (and other) departments occur naturally given that there are regular meetings of the head of departments in which the respective requirements are discussed (*"We are working as one team"* (JP)). The AUDA representative HT noted that health considerations in urban blue space planning would mainly evolve around WASH issues.

The AMC adopted the concept to other public parks, but ceased the possibility of business activities. As brought forward by the interviewee MAB, exceptions include Kankaria Lake and Vastrapur Lake where contracts with the private sector were set up to use part of the profits of the local food sellers for the lake maintenance. Parimal Garden and Law Garden fall into the program "Pratiti" which has been set up as a CSR activity by the UNM Foundation by the pharmaceutical and energy firm Torrent Group. They charged an architecture firm with the regeneration and maintenance of 15 city parks until 2020, potentially adding more in future. Since the decision-making was handed over to the company, *"the AMC has no say"* (VK) regarding the design and maintenance. As the

interviewee VK put it: *"That are our parks. That is our responsibility. (...) I mean, we keep on visiting; we listen to the people. It is not like 'We have done it and now we are away.' It is a collaboration between the society, the neighborhood and the owners of the parks."*

According to several interviewees, there is a strong interest for blue and green space development in commercial and residential areas within the private sector. As such, IG, SC and AT & NT experienced that many businesses (e.g., factory owners, real estate developers) are aware about the importance of integrating nature in the city, invest in high-qualitative landscape design and would perform better in the maintenance of blue and green spaces as the public sector. Yet, as noted by several participants, blue space development in the real estate sector is typically coined by the exclusion of lower-income people:

> *"Today's demand is a garden with a waterbody. (...). For the 3 or 4 BHK [bedroom, hall and kitchen] and bigger ones, the elite societies, they give gardens and fountains. (...) There are always waterbodies in new residential complexes to attract investors to buy properties. Water becomes a status symbol in beautification. You know: My society has a waterbody; my society has a garden"* (IG).

> *"In fact, the kind of blue spaces you are talking about will be in neighborhoods which are upscale neighborhoods, where they maybe have a small swimming pool or a nice blue waterbody attached to upscale housing complexes"* (TS).

4.1.3.2 Perceptions on the health potential of urban blue spaces for older people

The analysis revealed that the overwhelming majority of the key informants and experts perceive health benefits of urban blue spaces for older people. For some, the blue space-health relationship was considered rather obvious (e.g., *"quite straightforward"* (TS)), while for others, the linkages between blue spaces and health were considered indirect or rather unapparent (e.g., *"there is a dulled relation"* (MB), among others because of lacking evidence). The participants widely agreed that there is a strong interconnection between blue and green spaces (e.g., *"Blue space is important for green space and green space is required for blue space. (...) Both are supporting their existence"* (JP); *"Blue cannot be without green without looking dull"* (SC); *"There is an immediate link between green and blue"* (TS)).

As table 4.4 shows, urban blue-green spaces were recognized as health-promoting and health-protecting places in five main dimensions: beautification/water as a landscape design element, blue-green spaces as places for recreation and healthy behaviors, as places for health education, as places for beneficial social interaction and environmental benefits linked to human health and wellbeing. Interviewees from across all sectors, but predominantly urban planning and policy, pointed to positive effects of integrating water into landscape designs, which many of them experienced in their own architectural and planning work, e.g., providing happiness, aesthetic enjoyment and positive sensory perceptions (see quotes no. [1] in table 4.4). According to several interviewees (see quotes no. [2]), the presence of water makes an obvious difference to landscapes without water. A common view amongst participants was the general importance of integrating blue-green spaces into the urban environment.

Within the dimensions 2-4, urban blue-green spaces were described as places for recreation and conducting healthy behaviors, for health education and for beneficial social interaction. The latter was considered particularly relevant for older adults, especially those who might suffer from loneliness or elder abuse[38] at home. As noted by TS, the benefits of social interaction at blue spaces have to be seen in the context of the ongoing social transformations in India:

> *"The traditional support systems are somewhat disintegrating, so which means that extra-familiar support, for example friends' networks, these will be important and these green and blue spaces definitely offer them that. So I would say it is more than the physiological, it is more the psychological support that they might get"* (TS).

In addition, many interviewees pointed to the diverse ecosystem services and related environmental benefits that blue spaces provide and that are linked to human health and wellbeing such as habitat creation, controlling atmospheric conditions, improving the air quality and providing cooling effects (see quotes no. [5]).

[38] As noted by some interviewees, Ahmedabad shows high rates of elder abuse (above the national average), including disrespect, neglect, verbal and physical abuse, economic exploitation (see also HelpAge India, 2018).

Table 4.4: Perceptions of interviewees in Ahmedabad on the health potential of blue spaces (author's compilation)

Theme	Description / Examples
1. Beautification / Water as a landscape design element	A number of interviewees referred to water entailing the intrinsic capacity to beautify environments. The aesthetic experience is considered beneficial to health and wellbeing. [1] "People feel happy when they walk through gardens" (AT) "The clear joy that it [water] can give to people" (AB) "Water is an emotional product. It creates positive energies" (SC) "Blue spaces are a requirement of beauty. Water adds beauty to housing projects in the first place" (SC) "People still wonder how it [talking about the 'tap circle', a traffic island with a fountain] works, it looks so beautiful" (IG)
	[2] "Just see it. You see how water makes a true difference in each scene" (AT) "Water brings you happiness. Of course, also flowers are nice to see, you can enjoy, but water gives you different feeling. You can breathe it; it makes you feel…you know, comfortable [hugs herself]." (IG) "Just looking at it [water] gives good feelings" (AT) "It is extremely important to have blue and green spaces within the city fabric. (…) Having water influences your health and not having water influences your health" (MAB) "No one can deny the importance of blue and green spaces in a city" (TS)
2. Blue-green spaces as places for recreation, restoration and healthy behaviors	According to several interviewees (e.g., MAB, BS, JP, TS), (well-maintained) blue-green spaces function as recreational spaces where healthy behaviors are conducted (e.g., physical activity such as walking, exercise and yoga). Health-related benefits would be provided by spending time outdoors, in a healthy environment (e.g., "Your health improves because you are not bound to indoor spaces" (MAB)), by having contact to nature and by enjoying a stress-reducing surrounding (e.g., "Recreational blue-green space will increase your work ability" (JP), "(…) to come outdoors and feel happy for some time of the day. Two hours in the park are older adults' food for the day" (RS)).
3. Blue-green spaces as places for health education	According to several interviewees (RS, BS, YP), blue-green spaces such as Parimal Garden are used by governmental staff and NGOs to conduct health education (e.g., awareness campaigns about infectious disease outbreaks, free diabetes screenings and blood pressure measurements), which would contribute to increase their health literacy and to improve the population health.
4. Blue-green spaces as places for beneficial social interaction	"They [older adults] are enjoying with their friends, they are meeting each other" (BS) "Good spaces for people to be with themselves, with families" (MAB) "They [blue-green spaces] may act as a site for social interaction which might not be the case for younger people" (TS)

Theme	Description / Examples
5. Environmental benefits of blue-green spaces linked to human health and wellbeing	"Something wonderful to have in hot climate conditions" (AB) "It [water] also provides oxygen" (SC) "It [blue spaces] makes an area which we usually call urban lungs, where people go morning and evening for fresh air" (HT) "Because of the waterbody, the water level of that surrounding area is up and the quality of the drinking water surrounding the waterbody is comparatively good as compared with other areas" (JP) "Everybody knows very well that green, greenery and blue spaces are required to maintain the environmental balance. As we are all aware about the heat island effect and as well as the importance of the carbon cycle and nitrous cycle and so, and blue-green spaces control all these things" (JP)

Some interviewees noted that older adults' intense use of blue-green spaces would come along with strong feelings about those spaces, even including a feeling of ownership:

> *"If we want to do some kind of other activities in that garden, the older people, they would not allow us to do such kind of other activities. They are so much united in that garden and they believe 'This is our garden.' So that kind of ownership they have in their mind"* (BS).
> *"One woman warned us to not spoil the regeneration"* (AB).

Concerns regarding the prevalence of mosquitos at blue spaces, a poor environmental/water quality and associated health risks (water-associated diseases) were widespread. In this regard, the interviewee MB noted that corresponding to her own observations and people's everyday communication, the mosquito population in the city has increased in recent decades, likely because the natural seasonality of many waterbodies has been ceased. She argued that the ecological health feature prominently in the discussion if and which health benefits blue spaces provide: *"Before talking about the health of the people, we have to first talk about the health of the blue space itself, because you have also realized, that not all blue spaces are healthy. They are unhealthy by themselves. So what can they offer to the people?"* (MB). In her view, due to the potential exclusionary dimensions of urban blue space development, there are clear causal links between the quality of a waterbody and the health status of its users (*"(...) link healthy blue spaces to healthy users and unhealthy blue spaces to unhealthy users"* (MB)). Similarly, TS highlighted that living close to highly polluted waterbodies –as common in urban slums in developing countries– does not provide any health benefits:

> *"You have a very unclean and highly polluted blue space and of course in that case, (...), it actually does not have any health effects (...) to live close to a water body which is not blue anymore, it is maybe black because of all the garbage that has been dumped. I think, in developing countries' context, this is crucial because what we understand as blue spaces in advanced nations might not be the same"* (TS).

Limitations in the accessibility and usability of well-maintained blue spaces for older adults occurred as another (potential) restriction to the uptake of 'blue health'. Several interviewees from different sectors (older adults' representations, private sector, science) were unanimous in the view that older people's demands and needs are so far neglected in urban planning which is why many urban blue-green spaces would not be accessible, affordable[39] or usable for older adults, particularly if living far away, having mobility impairments and/or not owning a private vehicle. Statements to this issue included: *"None of our parks are elderly friendly"* (MAB), *"(...) it [the Sabarmati Riverfront] is not the best case, (...) no great urban design which enables that [healthy aging]"* (MAB) and *"[Age-friendliness] is not at all a topic in urban planning and development anywhere"* (PS). Similarly, AD argued that the specific needs of any population group, including older people, would not be considered in today's urban planning (*"not at all age-friendly"*) and TS noted that blue-green or *"whatever spaces" "(...) have not been provided from the perspective of senior citizens"* as those *"(...) are driven by urban development planners"* who lack the commitment to consider older adults' interests. She commented: *"(...) their interests are not well represented in the policy discourse which also translates into urban development policies which will be 'age-blind' so to speak"* (TS). Thus, in her view, Ahmedabad *"(...) still has a long way to go in terms of designing a city which is age-friendly"* (TS). AB mentioned that age-friendliness is not a topic people would talk about but that *"(...) some things have been learned"* (AB). Based on his experience in architectural and planning practice, the concept merges into universal design and is therefore rather implemented *"(...) to the extent that spaces are universally accessible"* (AB). In contrast to the attention paid to children-friendly design, there would be no comparable focus on older adults *"(...) rather than to say that 'They like to sit in groups' or that 'They like to sit next to children, that it is not good to separate them' or*

[39] In this regard, one participant exemplified the introduction of a senior citizens' card offering discount for blue spaces such as the Sabarmati Riverfront as a good practice example targeting older adults' blue space use.

that 'Give them a separate corner because they really want to be where the laughter is'" (AB). Similarly, IG called attention to the fact that older people would enjoy the same sensory perceptions that children do: *"Why should I be old at my heart? I am old, but I do not want to sit on a bench and throw stones in the water. I want to put my feet in it, enjoy it, like the children"* (IG).

When asked about the consideration of older adults in the program "Pratiti", the interviewee VK reported that the public was consulted (e.g., conducting interviews with parks users and local communities to elicit their interests and needs and to discuss regeneration plans), although no in-depth studies were conducted. His colleague added that *"We have held very strongly that when it comes to public work, public work must happen in consultation and it should not happen by a bunch of designers sitting in their office doing what they want to do"* (AB); yet, that participation of the public would not be common in contemporary India. He commented: *"That [the question what the local community demands and needs] is a very European question, because in India, the community is happy to get whatever it gets or it gets nothing"* (AB). For him, a main reason for the insignificance of public participation is the pronounced land contestation coming along with explosive urban growth. Consequently, people are just not used to have high-quality, well-maintained public spaces around:

> *"The square meter per person is perhaps one of the lowest in the world. People just do not have places to go. It is a joke that we have in the office, that if you put traffic islands in the middle of the road, people would sit on the middle of the traffic island. And they actually do! They actually sit on the middle of the traffic island, because, you know, that is the only open space that you get!"* (AB).

Therefore, the expectations of most Indian people about public and blue-green space provision and design would be still modest and they would not be familiar to make sophisticated demands: *"People are just grateful that something is done. I mean, the expectation level is still so low. (...) Unless you learned driving the very basic car, you are not going to ask for a good air conditioning or a sound system"* (AB). He exemplified an older man living close to a deteriorated park who used to complain about the condition of the park to the AMC for seven years, until the Torrent Group decided to regenerate it. The man was so grateful that he invited the architecture office responsible for the

regeneration for dinner. *"So, the gratitude is not at all specified by what happens in the garden. The very fact that it happens, is great"* (AB). Yet, he noted that exceptions still exist: in some urban parks, the architects met older people who have developed such a sense of ownership over the years of using those spaces that they feel they would need to protect 'their' park and were able to articulate concrete design needs.

TS and the interviewees AM and AD criticized that the lacking consideration of older adults would extend to other policy areas (e.g., health care, transportation) and that for many of them, the basic needs would remain unmet. The insufficient consideration of older adults in policymaking on the one side and the limited coverage and lacking awareness of existing policies and laws related to older adults on the other side would leave them as a vulnerable population group, which is particularly apparent during natural hazards and other disasters.[40]

With regard to the integration of older adults' demands and needs into urban blue space planning, the analysis revealed results comparable to the integration of health interests (see chapter 4.1.3.1). The municipal representatives remained vague about the responsibilities for age-friendly urban planning and its implementation into practice (e.g., if specific policies, guidelines or plans on age-friendliness exist[41]). Statements to this issue included for example: *"We keep this topic in mind. It is in planning right now, but I am not sure about this, because I have to check it with the planning department"* (JP), *"Once the awareness is there, then automatically it comes as a part of the designing"* (HT). Yet, the municipal representatives argued that blue spaces are basically developed for the general public, including all age groups (e.g., *"We are trying our best to serve for this age group"* (BS), *"All classes, [but] majorly we concentrate on children below 4 up to 12 years and senior citizens above 65. They need movement more, while the youngsters, the middle-aged people, they are busy from morning to evening doing work"* (HT)). Talking about this issue with the health department, BS noted that early health promotion and disease prevention (including health education) would be a priority of the municipal health policy as it unfolds benefits reaching up to old age:

[40] In a mail received during the global Corona pandemic, AD exemplified that due to the lockdown and the fear about older adults being especially vulnerable for severe disease progressions, older adults were confined to their homes, causing negative impacts on their mental health.

[41] HT noted that mandatory regulations on inclusive (barrier-free) design would exist for buildings and public spaces, e.g., to provide easy access. Yet, he did not specify the concrete requirements.

> *"Definitely, the health awareness part that is the most important part. Not only the older age group; even at the age of 40, we must develop certain health activities, certain kind of restrictions (…) like salt intake or smoking or drinking habits (…). Even the experts are saying, if you want to prevent obesity, if you want to prevent some kind of heart diseases, you have to start at the age of 20"* (BS).

The AMC –through its primary health centers– would support a lifestyle modification towards healthy behaviors among all population groups, which would be successfully reflected in the rising popularity of healthy lifestyles such as yoga, the rise of local sports groups and in the increased health literacy of the population.

4.1.3.3 Facilitators and obstacles to successful urban blue space governance

The analysis revealed that several factors challenge the provision of (age-friendly and health-promoting) urban blue spaces in Ahmedabad, while others facilitate its implementation. Suggestions were made on how to advance urban blue space planning and design.

Obstacles

The maintenance problem brought forward by the study population of older adults (see chapter 4.1.2.1) recurred prominently among the sample of key informants and experts. In addition, many interviewees criticized that planning interventions targeting blue spaces are not sufficiently and properly done as required. As table 4.5 in the appendices (see annex no. X) shows, a number of factors were reported to impede the development and maintenance of urban blue spaces:

[1] Some interviewees from the field of urban planning and policy claimed that the public sector would lack knowledge and sophisticated technologies or would have outdated knowledge related to blue space development, e.g., about the most recent technologies in water engineering. In addition, several scientific experts pointed to a lacking awareness of blue spaces and its potential health benefits in research and policy as well as expectations of the public and decision-makers that contradict ecological interests.

[2] Across all sectors, high costs and the lack of financial resources was stated as a key reason why blue spaces are not sufficiently developed and badly maintained.

[3] Interviewees from different fields indicated a lacking commitment of responsible actors to develop and maintain blue spaces involving pretexts and prejudices, refusal to work and a widespread corruption.
[4] Several interviewees criticized that the funds available for blue space development are wasted on showcasing landscapes.
[5] A number of interviewees indicated that current urban blue space planning does not succeed in integrating different interests, most notably environmental and social concerns (including age-friendliness; for critique relative to the lacking consideration of older adults' demands and needs, see chapter 4.1.3.2).
[6] For several interviewees, the maintenance of blue spaces is hindered by a widespread misuse of blue spaces, involving a lacking valuation of public goods, people acting in their own self-interests and the unawareness about negative consequences.
[7] The lack of natural water resources and the semi-arid climate came up as further obstacles to blue space development and maintenance.
[8] Interviewees across all sectors expressed the concern that the explosive and mostly uncontrolled urban growth coming along with a pronounced land contestation and the general urban development and maintenance backlog challenges the development of new and the maintenance of existing blue spaces.

The regeneration of urban blue spaces occurred as a contentious matter that spans the above-mentioned themes [4], [5] and [8] and is therefore set out in more detail below.
Opinions differed as to whether the regeneration of the Sabarmati Riverfront and certain lakes (e.g., Kankaria Lake) has been beneficial for the environment. For example, the AMC representative JP argued that the Sabarmati Riverfront project contributed to improve the environmental health in the city due to large green space development (*"You can find green space at both sides –there are three big gardens as well as plantations along the river. (...) 20,000 trees are there. Because of that trees, (...) it helps to improve the air quality"* (JP)), improvements of the water quality and a facilitated traffic guidance:

> *"Before the development of the Sabarmati Riverfront Project, one Ashram Road was there and there is huge traffic on Ashram Road. You can imagine: one signal, more than 500 vehicles are there for a number of minutes. What is the carbon emission because of that vehicles? That is huge! Because of this road network, all*

> *the vehicles are passing fast. So, carbon emission from the vehicle pollution is down, because of this easy road network"* (JP).
> *"Earlier, it was about 600 to 700 TDS [total dissolved solids] in the water, right now, it is hardly of 250 to 300*[42]*"* (JP).

In contrast, several architects, planners and scientific experts shared the view that ecological interests have been widely disregarded and thus, that the environmental quality was not improved (see quotes [5] in table 4.5, annex no. X). The change of the nature of the ecosystems (from seasonal to perennial waterbodies) was criticized most prominently. As MB noted, this resulted in changes of the surrounding biodiversity and in the socio-cultural relationship: *"This is a cyclic process, you cannot avoid it, because in planning, we make some changes. People will behave accordingly and according to their behavior, we again make some ecosystem changes, so this process goes on and on"* (MB). She pointed to increased health risks due to the rising mosquito population. AT stated that the artificial inlet of water into the river is *"ecological nonsense"* to him. Talking about the riverfront regeneration, RD mentioned that *"nothing was done"* with regard to environmental improvement:

> *"At larger scale, there is no environmental improvement there. It is simply a project of reimagining a very different kind of skyline, a different image for the city. In fact, that this skyline is not even achieved is a different story, which is also a story about how speculations, broadly speaking, speculative projects, you cannot predict what that timeline is going to be and whether you have boom or bust"* (RD).

She highlighted that the water pollution continues, just that it has been 'displaced' to another stretch of the river beyond the project boundaries:

> *"If you go a little bit further down, there is a place where all the industrial pollutants of Ahmedabad are directly pumped into the river. This is purple water, you can see it. (...) It is very chemical, like you can smell the chemicals if you stand there. So, if you think about (...) the health of waterbodies, and then the health of its citizens, I do not see the Sabarmati Riverfront project having had any serious engagement with. (...) If it was about creating a better environment for the city, you do not have to do this project; to clean the river is a longer story, because the river cannot just be cleaned in 11 kilometers"* (RD).

[42] According to the U.S. Environmental Protection Agency, >500 TDS is the maximum water contamination level meaning that acceptable TDS levels for drinking water are lower than 500 TDS.

The divergent opinions might be best illustrated by the following juxtaposition: In the view of JP, the Sabarmati Riverfront regeneration is *"one of the best examples of blue space development in the city"* (JP), while others called it *"a disaster –there is nothing to talk about"* (AB) and *"a disaster - normally, a city would grow around a river but in the Sabarmati case, a real front has been built where you first enter into traffic jam"* (AT).

Contrasting views occurred also with regard to the social inclusiveness of the blue spaces regenerated. According to the municipal representative BS, the Sabarmati Riverfront has been beneficial in terms of improving the access to blue spaces for communities in Eastern Ahmedabad and generally, for increasing the quality of life by improved urban aesthetics and providing a setting for healthy behaviors. He stated that it *"(...) is a developing place (...); improvements will be done for all social groups to be able to enjoy the place"* and argued that the AMC would try "*(...) our best to provide all kind of services to all the age groups, to all the economic status, all the religious groups"* (BS). His colleague JP agreed that the AMC undertook efforts to ensure a socially compatible regeneration, e.g., by providing houses to 10,000 families who used to live in informal settlements along the river. Yet, he noted that socially compatible blue space development would be *"somewhat difficult"* (JP) and that the municipal corporation could not sustain all livelihoods related to the river (e.g., the business of the laundrymen). As the following comments show, the view of other stakeholders was more differentiated:
For TS, the riverfront *"has a very long history of oppression"*, referring to the fact that it was settled by low-income communities who were displaced *"(...) because they wanted to beautify"* (TS). As such, the project did improve the access to and use of blue spaces only for certain social groups. MAB claimed that the government did not provide adequate alternative housing for those communities who used to live along the river for more than 40 years, but just evicted them due to self-interests (*"Oh, now I want a garden"* (MAB)). In her view, the government has made a questionable choice:

> *"So you first neglected the river, allowed people to settle down, then you come up with a great idea to have a riverfront and giving space back to the people. Great. People, who were already there, which I think were 9,000 families, they were asked to be driven away, given housing, but 20 kilometers south. They said 'We will give*

> *you buses', but they did not take commuting time into consideration and how they would come back?"* (MAB).

This view was echoed by the architect and scholar RD who has studied the resettlements of the urban poor in the course of development projects such as the Sabarmati Riverfront. She argued that –although the riverfront is marketed as an accessible place for everyone– the imagination linked to the regeneration involved the development of high-end commercial and residential areas right from the start (*"So I do not think that the poor or the lower-income groups are part of that imagination in any concrete way"* (RD)). Further, access has not been ensured for the people resettled to the outskirts who now lack livelihoods and public spaces. As the projects Sabarmati Riverfront or Kankaria and Vastrapur Lakes show, she and others argued that there is *"(…) a move towards a sort of anti-poor development projects"* in certain urban areas to create *"somewhat sanitized environments for the middle-class around there"* (RD) (e.g., by charging fees and putting up fences) that involve eviction and social exclusion. This development trend can be seen in many Indian cities as in the era of globalization, cities are forced to market themselves as a global city *"to meet a certain kind of image of what a city should be"* (RD) and blue spaces *"become [those] spaces of reimagining the city"* (RD). In other words:

> *"Water has become this resource and space to appropriate for elite imaginings of the city and therefore, any sort of socially deprived or economically disadvantaged groups who have historically inhabited the embankments of these waterbodies, you see them constantly being evicted"* (RD).

<u>Facilitators & suggestions for urban planning and policy</u>

Despite the above-mentioned critique of the municipal blue space planning and policy, several interviewees felt that Ahmedabad –compared to other Indian cities– stands out in the provision of public blue-green spaces (or at least in the efforts to develop those). As such, it was noted that there is an increased recognition for blue-green spaces, in particular lakes and their preservation, and that the AMC –with the help of state and central government funds– has invested in urban blue space development in recent years:

> *"They are trying to do something. It [Vastrapur Lake] is not the best design, but at least there is an attempt"* (MAB).
> *"Because there was a [National Lake] policy, there was some budget for taking care of some lakes"* (MB).

> *"Blue spaces are coming in very handy if they are developed as a green-blue space together; because if they are developed, then we have good greens, then people are going there, so there is a direct causal relation, which you can relate with"* (MB).

In this regard, RD noted that socially exclusive urban blue space development is somewhat limited: First, given the large population with low income, the government would not be able to fully ignore this social group and is forced to include them in the development planning to a certain extent. Even if affluent areas would be prioritized (e.g., in the water supply), she called for caution about hasty generalizations as there are (less-known and less-investigated) activities related to public and blue-green spaces projects in poor areas: *"The elite spaces have been created, but it does not mean that nothing is happening in localities which are concentrations of lower-income groups. (…) There may be programs, certain kinds of projects in some muck wards, (…) which are less visible to us, right?"* (RD). Second, –since places are shaped by people– she argued that people in low income would sometimes be able to *"just claim those spaces"* (RD) and thus hinder the development of 'sanitized environments'. While this forming of space would obviously not eliminate existing inequalities, it shows that access to blue spaces for poor people could not be fully restricted yet.

The above-mentioned view was echoed by the municipal representatives who argued that the local government –despite the challenges and obstacles outlined– would make continuous efforts to develop blue spaces. For example, HT claimed that the AUDA has already integrated lakes into their development planning before the national policy came into force and *"(…) viewed it as an integral part of our urban fabric"* (HT)). In his view, planning instruments such as TPS have facilitated urban blue space development, but operational difficulties impeded progress. Consequently, it is mainly *"a matter of time"* (HT) until Ahmedabad's remaining lakes will be developed as public blue spaces (*"The figures are definitely going to be amazing"* (HT)). In contrast to his critique of the mismanagement of the AMC, he claimed that it is yet a democratic system in which elected members as well as zonal officers are answerable, e.g., for any mishandling regarding the maintenance of public spaces.

Given its high recognition for blue-green spaces as an aesthetic and wellbeing-supportive landscape element and its better boundary conditions compared to the public sector (e.g.,

in terms of financial resources, know-how, technologies), the involvement of the private sector recurred as a potential facilitator for blue space development and maintenance throughout several interviews. The analysis shows that the regeneration of blue spaces as a corporate social responsibility (CSR) mode –particularly in the case of the program "Pratiti"– was considered quite uncontroversial among the interviewees. In fact, the majority of them indicated that Parimal Garden can be seen as a good practice example of health-promoting and age-friendly urban blue-green space development, which adds to the results of the other methodological strands (see chapter 4.1.2.3). The value of the park for older adults would be constituted by its central location near to residential areas (accessibility), its high-quality design in terms of aesthetics (e.g., *"beautiful place"* (BS)) and the provision of amenities (e.g., seating options, sanitation facilities, exercise equipment, planting, the Lotus lake), and in the presence of many (older) users which provide opportunities for social interaction (e.g., *"really nice area for building social interaction outside the family"* (TS), *"They are connected with each other in this garden. So that is the most positive point of this garden"* (BS)). In addition, the park staff HA & MA reported that the user behavior –potentially supported by the presence of security staff– is unproblematic, i.e., that park rules are followed and hardly any user conflicts occur[43] (e.g., *"It is a very peaceful place. (...) People who come here are very cordial"* (HA), *"There are no risks over here. We have never seen any problems or fights taking place"* (MA)).

Interestingly, in the view of RD, Parimal Garden would be an example of how a minority group (Muslims) has *"(...) somehow decided, despite being in an upper-middle-income Hindu dominated area, 'We are going to use these spaces', because they are public gardens and it is not restricted"* (RD). *"Unlike what would one expect in Ahmedabad"* (RD), the park has become a socially inclusive space on the religious front, but not necessarily with regard to the socio-economic status as it remains unclear if different groups of poor people would actually use the space (except observing some beggars sleeping on the benches in the afternoon). Yet, other interviewees did not fully agree with that statement. For example, TS doubted that the park is used by many Muslims (*"I am sure you will find that there are not so many Muslim households; I would*

[43] As noted by HA & MA, young couples ("lovebirds") form an exception as they often do not align with the conservative behavior expected at public parks and therefore cause public nuisance (*"There are lot of complaints received from people because of lovebirds"* (HA)).

be very surprised if you are able to interview a Muslim" (TS)). She considered the age-friendliness of the park as *"a positive unintended consequence"* which is driven by the residential surrounding, a health-conscious upper-middle-income class:

> *"But Parimal Garden actually, if you look at the geography of that area, there are a lot of nice neighborhoods close by, upper- and middle-income class neighborhoods of course, so I think this is a reason. The people are health conscious. I think, you know, to be aware of health is also something which is a very middle-class thing. If you are from a low-income community, your attention to health will be somewhat minimized because your everyday struggle is so much that your attention to health might be neglected. But in an upper-and middle-class neighborhood, people are reasonably conscious about their health. So I think this is a reason why Parimal Garden is somewhat more frequently used than other green and blue spaces in the city"* (TS).

In comparison to other blue spaces such as Kankaria Lake and the Riverfront (marketed as family destinations), Parimal Garden would allow older adults to pursue their own interests such as exercising.

In line with the responsible architects (AB & VK), HA & MA noted that a sophisticated planning and design of the park (e.g., the selection of local and seasonal plants to foster biodiversity, ensuring water circulation of the lake, implementation of a drainage system to prevent flooding and standards for recycling waste) contributes to functioning maintenance processes. As such, duties would be clearly arranged and regularly checked. The success of "Pratiti" was attributed by AB & VK to the following facilitators: the culture of the company and of the architectural firm demanding to provide socially inclusive parks (*"We have a very, very strong and clear policy on all that, you know, that the park is for everyone. So, there is absolutely no question of creating any hierarchy of who can and who cannot enter*" (AB)[44]), the efficiency and expertise of the private sector to conduct elaborate planning processes[45] and having high self-expectations and quality

[44] According to AB, the parks eligible for regeneration were selected considering existing environmental inequalities, the size of the park and the general usability. Non-recreational uses such as washing clothes might be considered in the regeneration planning (e.g., at Victoria Park in Eastern Ahmedabad) if such user behaviors where already common before the regeneration and as long as those are not anti-social.

[45] The architects described the detailed groundwork done in the course of "Pratiti", including initial research on the city's parks, the current conditions and usages, mapping, the creation of a park development manual, a comprehensive assessment of design requirements (e.g., lighting without light pollution, irrigation needs and storm water use, walkability, aesthetics – *"So even the way you look at the signage is what we have done"* (VK)) and the development of modular design packages.

standards: *"When we set up this endeavor, we really wanted to somehow be able to involve psychologically; to do something that could be repeated quite easily; what really counts in parks"* (AB). Consequently, the parks were regenerated much cheaper (210 rupees per square foot including equipment –*"which is nothing"* (AB)) and of better quality than the public sector could have done it. According to AB, Ahmedabad's municipal commissioner endorsed the CSR activity, stating, *"We should do more like this kind of parks because everything is done well."*

Finally, the AUDA representative HT felt that CSR and other types of public sector involvement could be extended to support urban blue space development and maintenance in future, particularly for the operational management of such spaces. Referring to the example of the AMUL Gardens, he considered the ongoing business activities at the parks (kiosks selling dairy products) as beneficial for public security and considered the concept to be replicable to other manufacturing companies of articles of daily use:

> *"So at 5'o clock in the morning, when the senior citizens go for a morning walk, there is always a person from that side. Because the kiosk is on, some lights are on, the garden light will be on. In the evening somebody sits: the family members, ladies or children are playing in the garden lawn, the kiosk is also on, so there is a sense of security in these areas"* (HT).

However, for the landscape planning and design, he would favor a dedicated separate authority with a fixed budget allocation (similar to the Ahmedabad Metro, a special authority working with tendering procedures) which would implement a masterplan developed by the municipal corporation. In this *"collective system"*, the private sector (for operation and maintenance) and others, e.g., experts *"volunteering their time"* (HT), could help to accelerate urban blue space development. While others such as MAB generally agreed on the involvement of the private sector, she argued that advertisement rights would need to be restricted and public participation in planning ensured.

With regard to achieving blue spaces that are sensitive of the demands and needs of older adults, the availability and accessibility of blue spaces were issues particularly prominent in the interview data (e.g., *"Accessibility. Accessibility. Accessibility. It is all about accessibility"* (NT)). Other aspects included the quality of blue spaces (provision of

amenities, ensuring multi-functionality to accommodate to different needs within the population, safety and long-term maintenance) and participation in planning (e.g., *"Currently, we are not allowing older people to become partners in urban planning"* (AD)). One concern expressed by the architects AB & VK was whether landscape design should be particularly adapted to older adults' concerns. They argued for a universal design approach, as many demands and needs would spread across all age groups, e.g., non-slippery grounds and comfortable benches. Moreover, any age-specific provisions would entail the risk to make older people feel older and thus, to overprotect them:

> *"When we begin to tell them 'You do not belong to the regular class of the society and now you have to be caged and protected' –such as in the 60, 70 years back to them, where you had children play and one put fences around them. So you said that 'The kid is someone who needs to be protected.' So you put a little, gently fence around it, like a little monkey in a zoo, right? I think the other end of that should also not happen. (...) Overprotecting people who are old is also not a good thing"* (AB).

There were some suggestions to intensify the use of urban blue spaces, e.g., by integrating structural and behavior prevention (free health checks, lifestyle offers like yoga and laughing clubs) and by offering volunteering (e.g., asking older adults to become *"guards of the waterbodies"* (AD) to support maintenance or to engage for social matters such as teaching children who dropped out of school). As noted by the gerontologist TS, being involved in the community and social participation are central to the experience of healthy aging: *"(...) because healthy aging is also about participation, about giving back to the society. So I think, older people would also feel valued, as a valued person, not as a burden. (...) There is so much older people can offer and I think those links need to be harnessed"* (TS). Thus, she called for raising awareness *"(...) about the utility of caring together, doing things together, of volunteering"* (TS), particularly with regard to the increasing erosion of multi-generational living arrangements. While concerns about the change of older adults' living arrangements, elder abuse and a lacking consideration of older adults in policymaking would be justified in her view, she noted that there is generally a high acceptance of aging in the Indian culture (*"There is no active denial of that life process"* (TS)) as compared to countries in the Western world where a *"persistent denial"* of age prevails (*"So even 80-years old, they do not want be called old"* (TS)).

With regard to the obstacles experienced in urban blue space governance, a number of the interviewees suggested the following further actions for urban planning and policy:

- To refrain from carrying out flagship projects and to decentralize urban blue space planning so that smaller blue-green spaces are developed in different parts of the city, particularly where those are lacking (e.g., *"cozier spaces", (...) a European way to look at"* (MAB), *"We have to learn to plan on small-scale"* (AT)). This included calls for a *"compact urban development"* (HT), for vertical greening and small-scale, impermanent blue-green solutions such as seasonal retention basins, pocket parks and landscaping traffic areas.

- To deploy integrated and intersectoral as well as more humanistic urban (blue space) planning, i.e., planning oriented towards human health and wellbeing and quality of life (e.g., *"(...) to set humans at the center of urban planning and policy, not glamourous houses"* (AD)). This came along with calls for considering other needs than recreation in urban blue space planning, particularly shelter and WASH (e.g., *"Just creating blue spaces and not taking care of the sanitation…they need to go hand in hand, you need to create proper sanitation that people can use them in their own homes and do not have to rely on these public blue spaces"* (TS); *"People should also not have to depend on these lakes for say, water and sanitation. You need to provide those water and sanitation infrastructure and services to them"* (RD)).

- To better reconcile ecological interests in urban blue space development, e.g., by shifting from primarily public space development to renaturalization (e.g., *"We have to learn to leave nature alone, to learn to unplan"* (MB)), to stop environmental pollution (e.g., *"If it [the blue space] is receiving wastewater, we have the responsibility to treat the wastewater"* (MB)), to apply an eco-friendly landscape design (see below) and to improve the education and training of architects and planners and awareness-raising in the public about the significance of eco-friendly and well-maintained natural spaces in cities and its linkages to health (e.g., *"Environmental awakening at grass root level. (...) We really need to hammer people"* (MB)).

- To refrain from urban blue space development if maintenance and safety cannot be ensured. As such, several architectural interviewees pointed to the maintenance needs of blue spaces (e.g., *"The maintenance of water requires a serious kind of commitment"* (AB)) and its potential health risk if the spaces (particularly the water quality) are not taken care of (e.g., *"Unless you have a proper filtration system, you cannot implement water in that plan. (...) You cannot let children play in sewage water"* (AT)). Compromises could be to install blue spaces only at major parks (AB) or to consider short-term operations: *"The government can afford to look after fountains and waterbodies, just for few hours that would not cost them much. Maybe from 5 to 6pm or 6 to 7pm, when people are going out"* (IG). For the city's lakes, proposals included to accept the impermanence of water availability and to allow alternative uses such as community gardening, playgrounds and events (*"In other countries, you go ice-skating when the blue spaces freeze"* (MAB)).

- If developing blue-green spaces, invest into a landscape design that is eco-friendly, cost-effective, durable, vandal-proof, easy to maintain/replicate and offers meaning and utility to people (in other words, *"waterbodies need to be designed perfectly"* (AT)). According to the architectural experts, this includes e.g., appropriate planting which is *"not only beautiful to look at"* (AB) (considering local climatic conditions, the value for the local fauna and human needs such as shade), ensuring the circulation of water, collection of rainwater and water conservation (*"zero run off parks"* (AB)), adequate engineering (e.g., pumps), prevention of mosquitos (e.g., by settling fish) and recycling/composting. As noted by some interviewees, reconciling ecological interests and achieving a good water quality is relatively easy (*"This is not rocket science"* (AB)), if elaborate planning is undertaken (e.g., thorough calculations of natural water availability and evaporation losses) and expertise and technologies are available.

- To prevent the waste of groundwater for recreational spaces as much as possible (e.g., *"Find ways to treat your wastewater and fill your ponds"* (MAB), particularly in cases where only visual access to water is provided (e.g., *"Nobody*

would drink or use it, but children for example would enjoy it, like to hear and feel it. I also would enjoy having a fountain at the garden nearby" (IG)).

- Give special attention to social inclusion in urban blue space planning (particularly where investments are done) as the city is highly segregated (e.g., *"Take the status quo of Ahmedabad's class, cast and religious geography (…) as kind of given, because it is not something that will change easily"* (RD)), which ultimately means to prioritize a decentralization of blue-green spaces, but to also consider the perceived accessibility (e.g., *"If you want to build inclusive cities or inclusive spaces you need to take into account that everyone has access but also does not feel intimidated. It is not just about making things available and free"* (TS)). The call for socially inclusive blue space planning also surfaced in relation to gender equality. Concerns were expressed whether women (regardless of their age) have the right to access public spaces and –given the prevalence of violence against women in Indian cities– feel secure to use those (e.g., *"So that is not because they [women] do not want it, but it just has a long history of women being confined to indoor spaces; they might not feel comfortable to engage in social interaction in public spaces"* (TS); *"Public spaces belong to men and women differently at certain hours of the day"* (AD)). Interestingly, the risk of a 'blue gentrification' was not particularly prominent in the interview data.[46]

- To support research, e.g., on recreational needs (of older adults and others), accessibility of different social groups to blue spaces and their qualitative characteristics and links between human health and the environment (e.g., health impact assessments of blue space development) and to translate scientific evidence into policymaking.

[46] While several interviewees raised concerns about the eviction and displacement of the urban poor in the course of urban blue space development projects, hardly any mentioned the risk of a gentrification explicitly. In fact, AB argued that compared to other countries, the risk of a 'blue or green gentrification' would be rather low in urban India, as social transformations would happen slowly and most blue-green space development happens after a community has settled. Even if the real estate value of socio-economic weak areas might increase after large urban development projects have been done (*"Because it becomes more attractive to be facing a decent park"* (AB)), this process would not happen habitual and as fast as in major cities in the Western world, where the profile of neighborhoods changes dramatically. He is convinced that in urban India, *"there still needs to be a magnet for other things to come"* (AB), not only a blue-green space.

4.1.4 Summary of results

The results of this case study show that urban blue spaces are regularly visited by older adults in Ahmedabad for active uses such as walking and exercising and passive uses such as aesthetic pleasure, restoration/relaxation and social interaction. For many older adults, going to the main research site Parimal Garden has become a beneficial long-standing (daily) routine in their life. Individual, social and environmental factors were identified that influence the use of blue spaces. In summary, older adults hold diverse positive feelings about blue spaces and consider them extremely valuable in the urban context. All dimensions of the therapeutic landscape concept were identified. Blue spaces hold meaning to older people in terms of enabling physical activity, having positive emotional and social bonds, aesthetic and restorative experiences and positive sensory perceptions (linked to the environmental benefits provided). The majority of older people in this study preferred developed (landscaped) and well-maintained blue spaces and voiced out a great appreciation for hybrid (i.e., blue-green) environments. The following features were identified to make blue spaces valuable for older adults: the provision of amenities[47], ensuring access/accessibility (ease-of-use) and minimizing risks, a barrier-free, disabled-friendly landscape design and maintaining a good quality in the long term. Criticism occurred with regard to difficulties in accessing blue spaces, inequalities in the blue space provision and issues related to the quality of blue spaces (immense maintenance backlog). Looking at the current urban blue space governance, the results indicate that the private sector plays a significant role in the development and maintenance of blue spaces such as CSR activities related to urban parks. The majority of the actors interviewed perceive diverse health benefits of blue spaces for older people. However, a number of factors were reported that currently impede progress to provide high-quality blue spaces and "blue health for all". In addition, adaptations in urban (blue space) planning are necessary to be responsive to the demands and needs of older adults.

[47] Those considered as age-friendly, important and/or health-promoting are e.g., benches/seating options, drinking water stations, first aid stations/provision of assistance, different options of shade, public toilets, playgrounds, greenery/plantation and wildlife, open space, socio-cultural offers.

4.2 Case report Ruhr Metropolis

Description of the sample

In total 51 older adults were involved in the study. Yet, as some FGD participants did not participate in the stated preference valuation, data is available only for 41 older people. As table 4.6 shows, the majority were female (n=27) and young-to-middle old, i.e., 65-79 years (n=29). In total 16 participants had a migration background, i.e., with own migration experience, not being born in Germany. Most were Christians (n=33); the remaining were Moslems (n=3) or confessionless (n=5). The information available on the educational background, profession, place of residence and income sufficiency revealed that the sample consists of older people with a lower and middle socio-economic status. Most participants were married (n=21) or widowed (n=14), the latter being particularly prevalent (9 out of 16) among female migrants. Slightly over half of the surveyed reported living together with another person (n=21); more than one third (n=16) reported living alone. Most of the participants have lived in their neighborhoods for several years: 33 persons for more than 10 years, 4 participants for more than 5 years. Although about half of the respondents (n=21) own a car, this applies almost exclusively to the baseline survey participants who almost all do not have a migration background. Dog owners were hardly represented in the sample (n=4).

Almost half of the participants (n=20) described their general health status as fair; about one third (n= 14) as good or very good (the remaining, n=7 as poor or n/a). A majority of participants (n=34) indicated having (at least) one chronic disease, but still more than a quarter (n=10) of those reported having a good or very good general health status. Mental wellbeing and physical activity levels were assessed only from the baseline survey participants (n=26). Out of those older adults, almost two-thirds (n=17) scored ≥50% in the WHO-5 measure of wellbeing, indicative of not suffering from depression. While a majority of participants (n=19) stated doing recreational walking on 5-7 days over the last seven days, the answers to physical activity varied: one half (n=14) reported doing no moderate-to-vigorous activity over the last seven days and the other half indicated doing moderate-to-vigorous activity on 1-3 days (n=6) or daily (n=6) over the last seven days.

Table 4.6: Overview of the study population in Ruhr Metropolis (author's compilation)

	n	Female (%)	Male (%)	n (%)	Age (years)
Baseline survey / Lake Niederfeld sample	26	12	14	17 9	65-79 80+
Photowalkers (part of the Lake Niederfeld sample)	2	1	1		
	Mrs. Esche, 66 years; Mr. Esche, 68 years				
FGD Samowar	3	3	/	3	65-79
FGD Center 60+ International	12	12	/	9 3	65-79 80+
Total	**41**	**27 (65.9%)**	**14 (34.1%)**	**29 (70.7%) 12 (29.3%)**	**65-79 80+**

For information on the key informants and experts interviewed and their pseudonyms see table 3.2 in chapter 3.3.6.

4.2.1 The urban blue space-health relationship of older adults in Ruhr Metropolis

4.2.1.1 Older adults' engagement with blue spaces in daily life and influencing factors

Residential exposure / Access to urban blue spaces

A majority of participants of the baseline survey and the FGDs (n=32) reported living in walking or cycling distance to the next urban blue space, while less than one third (n=11) indicated that public or private transport is needed to reach the next blue space. However, contradictory answers in all samples reduce the conclusiveness of these findings.[48] A majority of those surveyed at Lake Niederfeld (23 out of 26) noted to access the main research site by walking or cycling.

Visit frequency and types of blue spaces used

While comparatively few older people were observed at Lake Niederfeld during the observation period, the majority of the baseline survey participants (21 out of 26) stated that they visit the main research site daily or several times per week, most (n=12) in the afternoon (both, on weekdays and weekends). Over half of those surveyed (n=15) spent an average of one to two hours at the lake. A majority of 22 individuals reported using

[48] For example, participants checked contradictious options such as "living in walking or cycling distance" and "in need of public or private transport" or "not being able to regularly reach any blue space" but reported to regularly visit any blue space.

other urban blue spaces, including Krupp-Park, Lake Baldeney, Gruga-Park, Schlosspark Borbeck and the River Ruhr. Out of the FGD participants (n=15), more than half (n=10) indicated to visit any urban blue space at least once per month, most of them belonging to the group of Russian-speaking older women (Center60+ International). The blue spaces visited correspond with those of the baseline survey sample. Yet, as brought forward in the FGDs and in some interviews (YA, IG & HC), many of the older migrants would use urban blue spaces only irregularly (particularly in the group of Turkish migrants) or rather occasionally, e.g., as part of organized activities of the community centers.

Activities undertaken

If older people were observed at Lake Niederfeld, those were mainly doing moderate physical (e.g., walking or cycling) or sedentary activities (e.g., sitting in the café, sitting on a bench) in the morning and/or afternoon. This observation is confirmed by the results of the baseline survey which showed that aesthetic pleasure/watching the scenery; stress relief, relaxation and restoration and social interaction/spending time with family and friends are the most common activities older people undertake at Lake Niederfeld. Further common activities reported are nature/wildlife watching and walking (see fig. 4.12).

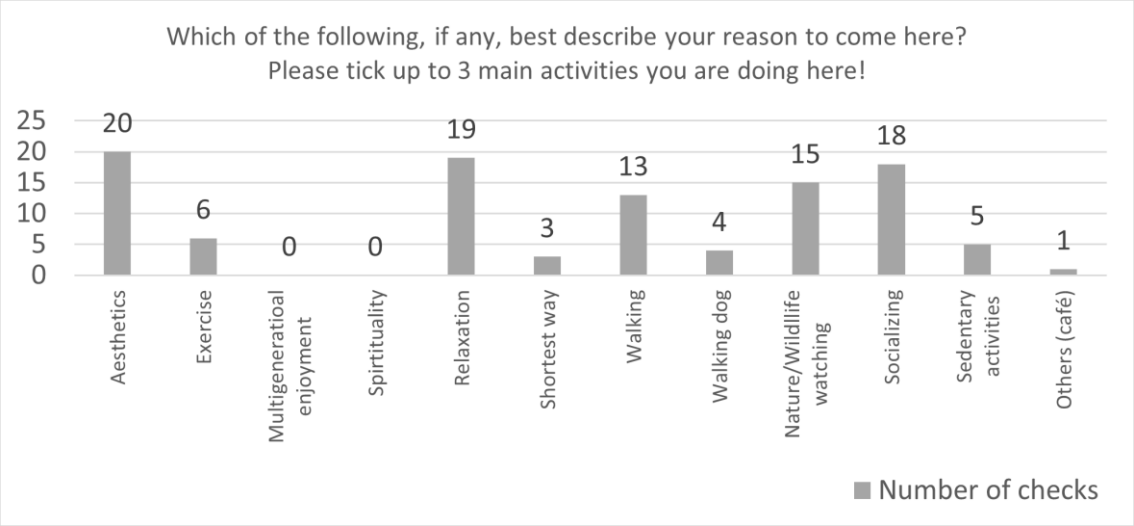


Figure 4.12: Reasons for visiting Lake Niederfeld (author's compilation)

The observation and the photowalks revealed that Lake Niederfeld is also frequently used by walkers and cyclists in transit. As the comments below illustrate (see fig. 4.13), the

photowalkers Mrs. and Mr. Esche like to stop by at the café when cycling to the city center

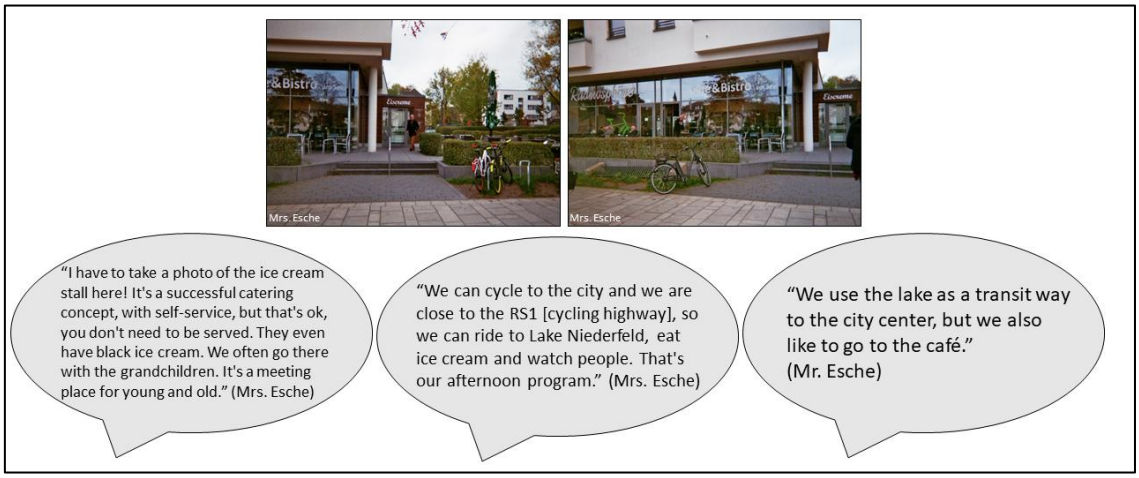


Figure 4.13: Participants' photos and narrations of regular activities undertaken at Lake Niederfeld (author's compilation)

In addition, they like to go to the lake to have ice cream with their grandchildren or to just watch the scenery. Likewise, the two reported using the blue space "Green Center" as another transit destination when cycling to the city (e.g., *"Here, we frequently pass by!"* (Mrs. Esche), *"We use the place as a transit route to get into the city by bike. We regularly drink coffee and eat ice cream here. It is also a good starting point for shopping in the city"* (Mr. Esche)). They never did any water-dependent activities but would prefer to be close to water (*"preferably just watching"* (Mrs. Esche)).

As indicated above, the FGDs and interviews revealed that many of the older migrants participating in this study use blue spaces rather irregularly or occasionally, when organized activities (e.g., picnics, rickshaw drives) are offered by the community centers for older people. Yet, some participants of both FGDs stated they would like walking along water, visiting blue spaces with family members/grandchildren, enjoy nature/wildlife watching (looking at water, watching ducks and birds) and having a picnic/ice cream.

Factors influencing blue space use

A range of factors and its interplay was noted that (potentially) influence older people's blue space use. Those include the available free time, the relatedness with nature, the familiarity with the living environment (knowledge about available/accessible blue spaces), the season/weather (e.g., more visits in spring and summer, shifting blue space visits to the evening during heatwaves) and cultural specifics/cultural background.

The availability, accessibility and quality of blue spaces emerged as particularly prominent influencing factors from the analysis. A common view was that the vicinity to the place of residence has a determining influence on older people's blue space use. As Mr. Esche put it: *"People stay in their neighborhood."* The quality of blue spaces involves the provision of a good sojourn quality, i.e., the provision of amenities, a clean environment as well as public safety. In this context, a few interviewees linked the usability of blue spaces to greater health benefits of blue spaces, as the following comment illustrates:

> *"It is nice to have blue-green spaces. They do all this kind of things, filter the air, prevent noise to some extent, all these environmental things. But if people do not use them, they do not benefit from them in a way that increases their physical activity levels or their mental health and so on. You can have a lot of blue-green space, but if it is not used, you do not achieve these health benefits"* (JS).

The individual health status resp. health constraints occurred as another salient influencing factor of older people's blue space use. For example, the interviewees YA and DP stated that many older migrants would have severe health constraints and/or disabilities that would limit their ability to going to blue spaces. Yet, the majority of the study participants with chronic diseases reported to use urban blue spaces at least once per month (29 out of 34), more than half of those even daily or several times per week. In the case of Turkish migrants, the interviewee YA noted that not only physical health problems (e.g., pain, mobility impairments), but also mental health burdens such as loneliness would deter the older women from visiting blue spaces as they would generally not like to go out alone (*"I realized that if the group would not be there, they are lonely. I am trying to find ways to connect them [e.g., by implementing a phone network], so that they would finally call each other and get out together, e.g., for walking. That is not happening at the moment"* (YA)). In contrast, some participants of the FGD Center60+

reported that they seek blue spaces particularly when feeling lonely or having depressive thoughts.

Several interviewees mentioned that the use of blue spaces depends much on the individual activity level and motivation to be active (e.g., *"Physical activity! That is what we need, so how do we get it? We think about local destinations. We do not want to be boring, so we cycle at least five times per week"* (Mrs. Esche), *"There are all kinds of people, it depends on the personality and the lifestyle. But we are really lucky to have relatively active older people around"* (HC), *"It would be nice if they [the older Turkish women coming to the community center] would visit destinations in their living environment such as Lake Niederfeld, because they are somewhat lazy to do so"* (YA)). With regard to older migrants, the opinions differed as to whether organized activities would promote their individual blue space use. On the one hand, YA reported that the Turkish older women would require to be convinced and accompanied as they would not use blue spaces on their own, despite efforts to activate them (e.g., *"They need to be taken along, almost need to be forced"*, *"Despite meeting others at these group meetings, they mostly do not have a friend with whom they would visit a park or walk. They do not meet each other outside of this group"* (YA)). He noted that blue space visits (or any other activities) have to be organized (*"It always needs to be guided; it is something they always ask for. Ideally, everything should be organized so that they would just need to come with us. They are like this!"* (YA)) and that there always has to be a certain reason such as a picnic or barbecue for meeting (*"Walking alone is not enough. If I tell them: Let us go walking, they would immediately answer: 'Shall we bring food?' For them, it is not about physical activity, it is about 'We have to do something'. Just doing nothing is not possible"* (YA)).

On the other hand, the interviewees IG & HC and DP experienced that a number of older migrants (from different origins) do use blue spaces in their leisure time and that the individual blue space use has been in parts promoted by the community centers for older people and by migrant organizations. As such, there are older migrants who initiated walking groups and those who continued to use blue spaces after joining organized activities such as a picnic in a park. In their view, the facilitation goes back to showing

them destinations (like blue-green spaces) in their living environment, networking effects (e.g., *"One person would come and say: Let us do this or that and another feels this would be a good idea or makes own suggestions. There is a certain dynamic"* (IG)) and setting up a motivation to become more active (e.g., *"They might have got used to be active"* (HC), *"Some wanted to be more physically active*" (IG)).

Health and social issues among older adults in Ruhr Metropolis

The key informants and experts referred to the widespread prevalence of NCDs (e.g., diabetes and dementia) among older adults in Ruhr Metropolis. A recurrent theme particularly relative to older migrant women was loneliness. For example, YA stated that most of the Turkish female migrants are widows living alone with little to no social contacts, because they used to care for the family. In addition, they mostly did not develop the habit of leisure activities linked to blue-green spaces in younger years (e.g., *"Then they are left alone, without German skills, without possibilities to care for themselves. In the past, they cared for children, did some minor jobs. These people now turned into lonely people, into older adults that still do not know which possibilities are there for them. (...) These women only know their flat, their children, their husbands and how to care for ill people. They never did something for themselves, just for the family"*; *"They told me: 'It is a pity we do not know any locals here because we were always busy to maintain our family life, to care for the children and maybe sending money to Turkey'"* (YA)). While community centers would try to talk openly with the women about it, he felt that they lack understanding for each other; thus, hardly any improvements have been achieved so far (*"I recognized that whenever they get together, they cannot really talk to each other well. They talk, but about topics such as shopping or so, but not about themselves, at least not if not being motivated externally"; "There is even hardly any exchange between the Alevist and the Turkish groups, despite both come from Turkey"* (YA)). While other interviewees working with older migrants agreed that loneliness is a widespread concern, they reported positive experiences regarding social participation. As such, IG & HC initially found it difficult to connect older migrants with each other, yet, over time, many of them would have established good relationships (e.g., *"Now, if they see each other, they hug each other. They built trust*" (IG)). All agreed that connecting older migrants and non-migrants would remain a central task for the future.

The results show that participants aged 80+ years visit blue spaces either as often as (FGD participants) or even more often (baseline survey participants) compared to those aged 65-79 years; yet non-representativeness has to be considered. Experiences with/the use of blue spaces in younger years were identified to possibly influence the blue space use in old age. For example, when the photowalk participants were asked to show pictures of their relationship to blue spaces (see fig. 4.14), Mr. and Mrs. Esche commented that the regular holidays at the Northern sea constitute an important addition to their regular use of urban blue spaces in Ruhr Metropolis. Since Mrs. Esche used to go to the island Norderney since childhood, they decided to keep the tradition over the years: *"It is a place of longing. It means a lot to me and it is easily accessible. We start from here in the*

morning and already in the afternoon, we can walk on the beach. (...) We already know every corner of it, but it is always nice" (Mrs. Esche).

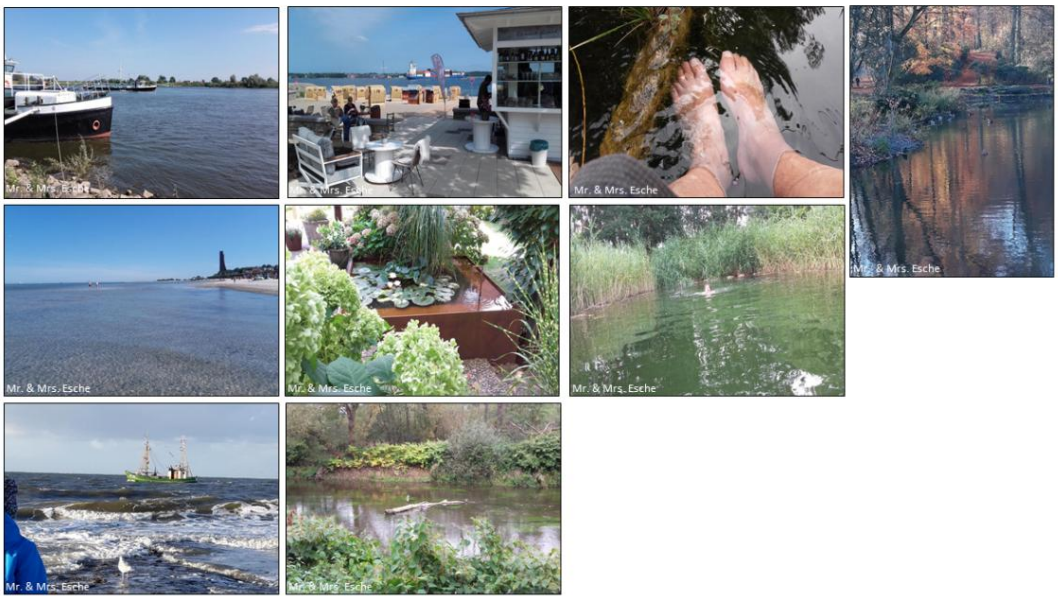


Figure 4.14: The relationship of Mr. and Mrs. Esche to blue spaces (author's compilation)

4.2.1.2 Older adults' feelings related to blue spaces and their (dis-)likes

The results show that older people attach value to urban blue spaces. Well over half of the participants (26 out of 41) somewhat or strongly agreed that having urban blue spaces around is an important reason in choosing a place of residence. The agreement rates were found to be higher among older men (64.3%) than among older women (45.9%) and higher among the samples of older migrants. When asked whether the presence of water forms an important reason for visiting Lake Niederfeld, a majority of the baseline survey respondents (21 out of 26) somewhat or strongly agreed.

The analysis of the qualitative data revealed that the majority of participants (across all samples of older adults) ascribe restorative qualities to blue spaces and appreciate the aesthetic experiences that water provides. For example, as the following excerpts show, a number of older people felt that being at blue spaces or looking at water enhances the mood and could reduce stress. Besides, the presence of water would contribute to a beautiful landscape design, particularly in the urban context.

> *[One participant (PGER1) of the FGD Center60+ citing a book she read]: "If you feel bad, have bad or gloomy thoughts, then go to and look at the water or look at the sky, that blue color!" From her own experience, when being by or looking at water, she feels calm and balanced. Water, for her, would be "an information", in the sense that the body is informed to relieve stress.*

> *"Valentina, for example, she is widowed and has no children. She is alone, here in Essen and in Germany. She said that when she is in a bad mood or having depressive thoughts, she goes to this lake [Lake Niederfeld] and counts ducks [laughs]. For her, it is a leisure activity and calms her"* (IG).

> *[Talking about incidental contact to urban blue spaces, e.g., passing by spouts in the city center]: "That is beautiful" (PGER2). In her view, such aesthetic experiences are not comparable to intended recreational activities at blue-green spaces, e.g., walking along a lake ("one would not take a walk in the city center"), yet, those incidental experiences have restorative potential: "(...) but it is calming and it belongs to the cityscape to have such an experience and opportunity"* (PERG2).

> *The participants of the FGD Samowar agreed that water "(...) forms an important landscape element in the urban context".*

> *[In response to how they feel at Lake Niederfeld]: "It is a resting point" (Mr. Esche), "It is designed beautifully"* (Mrs. Esche).

One FGD participant (PGER1.1) referred to water being a major component of the human body, which might contribute to people having a general preference for being by the water.

As can be seen in fig. 4.15, aesthetic (*"panoramic view"*) and restorative (*"relaxation, restoration"*) experiences were also mentioned as responses to what water means.

Figure 4.15: Participants' photos of what water means to them/feelings about the presence of water (author's compilation)

Mrs. and Mr. Esche both depictured the pond with the spout at Kaiser-Wilhelm-Park to highlight the importance of the presence of water at green spaces as it enhances the aesthetical experience and functions as a meeting place: *"Water is important, it upgrades every park. It belongs together. The pond suits well for meeting people and exchanging ideas"* (Mr. Esche), *"Yes, water acts as a destination. One can go for a walk and afterwards, sit by the water for half an hour and have a drink"* (Mrs. Esche), *"Water is something different than a lawn. A different element than green"* (Mr. Esche). Similarly, participants of the FGDs noted that blue and green spaces are closely intertwined and

both required for a good quality of life in cities. In their view, water and blue spaces would feature specific health-related effects (e.g., air quality, iodine), would offer a distinct wildlife experience (e.g., ducks), would be more calming than mere green space and *"would make green spaces more beautiful"* (FGD Samowar).

Regardless of the high appreciation of blue spaces, the majority of participants also expressed their preference for green spaces and greenery at blue spaces. In fact, greenery such as trees, lawns and planting belong to the favorite places at blue spaces and to the landscape elements affecting how the photowalk participants feel at blue spaces (e.g., *"I am simply amazed at these trees; how beautiful it is here!"* (Mrs. Esche), *"I like these large lawns"* (Mr. Esche); see fig. 4.16). As can be seen in fig. 4.16, other favorite places and landscape elements considered important for wellbeing included playgrounds (*"nice for the kids"* (Mrs. Esche)), seating options, arts installation, spaciousness/ample open space, the *"whole landscape design including lights, steps, the observation platform and benches"* (Mrs. Esche) and cafés.

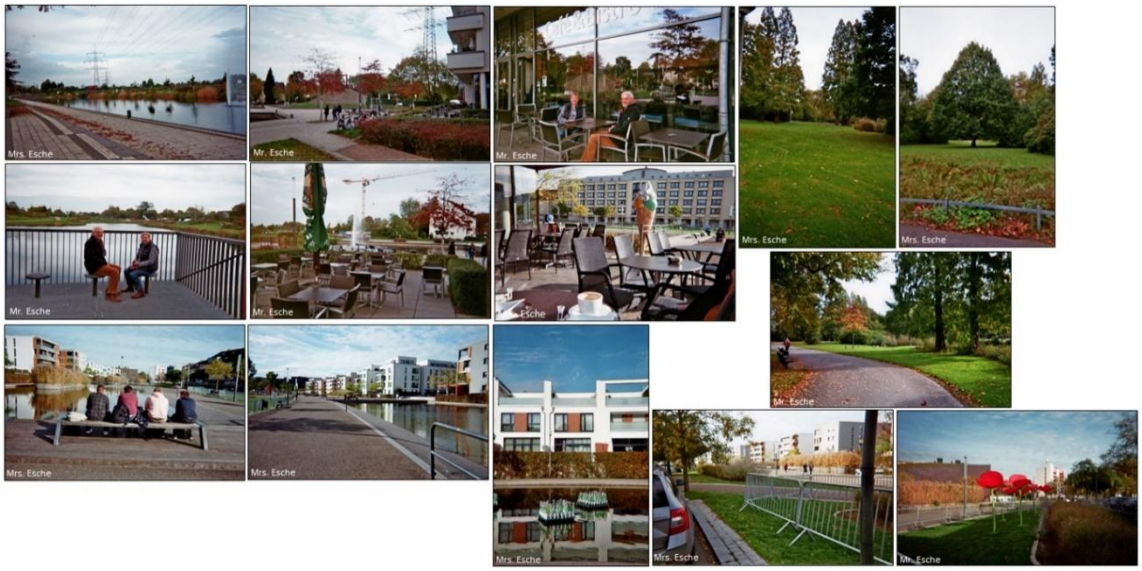


Figure 4.16: Participants' photos of their favorite places and landscape elements important for wellbeing (author's compilation)

The couple expressed positive feelings about most of the blue spaces visited (e.g., *"I am totally impressed by this [Kaiser-Wilhelm-] park. I feel ashamed of not knowing the place despite living close by"* (Mrs. Esche)), yet, both noted to prefer Lake Niederfeld and the

Green Center (representing their two most used blue spaces in Essen), for which they seem to have stronger emotional ties (e.g., *"Although we are living five kilometers away, the lake is in our thoughts. That is why we go there"* (Mrs. Esche)) and which best suit their needs (vicinity to the city center, catering options). As such, Mr. and Mrs. Esche agreed that Lake Niederfeld makes an important recreational space that provides the opportunity to be physically active (cycling, walking), promotes social interaction in the neighborhood, including inter-generational exchange and contact to migrants (*"Everyone comes together here, young and old. And we see people from abroad"* (Mrs. Esche)), provides leisure activities (e.g., concerts in summer) and simply invites to rest and enjoy (watching the scenery, eating ice cream). As Mrs. Esche put it: *"This upgrades the living environment."* Particularly its connection to the cycle path network makes Lake Niederfeld an attractive transit destination from their place of residence to the city center: *"That is quality of life. One gets to the city center through such a beautiful landscape"* (Mrs. Esche), *„We can set off from our home and cycle all the way to the city through here. That is really great"* (Mr. Esche).

Interestingly, compared to other blue spaces in the city, the newly built housing complex makes Lake Niederfeld special for Mrs. Esche as it reflects her strong desire to live by the water (see fig. 4.17): *"I would take pictures of the houses. I can imagine what it would be like to live there. That would be nice!"*).

Figure 4.17: Participants' photos of what makes Lake Niederfeld special to them (author's compilation)

During the interview, she repeatedly alluded to her preference for living by the water (e.g., *"Personally, I find living by the water very important. If we had the courage, we would sell everything and move to the water. To the Rhine, to see the ships, that would be*

great", *"Well, I really like it here [Green Center]. (...) I can imagine living here. It is extremely attractive"* (Mrs. Esche)), yet noted that the couple would be happy to live at their current place of residence. While Mr. Esche took the same picture as his wife, he seems to be less keen on the idea of moving (*"Then the issue with parking arise. I am not sure whether parking space is granted to the tenants"*).

Based on the results of the stated preference valuation (see table 4.7) –and partly in contrast to the qualitative results[49]– the participants generally preferred larger (artificial and natural) blue spaces (Lake Baldeney, River Ruhr, Lake Niederfeld) and landscaped blue-green spaces (Gruga-Park, Kaiser-Wilhelm-Park). Least preferred were smaller artificial blue spaces (Kaiser-Otto-Fountain, Green Center) and smaller natural blue spaces without amenities (Borbecker Mühlenbach). However, strong variations in the preferences across the different samples have to be considered, e.g., pictures A, C, D, E and H show a difference of at least three ranks between the groups (see table 4.7). With regard to the subjective emotional states associated with the most preferred blue space, the participants responded almost all with positive (or neutral) valence and arousal ratings. In response to the least preferred pictures, several participants still noted positive or neutral valence and arousal ratings (e.g., pleasant, calm for picture J; pleased, wide-awake for picture E; pleasant, neutral for picture D), indicating that blue spaces might be perceived as landscapes inherently linked to beneficial emotional experiences (e.g., evoking pleasure or calming). When being asked about the comparative willingness to visit different blue spaces (by choosing one picture among two or more options in pre-defined picture sets), the results did not clearly correspond to the overall ranking according to the perceived attractiveness. For example, in the picture sets 1 and 3, most participants checked to be willing to visit blue spaces that they previously ranked less attractive.

Concerns regarding the availability and accessibility of urban blue spaces recurred among participants of the FGDs (see chapter 4.2.2.1), while criticism related to the quality of

[49] For example, the photowalk participants Mrs. and Mr. Esche noted to prefer the blue spaces Lake Niederfeld and Green Center during the interviews, yet ranked them quite low (7th resp. 8th) in the choice experiment.

blue spaces such as lacking amenities was prominent across all samples of older adults (for more details, see chapter 4.2.2.2).

Table 4.7: Results of the stated-preference valuation in Ruhr Metropolis (author's compilation)

Rank	Urban blue space	Points (by groups and total)	Feelings associated with picture
1.	B (Lake Baldeney)	Total: 109 Photowalkers: 17 (2nd); FGD Samowar: 16 (5th); FGD Center60+: 76 (2nd)	Pleased, wide-awake; neutral, excited
	F (River Ruhr)	Total: 109 Photowalkers: 18 (1st); FGD Samowar: 19 (2nd); FGD Center60+: 72 (3rd)	Pleasant, wide-awake; pleasant, excited
2.	A (Lake Niederfeld)	Total: 108 Photowalkers: 7 (7th); FGD Samowar: 13 (7th); FGD Center60+: 88 (1st)	Unsatisfied, dull; pleasant, excited (3*); pleased, excited; neutral, neutral
3.	C (Grugapark - waterfall)	Total: 104 Photowalkers: 18 (1st); FGD Samowar: 28 (1st); FGD Center60+: 58 (5th)	Pleasant, wide-awake; pleasant, excited
4.	I (Grugapark - pond)	Total: 102 Photowalkers: 12 (3rd); FGD Samowar: 19 (2nd); FGD Center60+: 71 (4th)	Pleasant, excited; pleasant, calm
5.	J (Kaiser-Wilhelm-Park)	Total: 97 Photowalkers: 11 (4th); FGD Samowar: 15 (6th); FGD Center60+: 71 (4th)	Pleasant, calm; unpleasant, neutral; pleased, dull
6.	E (Emscherpark)	Total: 71 Photowalkers: 2 (9th); FGD Samowar: 17 (4th); FGD Center60+: 52 (6th)	Unsatisfied, neutral; neutral, dull; neutral, neutral; pleased, wide-awake
7.	G (Kaiser-Otto-Platz)	Total: 66 Photowalkers: 9 (6th); FGD Samowar: 7 (9th); FGD Center60+: 50 (7th)	Unsatisfied, neutral; neutral, neutral
8.	H (Green Center)	Total: 65 Photowalkers: 6 (8th); FGD Samowar: 18 (3rd); FGD Center60+: 41 (8th)	Neutral, calm
9.	D (Borbecker Mühlenbach)	Total: 42 Photowalkers: 10 (5th); FGD Samowar: 10 (8th); FGD Center60+: 22 (9th)	Pleasant, neutral; neutral, N/A (3*); unpleasant, neutral; neutral, calm

4.2.1.3 Older adults' perceptions of blue spaces as therapeutic landscapes and causes for (not) deriving health-related benefits

In the following, the results of the previous chapters are synthesized with further findings from the analysis related to whether and why older adults (not) gain health-related benefits from blue space visits.

A remarkable result is that all participants (n=41) reported to obtain health benefits from blue space visits. In response to what the most important benefit is, an overwhelming majority (n=38) ticked psychological benefits (e.g., stress relief, feeling of restoration)/improved mental wellbeing. About two-thirds of the participants (n=27) checked social interaction and more than half (n=22) physical activity/sense of improved physical health. The prioritization of mental over other health benefits was found to be similar for older men and for older women. Almost three quarters of the participants (n=30) ticked two or more options, even though the question asked to select only one

possible answer. Closer inspection of the data shows that older migrants found mental and social benefits equally important, while physical wellbeing not at all (FGD Samowar) or considered mental, physical and social wellbeing almost equally important (FGD Center60+), whereas participants of the baseline survey (almost all non-migrants) clearly prioritized mental health benefits over social and physical wellbeing. These findings are in line with results of the baseline survey showing that activities linked to mental and social wellbeing (aesthetic pleasure/watching the scenery; stress relief, relaxation and restoration and social interaction/spending time with family and friends) are the three most common activities older people undertake at Lake Niederfeld. Nevertheless, further analysis of the data shows that Lake Niederfeld (and other urban blue spaces) are also used by older adults for physical activity and urban mobility, most notably walking and cycling.

Overall, as noted across all samples of older people, blue spaces are valued as popular destinations for (individual and joint, regular and irregular) leisure activities (e.g., picnics, barbecues, having ice cream), for intergenerational enjoyment and for aesthetic and restorative experiences. In contrast to mere green spaces, *the blue* is considered as a (more) suitable meeting place and as an element "aesthetically upgrading" urban environments and green spaces; yet, many participants highlighted the importance of both, blue and green spaces for a good quality of life in cities. This also counts for those older people hardly using blue spaces on a regular basis, as YA commented: *"If they [older Turkish women] are at blue-green spaces, they are happy about it, but the way towards there, to take a first step, to have this motivation to go there, that is missing*." Talking about the blue space provision in their hometowns in Russia and Kazakhstan, some participants of the FGD Center60+ noted that the reasons for appreciating urban blue spaces are the same, including e.g., environmental benefits and aesthetic and restorative qualities. Those are linked to the experience of health benefits, as the following comment illustrates: *"It is health-promoting for everyone to look at water"* (PGER1.1). Environmental benefits such as the provision of good air were also mentioned among participants of the FGD Samowar. Talking about the health effects of blue spaces with Mr. and Mrs. Esche, both agreed that the presence of water would promote their health and wellbeing. For them, this is primarily linked to the motivation of being physically active and to improved mental wellbeing (e.g., *"I am physically active and feel relaxed"*

(Mr. Esche) and less mediated by social interaction/promotion of social wellbeing. The significance of blue spaces for mental health was reflected in participants' descriptions of positive feelings associated with blue spaces/water (e.g., *relaxation*, *restoration*, *feeling happy*, *feeling calm*) and reflected in positive affective states measured in valence and arousal ratings. Results of the photowalks further pointed to emotional bonds established to blue spaces that hold personal value (sense of place), e.g., *"a place of longing (...) it means a lot to me"* (Mrs. Esche) and (in response whether Lake Niederfeld contributes to a sense of identity) *"Yes, as a citizen of Essen. It shows the diversity in the neighborhood and how it changed"* (Mr. Esche). Similarly, Mrs. Esche added that the lake serves as a proof for the regional structural change and a new city identity and thus, to counteract stereotypes about Ruhr Metropolis: *"We like to show to guests how a city can change"* (Mrs. Esche).

Slightly over half of the baseline survey participants (14 out of 26) reported to associate potential harmful effects or health risks with urban blue space visits. The most frequently checked were feelings of fear and danger (n=10) and criminal and illegal activities (n=7). Less frequently checked were accidents and injuries (n=2) and attack risks from animals/fallen branches and trees (n=1). This result is confirmed by the analysis of qualitative data: while many older adults attribute mood-enhancing and stress-reducing/calming powers to blue spaces, not all of them would seek those spaces if they had to go there alone, particularly not in the evening (*"Every contact could be considered as a threat"* (YA)). Yet, several older adults and key informants and experts argued that the perception of lacking public safety (in Essen-Altendorf and adjacent neighborhoods) in large parts of the population is distorted by widespread stereotypes driven by one-sided and polarizing media reports about the neighborhood and by xenophobic attitudes. Talking about this issue an interviewee said:

> *"Much of what they [people] heard is not true, but they think it is real. (...) Many people only think about the Altendorfer Street. That is a 'multi-cultural mix', which is not something bad, there are many Turkish shops. (...) The problem is the bad press. There was once a boxer who was shot down. They will still talk about it in 10 years and link it to Altendorf. The positive things are not represented!"* (JH).

Other negative experiences linked to blue spaces that would hinder older adults to derive health benefits include noise, crowdedness, littering (e.g., *"In good weather, people have*

barbecues here [at Lake Niederfeld], so there is often garbage left" (Mr. Esche)), a bad water quality/olfactory pollution (*e.g., "The water [of Lake Niederfeld] is sometimes silty because of the algae. So, the appearance of the water is not really nice"* (Mrs. Esche), *"Well, one can smell the Emscher. I would not be interested to walk along the river or rest here, only cycling by"* (Mrs. Esche)) and conflicts of use (e.g., between cyclists and pedestrians).

4.2.2 Matching of older people's demands and needs with the blue space provision in Ruhr Metropolis

4.2.2.1 Assessment of the actual urban blue space provision

The participants of the baseline survey and the FGDs were asked to rate the living conditions of their respective neighborhoods. As can be seen in table 4.8, the majority agreed to have good access to urban green spaces (n=35), to live in walkable communities (n=32) and to feel respected and socially included (n=32).

Table 4.8: Participants' rating of their living conditions in Ruhr Metropolis (author's compilation)

Question	Results		
	Somewhat or strongly agree n (%)	Somewhat or strongly disagree n (%)	Agreement rates per group (%)
My community provides me with good access to urban green spaces (e.g., parks, gardens, forests, lawns).	35 (85.4%)	5 (12.2%)	Lake Niederfeld: 96.2% Center 60+: 58.3% Samowar: 100%
My community provides me with good access to urban blue spaces (e.g., rivers, streams, canals, lakes, ponds, pools, fountains).	23 (56.1%)	15 (36.6%)	Lake Niederfeld: 76.9% Center 60+: 25% Samowar: 0%
There are many urban stressors (e.g., (air) pollution, traffic congestion, noise) in my community.	27 (65.9%)	14 (34.1%)	Lake Niederfeld: 65.4% Center 60+: 75% Samowar: 33.3%
Overall, my community is a pleasant place to walk.	32 (78%)	8 (6.2%)	Lake Niederfeld: 84.6% Center 60+: 75% Samowar: 33.3%
There are major barriers to walking in my neighborhood that make it hard to get from place to place.	15 (36.6%)	25 (61%)	Lake Niederfeld: 15.4% Center 60+: 83.3% Samowar: 33.3%
I feel respected and socially included in my community.	32 (78%)	7 (17.1%)	Lake Niederfeld: 80.8% Center 60+: 66.7% Samowar: 100%

Still over half of the participants (n=23) agreed to have good access to urban blue spaces. Despite the high agreement rates for walkability and good access to blue/green spaces, over half of the respondents (n=27) agreed with the statement that there are many urban stressors in their respective communities. Closer inspection of the table shows some interesting differences across the groups. For example, older migrants less agreed with the statement that their community provides a good access to urban blue spaces. Although loneliness seems to be particularly prevalent among older Turkish women, all of them agreed to feel respected and socially included in their community.

Turning to the qualitative data, the majority of participants indicated to be generally satisfied with the urban blue (and green) space provision and the blue-green transformation that the city of Essen achieved (e.g., *"a beautiful city"* (PGER1.1), *"In contrast to other cities, Essen has become a green city, there are many trees and green spaces"* (Mrs. Esche)). Lake Niederfeld, Krupp-Park, Gruga-Park, the Ruhr promenade, fountains in Steele and the Green Center were mentioned as good practice examples of blue(-green) spaces. Yet, several older migrants claimed that the blue-green space provision in the city center (e.g., by installing waterspouts) and in some northern areas should be improved. For example, one woman commented: *"Just a dirty road, nothing else. That is all. You can sit there for maybe ten minutes, drink a coffee. There are no trees, no water. Everything built with concrete. It is not a nice city center"* (PGER2). Another participant stated that *"When arriving at the station and reading the sign 'Green Capital 2017' [an award by the European Commission], one could not see any green or blue, only shops and housing"* (PGER 12). Others felt that the blue spaces in the immediate living environment are not appealing (e.g., *"just a small pond"* (PGER3)) which requires them to visit blue spaces at the urban fringe (e.g., Lake Baldeney).

4.2.2.2 Older people's demands and needs in relation to blue spaces; features perceived as age-friendly and health-promoting

As written before, the overwhelming majority of older adults ascribed importance to having blue spaces in their living environment, including access to green spaces. In fact, the results of the SPV point to a general preference for larger blue spaces and landscaped blue-green spaces. A common view amongst participants was that blue spaces should be for ease of use, involving the dimensions availability, accessibility (including

connectivity to other blue-green spaces) and quality. Thus, demands were expressed that urban planning should consider easy access to blue (-green) spaces for all population groups, in every neighborhood (e.g., *"Everyone should have the opportunity"* (PGER5)), a barrier-free landscape design and to ensure public access in blue space regeneration schemes such as the renaturalization of the River Emscher (e.g., *"Investors are surely keen on it, it is a great place to build. Yet, one could also leave it for nature conservation"* (Mr. Esche)). Regarding the quality of blue spaces, the provision of amenities featured prominently throughout the dataset. Features that were considered as age-friendly and important for wellbeing ('feel-good factors') include the following: seating options (e.g., *"Benches are important"* (Mr. Esche), see fig. 4.18), public toilets, greenery, playground/features for children and youth such as a skate rink or waterspouts for inter-/multigenerational enjoyment (e.g., *"One has to think about the future, about next generations"* (PGER 6)), the provision of shade and catering options/permission for barbecuing (e.g., *"Shade and seating options are important for older adults, so that they can rest and have an ice cream [laughing]"* (PGER7).

Figure 4.18: Participants' photos and narrations of what age-friendliness means at Lake Niederfeld (author's compilation)

Further, the participants were unanimous in the view that a blue space of high quality must be well maintained (clean, functional) and ensure public safety (e.g., by providing sufficient lighting, preventing misuse and dangers such as drowning). According to some key informants working with older migrants, organized activities (*"having a reason"*) at blue spaces are needed to encourage them to use blue spaces. One concern expressed by participants of the FGD Samowar was whether sufficient privacy is provided at blue spaces. Hence, they called for spots hidden from view where they *"could be among themselves"* (YA) and would not feel observed. Others called for improved traffic safety resp. preventive measures to avoid a conflict of use, e.g., *"Many of the cyclists are rather reckless. That is a sort of security that is not given"* (YA), *"The mingling of pedestrian and cycling traffic is dangerous for older people"* (Mr. Esche), *"As a cyclist, one has to be really careful here [at Lake Niederfeld]. There are so many people and dogs on the way. One really has to be cautious"* (Mrs. Esche).

The aforementioned qualitative findings are confirmed by results of the baseline survey. When asked which aspects and elements (out of a given list) the participants consider important to their visit to any urban blue space, maintenance, nature (vegetation, animals) and security were among the most frequently ticked answers (n=26, n=26 and n=25 respectively). According to the total checks of "important", "quite important" and "very important", other important aspects and elements of blue spaces are ample free space (n=24), amenities (n=23), the presence of people (n=21) and age-friendliness (n=20), while weather (n=18) and soundscape (n=16) were considered less important.

4.2.2.3 Fits, misfits and changes needed

While the analysis shows that –with few exceptions (e.g., city center)– the older people in this study are quite satisfied with the provision of urban blue (and green) spaces in the city of Essen, some suggestions for improvement were made with regard to the aspects of accessibility and quality (maintenance, safety and amenities).

For example, several participants of the FGDs reported to perceive limitations in the accessibility of blue spaces due to health constraints/mobility impairments, lacking barrier-free landscape design (e.g., *"People with a rollator cannot visit the lake"* (PGER11)) and inconvenient or lacking public transport connections (e.g., involving long

walking distances). In fact, a majority of 12 FGD participants checked that they would like to live in a community with more blue and green spaces which also applied to almost all who rated the current access to blue and/or green spaces as good. A common view amongst participants was that 'living by the water' is considered attractive, but only affordable for high-income households (e.g., *"One has to be realistic, we cannot afford that. 'Living by the water' at a cheap rate, that would be great [laughing]!"* (Mrs. Esche), *"There are these private firms that buy the waterside areas and do not know what to do with the money. If the Emscher is regenerated, I am sure they will be all keen on the riverside areas"* (Mr. Esche)).

A number of older adults felt that changes are needed to achieve multi-functional and safe blue spaces for different user groups, e.g., by providing more hidden and quiet spots and separate cycling and walking paths. Regarding amenities, several older people pointed to the lack of (barrier-free) public toilets (*"What shall we do there? We are old; we have to go to toilet every half an hour. If we sit there for more than two hours, that is not good for us"* (PGER1.3)) and the lack of catering options (e.g., at Kaiser-Wilhelm-Park). The photowalk participants Mr. and Mrs. Esche pointed to the need for better maintenance of blue spaces (e.g., removal of algae and littering), including the provision of well-maintained public swimming pools (*"The swimming pools are in a catastrophic condition. Maintenance has become difficult with regard to municipal cultural and sports facilities"* (Mr. Esche)). The two were particularly critical of the current conditions at Emscherpark (e.g., *"The smell is unpleasant and there are no seating options"* (Mr. Esche), *"Phew, the smell is biting. That is quite something. You do not go for a walk there. In summer, it can be even more and you can sometimes see what is floating in the water"* (Mrs. Esche)) which would need major changes to become *"more interesting"* (Mrs. Esche) and to invite people to stay. As the interview excerpt and the pictures (see fig. 4.19) below show, those changes should include the provision of amenities for all ages, a more elaborate and eco-friendly landscape design, improvements of the water quality, access points to the water and the provision of recreational water-dependent activities.

> *Principal investigator: Imagine that you are responsible for the regeneration of the Emscher and you were allowed to design this blue space according to your ideas. What would you do here?*

Mr. Esche: There should be features for all ages. The water quality should be improved and the canalization should be reversed. I would leave some areas untouched to protect nature. But there should also be catering options on site and viewing platforms are great. It would be nice if the lawns [points to the banks] were more accessible to the public and you could have a picnic there, but other activities such as rowing or canoeing would also be nice.
Mrs. Esche: Exactly, a skate park for children, viewing platforms, benches. Older people also like to watch the scenery. And a Kneipp pool would be quite something! A soccer or a boules field would also be nice. And water features for the children to play.
Mr. Esche: And that the Emscher becomes a little river again. A natural body of water. That would be quite something! Here [pointing to the banks], I do not know if they would remove it. There should be plants, e.g., reeds and grasses.
Mrs. Esche: Yes, reeds and such.

Figure 4.19: Participants' photos of what they dislike at Emscherpark (author's compilation)

Among others (see chapter 4.2.2.1), the main research site was mentioned as a good practice example of urban blue(-green) spaces across all samples of older adults. Reasons given for this are, among others, the age-friendliness, the aesthetical landscape design (e.g., *"hardly any uncomfortable places"* (Mrs. Esche)), the connection to the cycle path network (*"We have always sought going to the city by bike and once the lake was built,*

we have been using the cycle highway ever since" (Mrs. Esche)) and the provision of amenities such as a café and seating options. The qualitative results were confirmed by results of the baseline survey showing that a majority of 19 participants rated the overall appearance and quality of Lake Niederfeld as excellent, very good or good and 19 out of 26 people rated it as extremely or quite safe. A majority of 23 participants considered the blue space as age-friendly without reservations.

4.2.3 Reflection and consideration of health interests and older adults' demands and needs in urban blue space planning and design

4.2.3.1 Blue space development and management in Ruhr Metropolis

The blue-green transformation of the city of Essen emerged as a central theme from the analysis, involving projects such as the Emscher restoration and its tributaries, the Lake Niederfeld, the Krupp-Park and the Green Center. According to the municipal representative SR, the city of Essen has been a regional pioneer in this regard, which is reflected in the European Green Capital Award (2017) by the European Commission that recognized the city's efforts for urban blue-green and open space development, driven by the restoration of the River Emscher and the master plan "Open space creates urban space". To implement the latter, the city has set up the action program "Essen. New ways to the water" in which more than 500 projects related to urban blue-green space development were carried out since 2015, involving investments of about 70 million euros (e.g., renaturalization of streams, decoupling of storm water, construction of parks and lakes/ponds). SR explained that the lack of waterbodies in the city was a main reason to focus particularly on blue space development, facilitated by the *"overarching bracket"* (SR), the restoration of the Emscher (see chapter 4.2.3.3):

> *"Well, we always thought of the water first because we do not have a waterbody within the city. Unfortunately, we do not have a Rhine or a Seine like in Paris or something like that. So we thought about how to create 'water qualities'. It was always clear that not only renaturalization, but also the creation of waterbodies to be anchored as a central part of urban development, that was a basic premise right from the start"* (SR).

Currently, the regional water management association would carry out a project focusing on storm water management and climate resilience to direct the city's handling with blue spaces in future climatic conditions (*"The story continues"* (SR)).

Another municipal representative, BS, reported on the different responsibilities linked to urban blue space development, involving e.g., the municipal department for green spaces, regional associations, water management associations and actors on the state/federal level. Given this plurality of actors, the local urban blue-green space development is coined by collaborative planning and management approaches. As the selection of project locations for blue-green space development in recent decades would show, the city has focused on developing blue-green spaces particularly in deprived neighborhoods to reduce environmental injustices. A prominent example is the Lake Niederfeld in the working-class neighborhood Altendorf. The social decline after de-industrialization (e.g., high unemployment rates, high proportion of low-income households), the lack of open space and outdated infrastructure and housing estate were driving forces to aim for removing the former railway embankment that separated the neighborhood and formed a barrier to accessing the 'Niederfeld', a mix of open space, allotment gardens, a stream and brownfields (*"There was a green open space that nobody really recognized. It was there, but it was also not there"* (BS)).

Integration of health interests into urban blue space planning

The extent to which the public health service is actually involved in urban blue space planning remained a rather unanswered question throughout the data collection. The municipal representative SR noted that the health department was not directly involved in any of the urban blue space development schemes, but carried out a project ("Do you want to walk with me?") in the course of the Green Capital process in which neighborhood walks from older people for older people were organized and which would still run until today. However, she and BS argued that health interests would be considered in urban blue space planning, as other actors (such as architects) would be similarly aware of linkages between a healthy and activating environment and human health (e.g., *"But we are all aware that a healthy and functioning living environment makes people healthier. If there is a cycling path close to my neighborhood, I create chances for better health – that is interconnected!"* (BS)). Similarly, SS, representing a local housing association, stated that health interests are considered in the housing estate development e.g., by providing green spaces *"(...) so that the living environment is simply healthy. That is does not only look healthy, but really is healthy and health-promoting for body and mind. That is why we also have playgrounds for children and older people, sports areas etc. We really generously think about what would fit on site"* (SS).

The scientific representatives JS & EH and DW felt that the consideration of health concerns into urban (blue space) planning depends strongly on the respective municipality and the engagement of individual people. Yet, as noted by JS, global agreements such as the New Urban Agenda (UN, 2016) and the 2030 Agenda for sustainable development have pushed the integration of health into urban planning in recent years ("*To what extent this is then implemented and how they deal with it is another question"* (JS)).

4.2.3.2 Perceptions on the health potential of urban blue spaces for older people

The interviewees were unanimous in the view that blue spaces provide multiple beneficial effects in cities (e.g., *"Water in the city has many synergetic effects"* (SR)) and that those would benefit all population groups. Benefits specific to older people were only mentioned by one participant with regard to the vulnerability of older adults for heat-related health risks and the cooling function of blue spaces (*"Water in the city clearly provides cooling. There are heat islands and in those heat islands, particularly the older population does not feel well and statistically, they die more often and faster as younger people"* (SO)). The overall impression among the participants was that 'the blue' enhances the experience of mere green spaces and that the benefits both types of landscapes provided are closely interlinked. Yet, there were also a few comments about the distinct effects of blue spaces compared to green spaces, e.g., recreational water-dependent activities such as swimming and boating and the specific flora and fauna (*"The flora and fauna near the water is something different than the ones in merely green spaces"* (SR)). The references made to health were mainly indirect (e.g., *"Health has not been evaluated [in the course of the Green Capital Award] as an individual parameter, it is something that always comes along, rather in a subtle way"* (SR)); common parameters mentioned were e.g., the quality of life, the local climate and physical activity. Several interviewees noted that they are not or hardly aware of the linkages between blue spaces and health, but reported positive effects based on their own experiences (e.g., *"When walking along the sea, I somehow feel better than walking along a street"* (SS)).

As table 4.9 shows, the perceptions on the health potential of blue spaces can be classified into four dimensions: beautification/water as a landscape design element, blue-green spaces as places for recreation and healthy behaviors, blue-as places for beneficial social interaction and environmental benefits linked to human health and wellbeing.

Table 4.9: Perceptions of interviewees in Ruhr Metropolis on the health potential of blue spaces (author's compilation)

Theme	Description / Examples
1. Beautification / Water as a landscape design element	A number of interviewees referred to water entailing the intrinsic capacity to beautify environments. The aesthetic experience is considered beneficial to health and wellbeing.

Theme	Description / Examples
	"Water improves the aesthetic quality of green spaces"; *"[Blue spaces are] a question of urban design"* (SR) *"All people like water. Water does not only have an ecological component, but is also an important quality feature for open space"*; "*Lake Niederfeld is a key design element that represents this new handling with rain water effectively to the public"* (BS) *"Blue-green spaces are important landscape design elements"*; *"Water is an element that is recognized and used in urban planning"* (DW); "*Water is always great and always attracts people. It is a cultural attraction that one cannot necessarily explain"* (KV)
2. Blue-green spaces as places for recreation, restoration and healthy behaviors	Many interviewees pointed to the vital role that blue(-green) spaces play in cities to enable recreation/restoration (e.g., *"to have an anchor point that one likes to visit"* (DW)) and to provide places for diverse healthy behaviors (e.g., walking, cycling, swimming). Particularly the popularity of blue spaces for being physically active was a recurrent theme among the interviewees (e.g., *"These spaces are gladly used"* (AS)), *"Blue spaces mean infrastructure for promoting physical activity because it is attractive, there is a magnet, a hotspot where many different activities are possible"* (DW)). In addition, there were several comments about emotional benefits provided by blue spaces and its qualities as places of refuge in the city, e.g., *"Older people benefit from being at the water. There is a certain calmness and a nice panoramic view. It is very important to be able to visit such blue spots in the city. Water is something vivid, even if is not flowing. We perceive it as calming, as comfortable"* (DP); *"Generally, water attracts people. People are so relaxed when they hear the spout"* (HK); *"Blue spaces help people to connect, to reduce depression, for example"* (EH), *"I think that water has always something calming for people"* (DW) and *"It evokes feelings of being in an upgraded environment, feeling well, somehow upgraded, maybe prestige-enhancing"* (KV).
3. Blue-green spaces as places for beneficial social interaction	A number of interviewees (e.g., IG &HC, DW, JS & EH, HK) stated that blue spaces function as important meeting places/places for connecting people of different social strata. Enabling social interaction is perceived as beneficial for health and wellbeing. For example, talking about Lake Niederfeld, HK noted that the lake has been well received by the local community and that positive social changes have become visible, e.g., social interaction between residents that did not happen before. *"That is how social connections are made. It is really nice and the people come again. The café has become a platform for meeting neighbors. It is caused by the lake, if it would not be there, nobody would go walking. Nobody takes a walk around the block, but around a lake"* (HK). Similarly, SS pointed to the importance of outdoor spaces in residential development planning for enabling encounters between tenants and for developing lively communities.
4. Environmental benefits of blue-green spaces linked to human health and wellbeing	Several interviewees (e.g., SR, DW, BS, SO, AS, JS) pointed to environmental benefits provided by blue(-green) spaces which affect human health, e.g., binding particulate emissions/improving the air quality and micro-climate, cooling function/prevention of urban heat islands, adaptation to climate change, creation of habitat/enhancing the local biodiversity. As noted by SO and BS, the increasing use of blue-green spaces as catchment areas for decoupled rain water would support the natural hydrologic cycle/to maintain a reasonable water level and to generate evaporation for achieving good climatic conditions in the city (*"That is our indirect contribution to health-promoting urban development"* (SO)).

With regard to the urban context, water was not only considered as an important element of landscape design with high aesthetic power (see exemplary quotes in table 4.9), but

also as something that belongs to and thrives urbanity, as the following comments illustrate:

> *"Water belongs to urbanity"* (SR).
>
> *"Looking at cities by the water or that integrate waterbodies a lot, I feel they achieve a more positive atmosphere with those blue spaces"* (DW).
>
> *As can be seen in major cities that were founded near waterbodies, living by the water "is simply attractive" and has always been "interesting"* (SS).
>
> *"Water is always a driving force of urban development"; "Water in the city is a key topic in Essen and Ruhr Metropolis, because water has always been a central element of urban development"* (BS).

In this context, the major urban transformations enabled in recent years by the restoration of the Emscher from an open sewer to a natural river occurred as a prominent example throughout the interview data. A common view amongst the participants was that this large-scale blue space regeneration scheme has successfully generated new urban qualities over the last two decades, bringing about benefits in various realms (e.g., health, local economy, recreation, tourism, sustainability/ecology). Statements to this issue included:

- The increase of public blue-green spaces and the provision of a high-quality open space design (e.g., *"And the fact that all these 'Köttelbecken' –as one says here in the Ruhr Metropolis– are being renaturalized means that these spaces are gradually becoming accessible to the public. In other words, these areas were previously fenced off and nobody could go there for reasons of danger. But nonetheless, they are green spaces, these sewers"* (BS)).
- The use of blue-green spaces for public health interventions as exemplified in the collaboration of the local water management association with a local health insurance who started the initiative "Healthy along the Emscher" involving public picnics and the installation of outdoor fitness equipment (*"It is great that a health insurance recognized the health potential of the created blue space"* (SO)).
- The provision of a new connectivity of blue-green spaces (*"a green pearl necklace"* (BS)) and neighborhoods, e.g., by transforming service roads along the

river into cycle and pedestrian paths (*"We now have a connection of green spaces and different neighborhoods that we never had before"* (BS), *"This was not possible along the Emscher, it stank, nobody wanted to go there and actually, there were hardly any paths. This is all we turn upside down! The river will be at the center of people; they can go there and observe how plants and animals are coming back. They can relax or be physically active (…). That was all not possible before"* (SO), *"These [the provision of new cycling and pedestrian paths] are measures that ideally lead to people being able to use these spaces again"* (AS)).

- The promotion of new residential developments and improvements of the living conditions/quality of life for residents of existing housing estate (e.g., *"In these connected blue-green infrastructure, which are relevant from an ecological point of view, but also from a recreational and urban planning point of view, completely new site qualities are created, because you are no longer looking at the sewer, but at a functioning green corridor"* (BS), *"These people will have a totally different quality of life, starting right away from the smell, but also the view on flora and fauna. It means a lot to people if we transform the brown into the blue"* (SO)). In addition, the blue-green transformation of the city has stabilized land values in economically weak areas (e.g., *"Such greening interventions stabilize neighborhoods that are economically weak"* (SR)).
- The improvement of the city's image and the attraction of new residents (e.g., *"Everyone within Ruhr Metropolis wants to move to Essen because Essen is one of the prospering cities"* (BS), *"This Essen where everything is black and dirty, this city does not exist anymore. If you look at it from above, the city is largely green"* (AS)).

Similarly, the majority of key informants and experts felt that Lake Niederfeld has been a successful project with benefits far beyond the provision of a new blue-green space in a deprived neighborhood, e.g., increasing the perception of safety (e.g., *"There were unpleasant allotment gardens and other no-go areas. It was really difficult. Now, it has a certain openness. That is reflected by the people who live here, I hear that every day. When people keep wondering what it used to look like here"* (HK), *"There were completely new sightlines"* (SS)) and inducing investments in the surrounding area (e.g.,

"Many housings have been renovated and upgraded only because of the lake" (BS)). Moreover, the lake has attracted new residents and tourists and the project would have improved the image of and sense of identity with the neighborhood, as the following comments illustrate:

> *"The people in Altendorf are very proud that their former run-down neighborhood now has such a great lake and park and that beautiful residential developments are created that attract different types of population and thus, a different social mix"* (SR).

> *"People were saying: 'Finally, something is happening' or 'Now, we finally have our own neighborhood park with a great waterbody.' (...) [Talking about the civic engagement of local residents to clean the place]: That is the proof that the people identify with the green space, with their park, with their neighborhood. (...) It became a flagship for the whole region, this Lake Niederfeld. That is the conclusion I derived. A well-accepted green space and it is indisputable that quality of life has been permanently improved"* (BS)).

> *"There were people being open enough that found new neighborliness, lively neighborliness. (...) [Relative to the tenants of the existing housing:] I think we managed to provide them a sense of self-esteem in a way that they think 'We are equally of value for them [the housing association]' even if we are not able to pay what the ones in the first row can pay. That is why our housings cannot look like the ones in the front row but still we live in a beautiful old house. I think this has been well received"* (SS).

Regarding the consideration and integration of older people's demands and needs in urban blue space planning and design, generally two divergent discourses (see fig. 4.20) emerged from the analysis.

One includes that accessibility and a barrier-free landscape design are prominent issues linked to age-friendliness that are already considered in contemporary urban (blue space) planning (e.g., by involving relevant advocacy groups, following relevant guidelines and applying universal design standards). In addition, popular features such as seating options would be commonly considered in current urban blue space designs. In this regard, several interviewees from different fields pointed to the general importance of adopting a differentiated image of old age and avoiding the equation of old age and health constraints/frailty (e.g., *"The average 65+ year old has not necessarily mobility impairments"* (SO), *"Older people who are not frail cycle and walk as younger people do. So what are you doing then explicitly for older people?"* (BS), *"Despite science has*

progressed, the ghosts of the past are still present in daily life. Older people are categorized negatively from the outset" (KV)). Thus, the universal design approach would be useful in urban planning and architectural practice to consider the diverse needs of all users, including e.g., people with disabilities and people in need of mobility aids (e.g., *"It is partly too easy to focus on one population group. Urban planning must consider the demands of all population groups"* (DW)). This would have been successfully adopted at urban blue space development projects such as Lake Niederfeld (e.g., *"One can see people using rollators because we created a barrier-free access*" (BS)). Moreover, it was argued that the demands and needs of older people cannot necessarily be generalized ('age-friendliness') (e.g., *"Those [demands and needs expressed by older adults] differed according to what we did locally"* (SO)) and that urban planning must prioritize local demands and needs (e.g., *"There is no blueprint for a whole city"* (DW)).

Another argument in this discourse strand was that public participation has become a new standard in urban planning which allows older adults (as any other population group) to voice out their demands and needs, which could then be integrated into the planning (e.g., *"Of course, they cannot plan by themselves, but we as planners can integrate their ideas"* (BS)). The various public participation formats (e.g., information, cycling tours/walks to the construction site, district conferences) offered in the blue space projects Emscher restoration and Lake Niederfeld were cited as good practice examples in which also older adults were involved (e.g., *"The project was communicated and implemented without major criticism. It has been a success story"* (SR), *"This all went really well. Of course, there are always some people who complain, but that is normal"* (BS), *"We invite everyone, from young to old, to participate in that thinking process 'What the river can provide for me, locally?' We give people a voice by letting them participate. (...) Ten years ago, many people said 'Mr. X comes and wants to do participation, we do not need that bullshit'. Now people are calling me. I see it as a success, this cultural change"* (SO)). For example, SO reported about a 'storytelling-atelier' that older residents initiated in the course of the regeneration of the stream Katernbach to tell children stories about how the interaction of the neighborhood with the stream used to be in the past. The children would have started to paint pictures linked to the stories, which will be published as a book. While almost all of the older study

participants stated that they never participated in any urban planning project, the interviewees IG & HC noted that they accompanied a few older migrants to an information event in the course of the Emscher restoration project (*"We are now waiting to see how it turns out"* (IG)). A recurrent view was that older people's participation in urban (blue space) planning (as well as their civic engagement) depends much on personal taste (e.g., *"Some argued: 'We are too old, we will not experience the results'"* (IG), *"I find it difficult. You have to see who participates. Tastes are so different and many people have no clue. And the press is dangerous. Why do we have a democracy and elections? I think politicians have to seek advice. After all, they have to get opinions from experts, do analyses"* (Mrs. Esche)).

Lastly, there were comments referring to the community centers for older people that could contribute to the integration of their demands and needs into urban (blue space) planning (e.g., by organizing visits of participation events, collaborating with relevant stakeholders such as neighborhood management offices, municipal departments and the municipal council of senior citizens). The other discourse implies that limitations in the accessibility and usability of blue spaces pose potential barriers for older people/certain groups of older people to experiencing 'blue health' which calls for a stronger integration of their demands and needs in urban (blue space) planning. Concerns were expressed that within the actual urban planning, the political participation of advocacy groups of older people is somewhat limited (e.g., non-binding recommendations) and has been complicated in the past (e.g., giving priority to the needs of younger generations and families, withholding information from the municipal council for senior citizens). In addition, the social work with older people (e.g., at the community centers, in projects such as walking mentors) depends much on volunteers (*"Without volunteers, nothing would work here"* (AS)).

Moreover, several interviewees noted that despite the fact that the availability of blue-green spaces and (general) accessibility have been increasingly considered in the past, the vulnerabilities in old age would not be sufficiently integrated in current notions of accessibility (e.g., *"I do think that it [walkability] is increasingly considered into urban planning, but surely not enough. This aspect has to be considered more offensively"* (DW), *"Older people are different from other people in the accessibility concept"* (EH), *"An older person in need of a rollator would be intimidated to walk 20 minutes to the*

next blue space" (DP)). Similarly, the importance of the quality of blue spaces (provision of amenities, cleanliness) as part of age-friendly blue spaces would not be sufficiently considered (e.g., *"It is not just about the amount, how much space is there and how accessible it is, but also the quality"* (JS)), which is exemplified by many interviewees in the lack of public toilets at almost all urban blue spaces. In this regard, –and opposed to the positive statements on the universal design approach– reference is also made to its limitations, reflected in a lacking multi-functionality of blue spaces for older people with contrasting demands and needs (e.g., preference for hidden places vs. preference for clear sightlines). Interestingly, one interviewee felt that the rising attention for ecological concerns and the reconfiguration of cities to adapt to climate change has somewhat reduced the need for age-friendly urban development: *"The age-friendly city now also has to be resource-efficient, climate-friendly, including for older people. I think there are not many programs explicitly focusing on older people"* (DW)

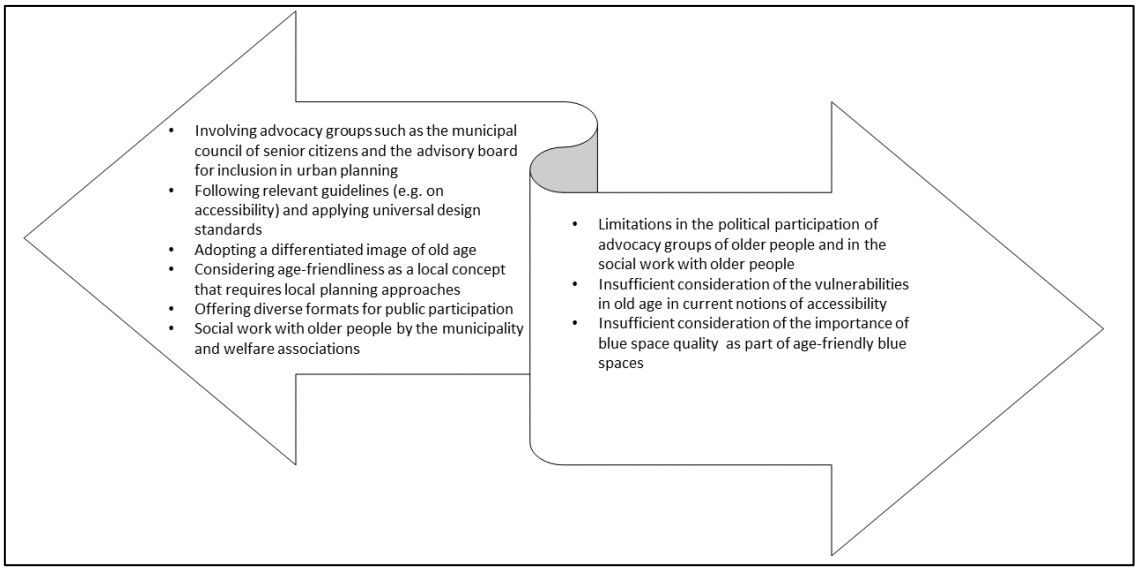


Figure 4.20: Discourses on the consideration and integration of older people's demands and needs in urban blue space planning and design (author's compilation)

4.2.3.3 Facilitators and obstacles to successful urban blue space governance

Facilitators

With reference to the blue-green space development approaches carried out in recent years, the key informants and experts widely agreed that the city of Essen provides many

high-quality blue-green spaces and has improved the access to blue-green spaces particularly in the deprived northern city areas. Several factors were mentioned that facilitated this urban transformation, which were recommended to consider in any future blue space development planning.

As mentioned by the municipal representative SR, the masterplan "Open space creates urban space", connecting both, the Ruhr and the Emscher valley within the city of Essen, has been *"a smart idea"* (SR) that has inspired other cities in Ruhr Metropolis to develop similar initiatives such as the strategy "Duisburg to the River Rhine". According to several interviewees, the regional river regeneration project Emscher restoration has facilitated the blue and green space development in the city of Essen (and other cities) as it offered an occasion to link it to further blue space regeneration schemes (e.g., inflows of the Emscher) and provided an opportunity for innovative open space and urban development planning, a vision that was shared among all stakeholders involved (e.g., *"At least the cities in the Emscher valley recognized the added value of the Emscher renaturalization, (...) that there must be an added value for the citizens"* (SR)). Thus, co-benefits for the public such as cycle and pedestrian paths were considered right from the start and implemented as quickly as possible: *"It was clear that it cannot last 15, 20 years until citizens gain benefits from the restoration of the River Emscher, that there must be tangible benefits already after the first years"* (SR).

In this regard, interviewees from different fields (urban planning, private sector, water management, science) pointed to integrated planning and extensive interdisciplinary/-sectoral collaboration as further facilitators for urban blue space development (e.g., *"It is all about trying to find agreements with as many people as possible and to convince them that there is an added value for them"* (BS)), exemplified most prominently in the project Lake Niederfeld in which the residential development planning by a local housing association matched the open space and traffic planning by the municipality and the regional association. All stakeholders would have shared the view that the project would bring about far-reaching benefits (*"They all considered this project not only as a single project, but also as part of something larger, as part of the urban development of the city"* (BS)). Further, the political will/courage supported the decision-making: *"The decision-makers at that time took the far-sighted decision to build*

the lake despite all the efforts it took" (SS). Due to the successful collaboration, the planning and implementation process (about 10 years) was *"quite fast"* (SR, SS) (e.g., *"There was a lively exchange and all actors acted in concert, which is really not something taken for granted"* (BS), *"We did have a great collaboration. There are certainly negative issues to say but, in this project, really all actors pulled together (...) which is why we succeeded in providing a final product that has an impact on the whole population of Essen and beyond. (...) It could have turned out much differently. (...) Usually, it takes much longer"* (SS)). As noted by SS and HK, the collaboration continued after the project implementation and facilitates to ensure maintenance and safety, e.g., by setting up a round table consisting of residents, the police and municipal representatives (*"It is important to bring people together and discuss issues and realize changes going on"* (HK)).

While the reconciliation of different social and economic interests was considered partly contentious, the integration of ecological concerns into blue space planning and design was considered relatively easy. In fact, as a few interviewees put it, there are much more synergies (*"The point is to create areas to increase biodiversity or to enable also other species to use urban spaces because now, they cannot, there are no spaces"* (JS), *"If a new neighborhood is planned, then it makes sense to decouple the rain water and to make it visible"* (BS)).

Talking about residential developments by blue spaces, a few interviewees noted that the availability of a municipal housing association and/or regulations for rental and public housing would facilitate to prevent gentrification (e.g., *"Only then you are able to do a completely different urban development and housing policy (...) You do not achieve similar results with market-based housing"* (SR)). In the case of Lake Niederfeld, however, the development of the blue space was actually used as a means to induce a *"positive gentrification"* (SS), to achieve a more socially mixed neighborhood by attracting higher-income households (*"Public housing alone creates 'ghettos' which will not work"* (JH)). As SS noted, a special funding model ensures that the rents of the existing housing would remain stable for up to 20 years and additional measures were taken to promote social cohesion within the neighborhood such as a networking project between former and potential new tenants, the renovation of existing housing ("*We wanted people to feel well not only when being by the water, but also when being in their*

flats, that they identify with the neighborhood in a positive way, not only negative like it used to be in the past" (SS)), the provision of indoor meeting spaces and outdoor play equipment at the lake (*"(…) to make particularly older adults meet outdoors, play boules or chess and get to know the neighbors from the existing housing"* (SS)) and the provision of infrastructure (e.g., café, bike rental shop, day care center for people in need of care).

As exemplified in the project Emscher restoration and the blue-green space development program "Essen. New Ways to the water", mixed funding and the availability of appropriate funding programs (e.g., for urban development in deprived neighborhoods or for climate resilience) occurred as further facilitators for successful urban blue space governance. Several interviewees highlighted that the project/program would not have been possible without funds from different (municipal, state, federal and supranational (EU)) levels and external parties such as the local water management association and a health insurance (e.g., *"The project could not have been done with municipal funds alone"* (SR), *"The funding is decisive"* (BS)). This also enabled to fund additional measures going beyond the mere regeneration of a waterbody such as the establishment of a neighborhood management (e.g., to support public participation) or the provision of facilities along the river like 'blue classrooms'. As noted by SR, founding a water management cooperative financed by sewage charges in an industrial region represents *"a very good model"* for dealing with questions of water treatment and *"(…) one of the best and smartest ideas one could have had for this issue"* (SR).

Public participation and civic engagement were identified as other key facilitators to successful urban blue space governance. As the comments below illustrate, participation was considered to fulfill different functions: to inform and exchange with local community members, to assess the local demands and needs and potential conflicts of interests and to ensure that the blue spaces are really used.

> *"This constant 'stay-tuned' in public communication is something that has to be considered and which requires human resources"* (SR).

> *"People used to turn away from the river, but now they shall turn to it. This can only be managed by talking to people. Our standard engineering tasks do not involve talking to people, so that is why my team and I are responsible for bringing people together and for making things possible. (…) We make a great contribution to people's quality of life in the region, particularly because we invite them to*

> *participate in the local planning. We are on the way to become a 'join-in-river'. We do not want to be a water management association that sits in the headquarter and is not responsive. We want to talk to local communities and to think together how the Emscher can become a 'join-in-Emscher'. I am convinced that participation is the key to success"* (SO).

> *"Participation is a strategy to engage all different population groups and to identify their needs and to see where this kind of complex conflict of interest appear, why and what are the driving forces and then to be able to tackle these issues"* (JS).

In addition, public participation would promote that people feel more responsible for the spaces and facilities implemented. In this regard, some interviewees reported about their experiences with civil engagement and highlighted its contribution for the maintenance of public spaces such as older adults becoming mentors for playgrounds and a citizens' initiative founded by an older resident that supports the municipal cleaning at Lake Niederfeld and the surrounding area (e.g., *"That is of course a great situation, that Mr. X [JH] is doing that. It is something we wished to have elsewhere, but that is obviously not the case. It is a lucky chance"* (SR)). If available, civic engagement could increase the social control on site and foster a sense of identity with the place.

Finally, the availability of up-to-date knowledge and technology (e.g., regarding the prevention of eutrophication) and external driving forces such as climate change (increasing the sensibility for ecological concerns and the need for integrating nature in cities), urban shrinkage/population decrease and de-industrialization (the two latter resulting in the increasing availability of open space) were mentioned as further facilitators for urban blue space planning and design.

Obstacles

The analysis of the interview data revealed that the reconciliation of contrasting interests/dealing with land-use conflicts and as such, carrying out integrated urban planning including a socially inclusive public participation, represents a major challenge to successful urban blue space governance. Talking about this issue, many interviewees reported about difficulties to balance opposing interests in urban blue space development planning (e.g., cost-effective engineering, flood control/safety, ecology, protection of monuments) which requires to exchange with/convincing many stakeholders and to find a common sense. For example, comments included:

"We had a tedious task ahead" (SR).

"One cannot simply demolish housing estate to have a green lawn" (BS).

"In every project, there are conflict of goals, there are always difficulties and challenges. The engineer who is planning a waterbody and who has to ensure flood control plans differently than an ecologist or a person who lived many years along the sewage canal and now wants to be close to the river. Everyone has demands and wishes which have to be brought together in planning. (...) There are different interests and framework conditions according to which we have to plan" (SO).

As exemplified by SO, parts of the new Emscher will continue to be fenced up because of safety concerns (*"Dreams like boating or swimming in the Emscher and its tributaries will remain dreams, for this, we have different rivers. But everything else: animals and plant come back, there are access options"* (SO)). Some interviewees argued that while cities usually lack spaces for development, the needs and interests increasingly diversify (e.g., urban mobility involving cycle and pedestrian lanes, scooters, parking space, carsharing space), resulting in a sharpening of land-use conflicts: *"The competition for land-use is just intensifying"* (DW).

A recurrent theme was a sense amongst interviewees that integrating economic interests in urban blue space development and preventing the sharpening of social inequalities and gentrification processes is particularly problematic. Statements to this issue included:

"It is always a problem that attempts are made to displace certain people" (DW).

"It was a big challenge for us to deal with that topic of gentrification, because we said we need people being able to pay the higher rents to achieve a socially mixed neighborhood, not another 'Hartz IV-recipient'. But how to prevent any divide between them, how to bring them together?" (...) Because this is what would happen normally in projects 'living by the water': first, the housing immediately by the water is most expensive, the location gets more attractive and thus, all other housing become more expensive and exclude a certain clientele over time" (SS).

"It [gentrification] is definitely a problem. It is easy for them [the local water management association] to say: 'That is not our responsibility, the real estate market is like it is, but of course we like to see that the social fabric is preserved.' But as soon as someone comes along and offers 50 million, what do they do? Then they do the same as everywhere else" (KV).

"[Referring to Lake Phoenix in the city of Dortmund:] You may argue that you have enabled access for the community to the lake and other facilities, you can say that the whole regeneration certainly provided new areas for physical activity and that the neighborhood and the surrounding area has obviously improved and so on. The question is whether the prices of the housing in the surrounding would rise

> *and whether those people would then be forced to move away. So basically, it did not make anything for them because they will go again in an area where there is nothing"* (JS).

While some interviewees emphasized that residential development legitimately needs to be refinanced (while acknowledging that the cost for housing must generally remain affordable), they also argued that keeping public access to common goods such as blue-green spaces would be of vital importance (e.g., *"The real artistry is to create space where everyone can go. That is decisive! (...) Public uses must be considered so that everyone is enabled to participate"* (SS), *"One could say that because of the social make-up of a city, one cannot recoup all investments. The municipality has to pay a certain amount for increasing the human capital of the city"* (DW)). Another much-discussed solution was the provision of public housing and/or imposing certain percentages for rental and public housing on private investors. Interestingly, a common view was that the project Lake Niederfeld has largely prevented a gentrification of the neighborhood (possibly due to the size of the waterbody and the lack of other attractive infrastructure in the neighborhood), while admitting that the new housing estate exclude lower-income people. Yet, there continues to be *"a situation of here live those people, there live other people"* (DP) when it comes to the social integration of migrants.

Despite improvements achieved in the past (*"There is a lot of effort to perform better"* (JS)), several interviewees felt that the interdisciplinary/-sectoral collaboration could be facilitated further to ensure integrated planning (e.g., by designing people in charge for the collaboration between municipal departments or setting up interdisciplinary working groups), as working in silos would be still prevailing (e.g., *"That is usually not the way how cities work*" (JS)) and much depends on individual people (e.g., *"The chemistry can be right or there is hostility that seems to divide everything"* (KV)). In addition, transdisciplinary research should be supported and scientific findings incorporated into planning practice to fuel successful urban transformations.

Participation

Concerns regarding public participation in blue space planning were widespread and manifested in several dimensions (see fig. 4.21): (1) need for appropriate (human and

financial) resources, (2) dealing with a diversity of opinions and public opposition, (3) contrasting perceptions on the implementation of participation and (4) inclusion of vulnerable populations.

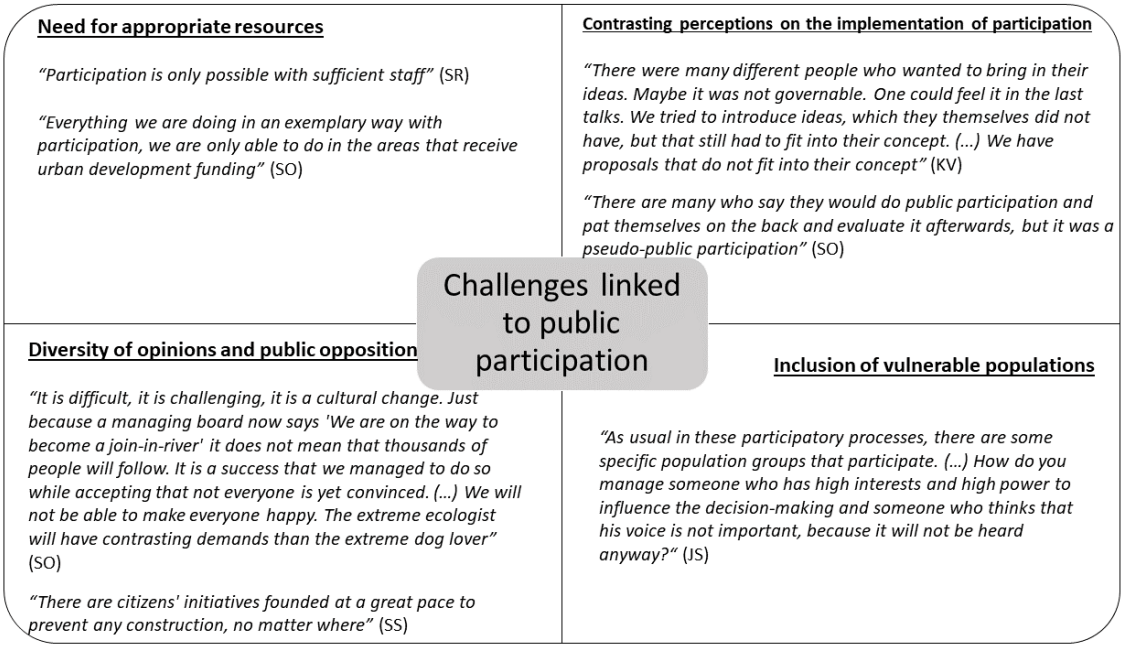


Figure 4.21: Dimensions of the challenge of public participation and exemplary quotes (author's compilation)

With regard to the dimension (2), several interviewees reported about the challenge to reconcile the diverse opinions, demands and needs in the public and to deal with public opposition to planning proposals. As noted by SS, there is *"(...) a development of agitation rather than a development of urban design in recent years. (...) It has become a trend to be upset and that is why it is important for society and politics to find a way of managing this agitation, to take people along in the discussions and become ready to compromise"* (SS). This view was echoed by other informants:

> *"I have meetings where people shout, but they shout with or without participation. (...) There is not one opinion in the population. (...) One citizen says, 'I want the water to be fenced off because the people having a dog will then walk here afterwards and, in this neighborhood, all people having a dog are stupid because they do not keep them on a leash and they poop all over the place and the breeding birds are bitten to death. Please fence them in.' (...) Then a person who has a dog would not dare to say anything at all"* (SO). *"I never experienced a planning process without some people whining, either because it is too much green, too little*

green, too bright, too dark, too costly and so on. There is always a harassing fire. One cannot please everybody" (BS).

SO further pointed to the challenge that people would voice out unrealizable demands or those that do not fall into the responsibility of the water management association. He recommends to have realistic notions on public participation (and its outcomes) and to clearly communicate the scope for decision-making as well as any limitations to the public:

"We cannot solve every problem, but we can make the world a bit more beautiful by blue spaces. And this is something people can have an impact on. (…) I am happy if we manage to reach some hundred people intensively over the time. We impact each other. I do not think that the results would have been better if thousands instead of hundreds of people would have come to our workshops. To be honest, if thousands would have come, we would not have been able to manage those" (SO).

"Sometimes, we also have to do a 'pseudo public participation'. But then we clearly say: 'In this case we have this and that possibility in a very limited scope and you can now have a say in it.' Then, I will not say 'Yay participation, now things are really heating up!' but in the end, there is only a tiny scope of decision-making. We communicate this clearly, otherwise it will backfire. Where there is a larger scope of decision-making, we give it to the public" (SO).

"Linking the legal requirements with participation and communicating the legal requirements to the public is really difficult. The local citizen is not interested in any framework legislation that we have to follow. If that person thinks 'We do not need all the things you want to do', we started to say: 'We have to restore the stream, no matter if you like it or not. You can have a say how the stream should look like later on or you leave it. There will be a construction here either way.' Sometimes, we have to communicate in a rough manner. (…) We communicate that clearly, otherwise, it will not work out" (SO).

The analysis revealed contrasting perceptions on the implementation of participation (dimension (3)). While the interviewee SO considered the participation in the Emscher restoration project extremely successful as various formats would have been carried out to reach out to different population groups and attempts have been made to bring people with opposing interests into exchange, he criticized that sometimes, public participation would be misused to withdraw from the responsibility to take decisions:

"I realized that politicians or decision-makers do not want to or cannot decide anymore and leave the decision up to the population because of strategic or other reasons. But the population is not stupid; they often realize that and they

> *themselves do not want to decide about every frippery. That is why we vote, politicians should decide it"* (SO).

Based on his experiences, he recommends not to apply any standards for participation (as this also depends on the acceptance of persons in charge) and focus on involving the local community:

> *"There are projects where there is a lot of public participation with my colleagues, who want it, and others who are still very reserved. Then it is a difficulty, a challenge, not to apply the same standards everywhere. There is no point in forcing an engineer who is not capable of engaging in intensive dialog with citizens because it means stress to him, because was never educated for this. Then the approaches differ. It is only important that the citizens get more out of it in the end. For one project it might be a little more, and for another project it might be a little less, but that is still great for the public"* (SO).

> *"To implement a waterbody in a neighborhood attracts first of all those who live right next to it. They dislike construction sites, so they have a negative attitude. It is all about reaching out to those people. To make them clear: there is a construction site, but you can decide over the result. It is also a bit egoistic. We want participation to have a more harmonic construction. (...) I had a situation where some persons protecting trees shouted 'You tree-killers!' Due to this action of eco-activists coming from somewhere else but not the local neighborhood, other people at the workshop were intimated and did not say anything. (...) One has to be careful who aims for which goals. (...) To me, participation means that the local residents participate"* (SO).

In contrast, the interviewee KV –chairing a citizens' organization that was originally co-initiated by the local water management association and who intended to co-create the Emscher restoration by carrying out different (particularly cultural) projects– painted a much more critical picture of the public participation. In his view, the stakeholders involved actually failed to carry out a highly participatory river restoration as the collaboration turned out to be quite difficult and only a few initiatives and ideas stemming from the civil society (e.g., the citizens' organization) were supported and implemented. This was driven by a rather standardized participation scheme repeating the same type of events at which the same representatives voice out their interests (*"always the same issues"* (KV)). He suggested to establish a different, more innovative type of participation that really empowers the community (e.g., self-organized by citizens and involving roleplaying to enable citizens to take over the role as planners) which would make

"a remarkable difference" (KV) to the participation organized by a third party that has to fulfill certain goals which are eventually placed on the people participating:

> *"It is a difference if one can tell the community: We are people like you, we joined up and we ask ourselves, 'How do we perceive ourselves as neighbors, as people getting into a conversation at eye level?' (...) I mean, why does not anybody ever come up with the idea to really have people act as the water management association: 'How would you do that?' And then also not to exert such a pressure. This pressure in it! According to the motto, 'Now we consulted you, you had the opportunity.' That is when the whole idea of participation shows its true face. It is actually an instrument of power used for legitimization. It always works! (...) I always have good reasons to make excuses afterwards"* (KV).

In addition, trade-offs would need to be communicated more precisely to the public as planning necessarily involves certain constraints. Thus, it would be obvious that not all promises could be kept: *"This 'acting as if' is the main problem of participation because it leads to false promises. (...) It would be nice if one could agree on promising less"* (KV).

Several interviewees stated that it is particularly challenging to involve vulnerable groups (e.g., low-income population, migrants) in urban (blue-green space) planning (dimension (4)) and shared some negative examples. For instance, reporting about her research on a participatory green space planning project in a deprived neighborhood in the city of Gelsenkirchen, JS noted that the green space remained underused after the regeneration, among others because one failed to consider different community members, particularly vulnerable groups (despite putting in *"a lot of effort", (...) "but in the end, it was not successful as it was meant to be"* (JS)). In addition, the participatory planning neglected concerns that nevertheless influence the use of the green space:

> *"When I went there and asked people, many of them mentioned that it was due to the rest of the surrounding area that the place was not good. So, they did not feel really safe there. There were no other people. That was basically one of the reasons. They tried to improve the park and they did it in a participatory way, but it was not the single problem in that area"* (JS).

She highlighted that as a result of the lacking inclusion of vulnerable groups, the access to high-quality blue-green spaces within cities remains socially unjust: *"That is why it is difficult to tackle environmental justice because it is difficult to reach these population groups that are the most vulnerable*" (JS).

Similarly, KV reported that the transformation of a former sewage plant into a 'cultural park' in the city of Bottrop failed to meet the demands and needs of local community members as the basin filled with water would be considered too dangerous:

> *"As someone in favor of monument protection, I understand why they wanted to keep that industrial heritage and it would have been difficult to make a kiddie pool out of it. But it is striking that the people who were considered to be the prototypic user group of the park were not consulted at all. (...) Until today, they [the Turkish women] say: 'We do not go there because we are feared. Our children might go wild and we cannot bridle them'"* (KV).

In consequence, both interviewees stressed the importance of including a variety of people in participatory blue space planning and to ensure that the voices of vulnerable groups are heard –despite all efforts it takes (e.g., *"(...) to enable also the ones who do not have the capacities to come to a certain level to be able to discuss and to meet their needs as well"* (JS)).

There were some suggestions how to facilitate the participation of older people. With regard to older migrants, several interviewees indicated the need for low-threshold, outreach work (e.g., "*It is really good to have personal contact. Like you [the principal investigator] were here today, you introduced yourself, explained a bit, they [the older migrants] understood what it was all about"* (HC)), including support services (information, counselling) and organized activities as offered by community centers for older people. As noted by SO, involving kindergartens and schools in participatory planning would also contribute to reach out to older migrants indirectly through children and teenagers. Another informant, AS, pointed to the importance of a political representation of older adults such as a municipal council (*"However you call it, but a political representation of older people is needed which serves as a contact point for older adults to bring their concerns forward"* (AS)), while one interviewee argued to consider the local circumstances in participatory planning and as such, put emphasis on older peoples' voices in neighborhoods where many older people live. Yet another interviewee felt that the successful inclusion of older people in participatory planning is linked to the right way of communicating with older people, i.e., *"to not call them older people"* (KV) and to avoid any special treatment: *"It only functions if it goes without saying. If I consider old age as something having a special status in the course of life (...), something goes wrong and will not work out"* (KV).

A number of interviewees referred to the efforts and costs needed for blue space development and maintenance –while generally having limited municipal funds– as another major obstacle to successful urban blue space governance. Relative to the development and maintenance efforts, the interviewees exemplified the necessary political will/courage (e.g., *"Much is possible to think about (...), but one has to have the courage for doing it"* (DW)) and preparatory work (e.g., municipalities having to realize urban development concepts against opposition) and the complexity of and the bureaucracy in urban planning that result in long-lasting processes while concurrently, the challenge arise to keep the multi-actor endeavor together over time:

> *"You have to implement all that and you want to involve different experts, you want to involve citizens, it is pretty much difficult to organize that, to manage the whole process, to keep the interest (...). At the beginning, everybody is pretty much enthusiastic, you know, they want to do everything and so on. But then, as the time goes by, it is more difficult (...). The ones that are much motivated due to their interests of course they are also more present. There is this kind of balance you need to maintain the whole thing"* (JS).

As noted by SR, difficulties on the way, just as contaminated waste in the project Lake Niederfeld (as usual in industrial regions) can prolong constructions and/or make projects more expensive. With regard to large-scale projects such as the renaturalization of a river over 30 years, SO highlighted that technological progress and cultural changes (e.g., the rise of new ways of collaboration, including participation) evolving during that time might force adaptions (but also optimizations) of the planning and implementation (e.g., *"What has been planned in 1992 has become old ten years later", "Also the administration had to reinvent itself"* (SO)).

Several interviewees pointed to the impact of the design and quality of blue spaces on the development and running costs. As such, "*everything that is done additionally requires additional maintenance costs"* (SO). This was illustrated by the example of providing public toilets, swimming spots (e.g., *"Because there are running costs to achieve a decent water quality that allows swimming without getting sick"* (BS)) and access to blue spaces via public transport (e.g., *"For two or three older people, you cannot establish a bus network. The question remains: What can be funded? What are public services?" What needs to be provided? It is always difficult"* (DW)).

The availability of water occurred as another issue that might pose a (natural) barrier to urban blue space development planning (e.g., *"Water is where it is and you cannot easily divert it through the city"* (SS)) or that might increase the development efforts and costs (as in the case of industrial used waterbodies that have to be regenerated). As noted by SS, this would also be the reason why green spaces would be much more common in residential developments:

> *"Theoretically, if we look out of this window, one could demolish that street and promptly make a green space out of it. It is not that easy when it comes to water. I first have to find ways to the water or the water has to find ways to us and that is more difficult. You can only do it -particularly in Ruhr Metropolis– if there are waterbodies that have been used industrially or economically and that can be regenerated, including making the access more attractive"* (SS).

Yet, several interviewees felt that cities of Ruhr Metropolis still have great potentials to reclaim spaces and waterbodies (e.g., *"I think there are waterbodies in Ruhr Metropolis that suit for a regeneration and therefore qualify for residential developments nearby"* (SS)) and *"(...) to activate the health-promoting qualities of blue spaces"* (DW). This includes the potential for intensifying investments into nature-based solutions for managing rainwater, as the interviewee SS noted. However, in his view, the experience of 'the blue' would be quite limited in this case as the water is *"rarely visible or difficult to experience"* (SS). In other words: *"I would not say it offers a sustainable experiential value"* (SS).

Another obstacle mentioned was the diffusion of responsibility, which particularly impedes the maintenance of blue spaces and its features –despite the city of Essen having an app in which citizens can report shortcomings in public space ("Mängelmelde-App"). In this regard, some interviewees argued that there is a certain dependency on civil engagement, as the following comments show:

> *"I would like to see that we [the citizens' initiative] take away somebody else's job, I do not have to do this. However, I do it because it is necessary. I like to have a clean surrounding"* (AS).

> *"Normally, it would have taken one year to remove it [a graffiti], because nobody feels responsible. That is why I organized and paid it in advance, but I will reclaim the money"* (AS)).

> *"You cannot leave things to take care of itself. It often happens: people construct something and move on to the next construction site. But it should be sustained; one has to care for it"* (HK).

The interviewees AS and HK, both volunteering for the maintenance of Lake Niederfeld, exemplified that –while the greenery around the lake would be maintained– they had to report issues related with the water quality (e.g., low water levels, prevalence of algae, broken pump) to responsible persons in the past, *"otherwise, nothing would happen"* (HK). In the case of JH, the volunteering comes along with a high personal commitment (e.g., *"I had many supporters for organizing a concert at Lake Niederfeld (…), so I invited them all for dinner, which alone costed me 500 euros. If you cannot finance that, it would not work. (…) You have to do something for togetherness"* (JH)). A diffusion of responsibility would not only occur at the municipal level, but also at the regional level (e.g., lacking cycle path connections) as the polycentric structure would complicate to find joint urban planning solutions (e.g., *"There are three administrative regions involved that compete with each other, it cannot work out. We have to work on that, to make urban planning and design easier"* (AS)).

Finally, social issues were reported that can negatively affect the reputation of places and in consequence, e.g., people's perception of blue spaces. Those include the misuse of blue spaces (e.g., littering, signs of vandalism) and existing social conflicts that are transferred to blue spaces, e.g., between the migrant and non-migrant population, between higher-income and lower-middle-income groups. For example, the interviewees AS and SS experienced new tenants at Lake Niederfeld complaining about the noise and (certain) people meeting there:

> *"If there are certain young people sitting there –you know, short sides haircut and smoking shisha– that is criminal in their view. I always say, 'They are not criminal, they are just normal youngsters, they have fun and it is normal that they are a bit louder'"* (SS).

> *"Some new residents think they would live in Bredeney [affluent neighborhood in Essen adjacent to a lake] but for the prices of Altendorf. This does not work"* (AS).

> *"There are people who think 'This is my lake and others have to go when I want them to go.' These are mostly people living immediately by the water. (…) They are in parts egoistic"* (SS).

As the comments below illustrate, several interviewees indicated that a cultural transformation to eventually reframe the local perceptions of blue spaces and surrounding neighborhoods requires support and time to evolve. As experienced in the case of Lake Niederfeld, this seems to count particularly for deprived neighborhoods, which suffer from prejudices and stereotypes that are reinforced by a bad press.

> *"Many people in the region cannot believe that 60, 80, or 100 years of having an open sewer have come to an end now. If you tell them, 'You can get a clean stream in two years' they will not believe it, particularly the older population who used to grow up there. They have many stories how living near the canal looked like and what they experienced. They find it hard to imagine that the canal will be a stream again. Opposed to this stand the children who immediately start to paint pictures of how they imagine the stream to be"* (SO).

> *"I had some craftsmen here who work in Essen for more than 30, 40 years and they have never been here. They did not know about the lake [Niederfeld]. (...) People from Essen do not know about the lake"* (HK).

> *"I clearly tell you: only because someone sits there smoking a shisha, he is not criminal! (...) It is decisive to attract people from outside to come and stay for a while in the neighborhood. They have to tell others how nice it is, only then we manage to make other clientele go there and finally, prejudices disappear. (...) Everyone just speaks about the beautiful Essen south"* (SS).

> *"What audacity to say that Altendorf is littered everywhere, (...) that there are dead rats! (...) The press has a tremendous power, they can push or destroy you. They should not whitewash the facts, but I want objectivity. (...) There were only bad reports about Altendorf, so I called the reporter at the WAZ [the local press] and told them that I have the impression that they collect waste, put it there to make it look more dramatic and take pictures. I told them that this is going to be their last negative article. Then I went out to people on the street asking them if they would like to participate in a cleaning action. This is how the initiative started to grow. (...) It would be nice if people would talk more positively about the neighborhood. For his, you have to do a lot, to make a continuous effort"* (JH).

4.2.4 Summary of results

The results of this case study show that urban blue spaces are used by older people for moderate physical and sedentary activities; however, most of the older migrant women participating in this study visit blue spaces rather irregularly. A range of factors was identified to influence older people's blue space use, most prominently the availability, accessibility and quality of blue spaces and the individual health status and activity level. The analysis revealed that older people ascribe aesthetic and restorative qualities to blue spaces and attach value to having blue spaces around their place of residence. A common

view amongst study participants was that the benefits of blue and green spaces are closely interlinked (yet, blue spaces would offer some distinct health-related effects) and that both types of landscapes are important for a good quality of life in cities. In fact, larger blue spaces and landscaped blue-green spaces were the most preferred landscapes. With regard to the health effects provided by blue spaces, psychological benefits (e.g., stress relief, relaxation) were ranked as the single most important benefit, yet, blue spaces hold meaning to older people also in terms of enabling physical activity, having positive social bonds and positive sensory perceptions (linked to the environmental benefits provided). While many older adults considered the availability and accessibility to urban blue (and green) spaces as sufficient/good, concerns regarding the quality of blue spaces (provision of amenities, ensuring safety and maintenance) were particularly prominent.

The (ongoing) transformation of a former industrial city to a 'European Green Capital' including the regeneration and development of blue spaces through various programs and projects has been described as the heart of successful urban blue space governance. Similarly to the older study participants, the key informants and experts perceived blue spaces as beneficial for human health in different dimensions (urban aesthetics, places for recreation, healthy behaviors and positive social interaction, environmental benefits). Opinions differed as to whether older people's demands and needs would be (adequately) integrated in the current urban blue space planning and design. The analysis revealed a range of facilitators and obstacles to successful urban blue space governance, whereby there are some interesting overlaps (e.g., integrated planning, public participation).

5 DISCUSSION

This chapter consists of a cross-case analysis and discussion of the key findings in the context of relevant literature, structured according to the main research questions (chapter 5.1), with each subchapter highlighting the implications for practice. Chapter 5.2 discusses the research contributions/strengths and limitations, and chapter 5.3 summarizes the key recommendations for action for practice and research.

5.1 Cross-case analysis and discussion

Similarities and differences of the study samples

In total 94 older people participated in the multiple case study (involved in baseline surveys, photowalks and FGDs). As can be seen in table 5.1, the samples in both case studies were predominantly (n=78) young-to-middle old, i.e., 65-79 years. While the sample in Ahmedabad was predominantly male (n=40) and represented middle-class households, mostly older women (n=27) with a lower-middle socio-economic status participated in Ruhr Metropolis; with a relatively high proportion of female migrants (n=16), most of them (n=9) being widowed.

Table 5.1: Overview of the samples of older people in both case studies (author's compilation)

	Sample size (n)	**Gender (n)**		**Age (n)**	
		Female	**Male**	**65-79 years**	**80+ years**
Ahmedabad	53	13	40	49	4
Ruhr Metropolis	41	27	14	29	12
Total	**94**	**40**	**54**	**78**	**16**

There are some differences in the living situations of older adults: In Ahmedabad, almost all older adults (47 out of 53) reported living together with at least one other person, whereas in Ruhr Metropolis this applies to slightly over half of the sample (21 out of 41). In each case study, approximately one third of the samples reported living in multi-generational households (Ahmedabad) resp. living alone (Ruhr Metropolis). Overall,

three-quarters of the participants (71 out of 94) have lived in their neighborhood for a long time (i.e., more than 10 years).

More than half of the study sample (n=56) noted having a good, very good or excellent health status (see fig. 5.1). Yet, as shown in fig. 5.2, older Amdavadis reported better levels of health (i.e., good, very good or excellent health status) compared to older people in Ruhr Metropolis (42 out of 53 versus 14 out of 41). This difference also applied to mental wellbeing: almost all baseline survey participants (26 out of 29) in Ahmedabad versus two-thirds (17 out of 26) of the baseline survey participants in Ruhr Metropolis scored ≥50% in the WHO-5 of wellbeing, indicative of not suffering from depression. Over half of the overall sample of older adults (61 out of 94) reported having at least one chronic disease with a higher percentage (34 out of 41 versus 27 out of 53) in Ruhr Metropolis. In both cases, the common 'wellbeing paradox' in old age can be observed as more than half of those being chronically ill (n=52) still perceived their health as good or very good (with a higher proportion in Ahmedabad: 22 out of 27 versus 10 out of 34 in Ruhr Metropolis).

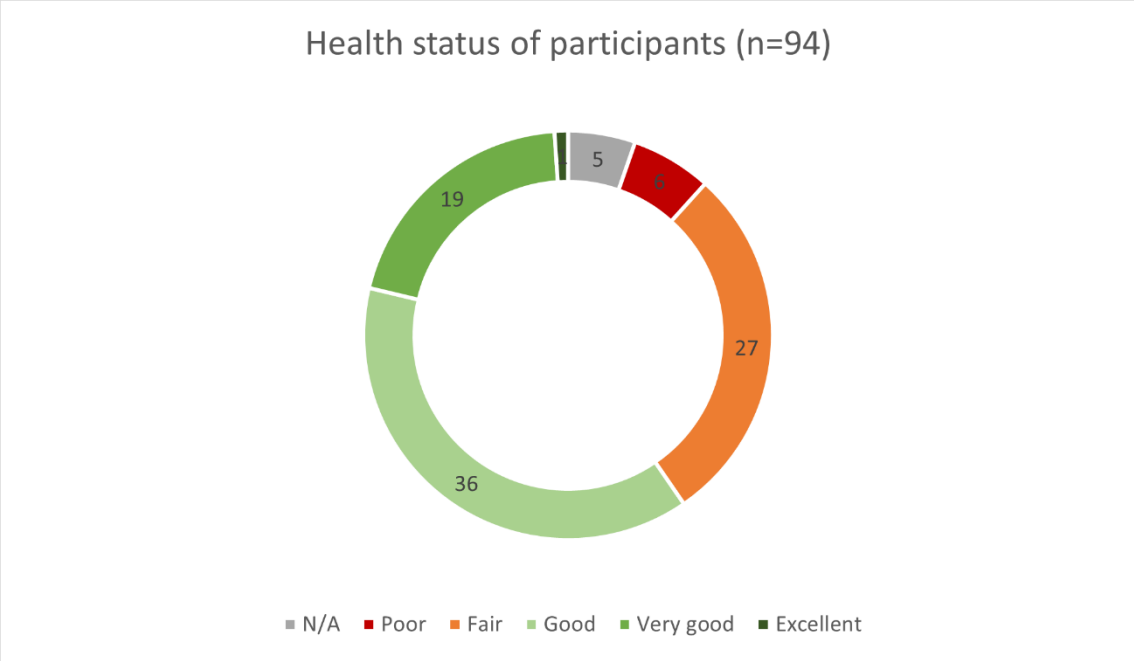


Figure 5.1: Self-reported general health status of the multiple case study participants (author's compilation)

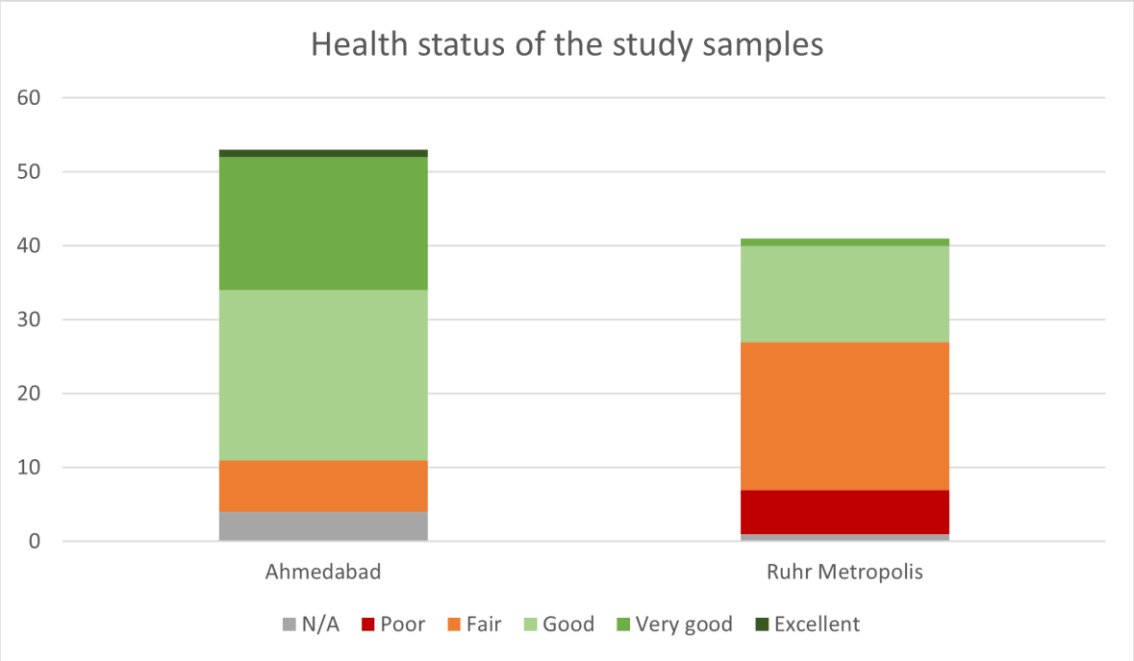


Figure 5.2: Comparison of the self-reported health status between the study samples (author's compilation)

The baseline survey samples in both case studies reported having a quite active lifestyle, with a majority of 27 out of 29 (Ahmedabad) resp. 19 out of 26 (Ruhr Metropolis) participants having done recreational walking for 5-7 days over the last seven days. In addition, over half (n=16, Ahmedabad) resp. almost half (n=12, Ruhr Metropolis) of the baseline survey participants stated having done moderate-to-vigorous physical activities on 4-7 days (Ahmedabad) resp. 1-3 days or daily (Ruhr Metropolis) over the past week. Yet, it is important to consider that the baseline survey participants represent only a part (i.e., 54% in Ahmedabad resp. 63% in Ruhr Metropolis) of the total sample of older adults in each case study.

5.1.1 Older people's experiences of the urban blue space-health relationship in Ahmedabad and Ruhr Metropolis

User behavior

In both cases, the results of the baseline surveys show that older adults frequently and regularly (i.e., several times per week or daily) use urban blue spaces (Ahmedabad: 27 out of 29, Ruhr Metropolis: 21 out of 26 participants). Most of them indicated staying for 1-2 hours or more per single visit. Another finding is that the majority of the FGD

participants (Ahmedabad: 13 out of 24, Ruhr Metropolis: 10 out of 15) use urban blue spaces at least once per month. Case differences occurred with respect to the visiting time and the type of blue space visited. While most of the baseline survey participants in Ahmedabad visit Parimal Garden in the (early) morning and hardly use any other blue spaces (on a regular basis), the main research site in Ruhr Metropolis is mainly visited in the afternoon and the majority of the baseline survey sample regularly use other blue spaces besides Lake Niederfeld. It is likely that those cross-case differences are due to the distinct climate, the culture of being physically active in the morning, the yoga courses offered in Ahmedabad, the better traffic connections and blue-green space connectivity in Ruhr Metropolis. A similar pattern of older people's blue space use (i.e., frequent/regular visits to blue and green spaces during the day) has been found in other studies (e.g., Pool et al. 2023; Coleman & Kearns 2015; Finlay et al. 2015). In addition, the findings align with previous research (e.g., Grace et al. 2023; Chen et al. 2022; Freeman et al. 2019) which found that older people tend to use nearby, walkable blue spaces. Contrary to other findings (e.g., Aliyas 2019), older participants in this study seem to stay relatively long (more than one hour) at blue spaces which could positively influence the health outcomes derived (Garrett et al. 2019b). Yet, the length of stay is often not considered in blue health studies and consistent evidence on this moderating variable is lacking.

As seen in fig. 5.3, the most common activities at both main research sites were aesthetic pleasure/watching the scenery, walking (in Ruhr Metropolis, including dog walking), relaxation and social interaction. While exercise emerged as the third most common reason to visit Parimal Garden in Ahmedabad, it played a minor role in Ruhr Metropolis. Here, the fourth most common reason to come to Lake Niederfeld was nature/wildlife watching, which was a rather uncommon activity in Ahmedabad. Yet, methodological shortcomings such as an unclear distinction between aesthetics/watching the scenery and nature/wildlife watching have to be considered. The qualitative results revealed that the main research site in Ruhr Metropolis is also commonly used as a transit destination for cyclists, whereas cycling was uncommon in Ahmedabad.

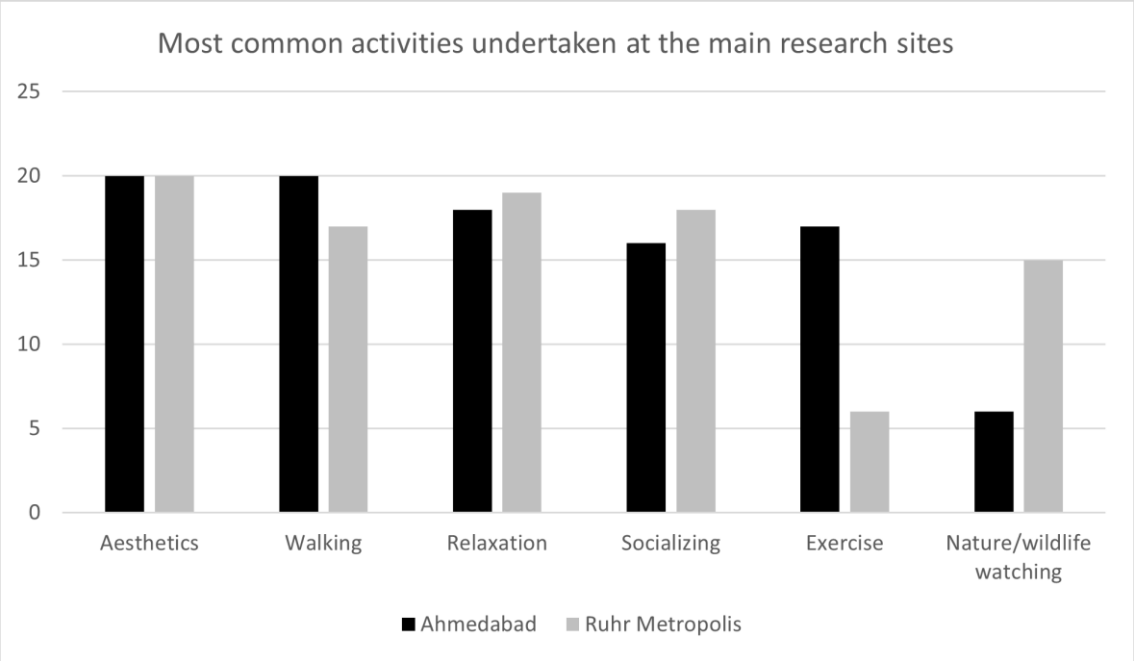


Figure 5.3: Comparison of the main reasons for visiting the main research sites (author's compilation)

In both case studies, results from the participant observation and the FGDs added evidence that urban blue spaces are mostly used by older adults for moderate physical activity (e.g., walking, cycling, (laughing) yoga), social interaction/spending time with family and friends (including intergenerational activities), aesthetic enjoyment/watching the scenery and relaxation/contemplation/restoration. Across the two cities, many older adults noted participating in (formally or informally organized) group activities at blue spaces such as yoga and joint picnics. However, regular group activities at blue spaces were only undertaken in Ahmedabad, while the ones in Ruhr Metropolis were only occasional events. The results align with previous research (e.g., Smith et al. 2022; Aliyas 2019; Finlay et al. 2015), which show that older people tend to undertake sedentary and moderate water-related or water-independent activities such as walking, light exercise at urban blue spaces. Further, it reflects the significance of the mediating pathway stress recovery/mental wellbeing as older adults intentionally seek blue spaces for such health effects. The findings underscore that blue spaces function as important places for intra- and intergenerational social interaction in later life (e.g., Pool et al. 2023; Smith et al. 2022; Finlay et al. 2015).

Influencing factors of blue space use

Individual, social and environmental factors influencing older people's blue space use were indicated throughout the data collection in both case studies, which are summarized in fig 35. In the following, some of these factors are outlined in more detail. While the data collection tools were designed considering the moderating variables of blue space use identified in previous research, some of these effect modifiers could not be investigated, e.g., due to small sample sizes or inappropriate metrics used. For example, dog ownership applied to only four participants in Ruhr Metropolis. Overall, the results support the existing evidence on effect modifiers influencing the blue space-health relationship outlined in chapter 2.2 and chapter 2.5.

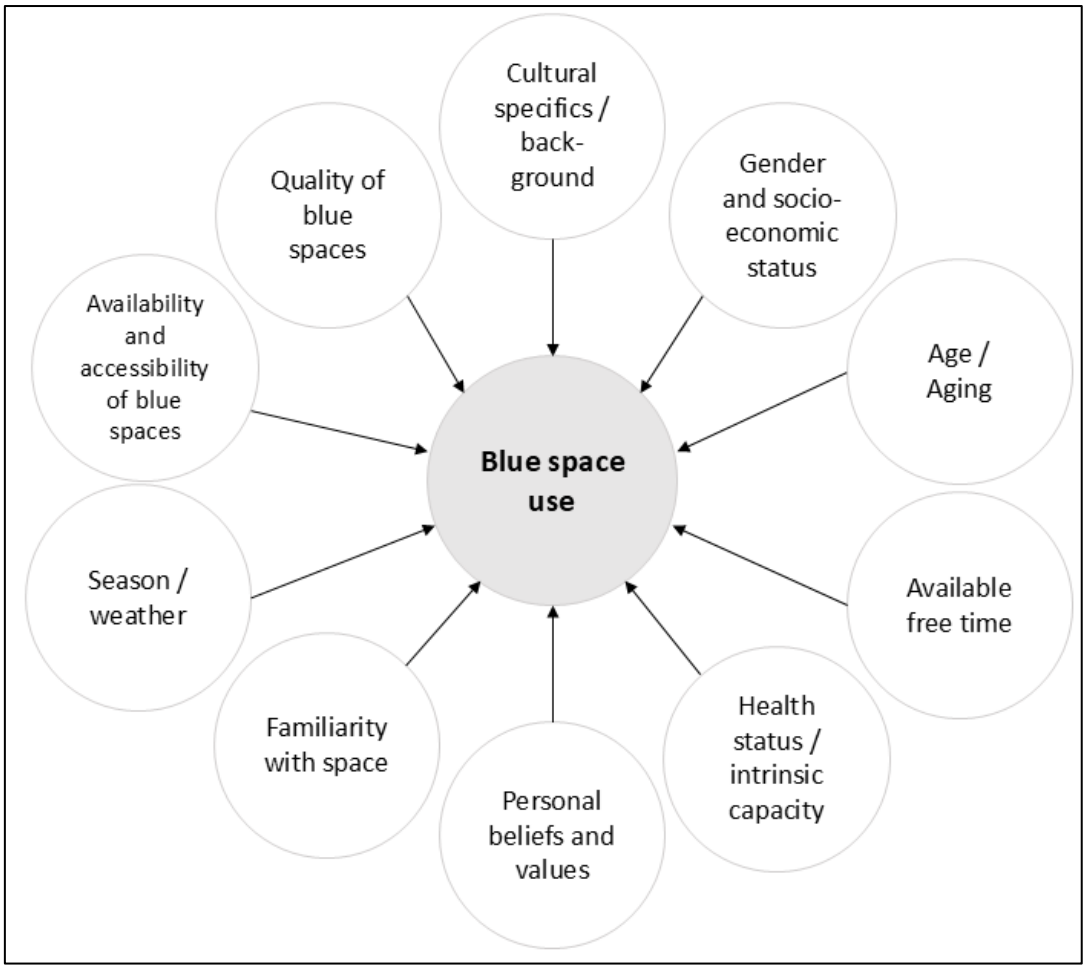


Figure 5.4: Influencing factors of older people's blue space use identified in this study (author's compilation)

Cultural specifics/background: As noted in previous research, concepts of nature and its use might differ between cultures, including different perceptions of and meanings attributed to blue spaces and different user behaviors (Grace et al. 2023; Rathmann 2021). The results of this study are consistent with these earlier findings. While the reasons for visiting urban blue spaces, some of the blue landscape preferences and therapeutic landscape experiences were generally the same in both cultures under study, cultural variations were reported with regard to differences in the perception and use of blue spaces between urban and rural India and differences in the religious/spiritual meanings attributed to blue spaces in India as compared to Germany (e.g., considering certain rivers as sacred, use of blue spaces for spiritual rituals). Further examples included differences in the behavior rules for public spaces (more conservative in India) and a potentially lower popularity of watersports in India as compared to Germany. In Ruhr Metropolis, interviewees also highlighted potential differences in urban blue space perception and use between migrant and non-migrant populations, e.g., a preference for outdoor celebrations at public spaces among Turkish migrants.

Gender and socio-economic status: Consistent with other research, this study found that gender is likely to influence recreational blue space use. At least in the Indian case study, it seems that women tend to visit blue spaces less frequently than men. Reasons noted by interviewees are safety concerns and the patriarchal society. Yet, urbanization changes this pattern in a way that women living in cities use blue spaces more than in rural areas. In Germany, the potential influence of gender on blue space use was not discussed. In comparison to Ahmedabad, the sample in Ruhr Metropolis consisted mostly of older women. However, due to the lacking representativeness of the samples, no reliable conclusions can be drawn about gender differences in blue space use.

While previous research (e.g., Geary et al. 2023; Georgiou et al. 2022/2021; White et al. 2018) has identified the SES as a predictor of blue space visit frequency, location of blue space visits and stronger blue health outcomes, this study could not confirm the existing evidence on this effect modifier due to the sampling process which did not allow any comparisons between people with different SES. With great reservations, however, some observations in this study might support earlier findings on greater health benefits and their relative importance among older people with a lower SES (e.g., Yang et al.

2024; Chen et al. 2022; Chen & Yuan 2020). For example, the agreement rates for deriving health benefits from blue space visits were highest among older Moslems in Ahmedabad, who –despite being middle class households– represent a marginalized group in India. The greater importance of social interaction compared to other health benefits from blue space visits among people with a lower SES (as shown by De Bell et al. 2017) was reflected in the lower-middle income sample in Ruhr Metropolis.

Age/Aging: Due to the lacking representativeness of the samples and the small number of participants aged 80+ years, the study could not provide any differentiated analysis, which could confirm or reject if increasing age reduces blue space visits as hypothesized by other researchers (e.g., McDougall et al. 2021). Yet, the results corroborate findings of previous research such as those by Freeman et al. (2019) indicating that shifting living circumstances and specific life events (e.g., change of residence, marriage) alter blue space perceptions and use –a topic that is still largely unexplored (Grace et al. 2023). In this sense, the focus of interest is rather the process of aging than old age itself. In accordance with the present results, previous research has highlighted that "urban blue spaces [as symbolic spaces] act as affective place triggers to specific memories and identities" (Smith et al. 2022: 15). For example, participants shared how blue space experiences in younger years (intentionally or unintentionally) influence blue space use in old age: blue space visits evoke good memories and help to keep them in mind, e.g., of the time spent together with spouses, of family holidays by the sea or of growing up close to a river. Finally, in line with previous research (e.g., Grace et al. 2023; Pool et al. 2023; Finlay et al. 2015), the findings suggest that older people, who have often lived in a certain area for a long time, mostly prefer to use neighborhood blue spaces. Common reasons are changes in their health and mobility level, but also the strong emotional bonds built to those spaces.

Health status/intrinsic capacity: In accordance with the present results, previous studies have demonstrated that health concerns such as the fear of falling, changing physical and mental abilities and chronic diseases influence blue space use in later life (Freeman et al. 2019; Coleman & Kearns 2015; Finlay et al. 2015). However, the findings remained vague whether and to what extent chronic diseases really limit blue space use among

participants as the majority of those having chronic diseases still reported to be able to regularly visit urban blue spaces in both cases (in total 50 out of 61 people). The qualitative data analysis suggests that health constraints at an older age limit predominantly the location of blue spaces (i.e., greater dependence on 'the neighborhood blue') and shorten the visit frequency/time. However, older people with chronic diseases in both cases reported to seek blue spaces for managing rehabilitation and recovery, supporting evidence from previous research (White et al. 2021). One interesting finding is that changes in older adults' health and mobility level can also act as a reason to meet at blue spaces as narrated by Mrs. Pame in Ahmedabad: due to barriers such as steep steps at private residences, she and her friends chose Parimal Garden as a *"a place where we can get together"*.

Personal beliefs and values: They include among others subjective health awareness, feelings of safety/fear of harm, the motivation to be active or the individual connectedness to nature. For example, this study found that older people with an active lifestyle consider urban blue spaces as opportunities for being physically active and reasons for getting out. The qualitative findings suggest that differences in the connectedness to nature influence people's perceptions and use of urban blue spaces as well as the perceived importance of design elements; e.g., Mrs. Esche noted to prefer going to artificial blue spaces close to the city center as *"We have always been city dwellers"* while others such as Mr. Madhu seek urban blue spaces as places to escape from the city and to immerse in nature.

With regard to blue landscape preferences of older adults, the group variations found within each case study corroborate earlier findings that landscape preferences are, among others, determined by individual biography, e.g., an acquired taste during life course (Rathmann 2021). Yet, while researchers such as Rathmann (2021) have argued that landscape preferences –as an expression of cultural ecosystem services– are also culturally determined, this study did not find any significant cultural differences in this matter. Both samples generally preferred the same types of blue spaces (see further below). Preferences for blue landscapes were not consistently stronger with increasing water proportion in the pictures. Hence, the results challenge the assumption of a possible dose-response-relationship in blue landscape preferences.

Availability and accessibility of blue spaces: The information gained on older people's access regarding their residential exposure to blue spaces remain inconclusive in both case studies due to contradictory answers. Yet, it seems that many older people – particularly in Ahmedabad– are dependent on private (or public, if available) transport to reach the nearest urban blue space, including the main research sites. As mentioned above, the cross-case analysis revealed that older people mostly prefer to use near-by blue spaces, not only due to potential health constraints and mobility impairments, but also because of the meanings attributed to those spaces (place attachments). These results reflect those of other researchers such as Pool et al. (2023), Grace et al. (2023), Smith et al. (2022), Coleman & Kearns (2015) and Finlay et al. (2015) who also found that the vicinity to older people's private homes and accessibility to "the everyday blue" are of vital importance. As noted by Pool et al. (2023), the ability to identify with a blue space and having a personal meaning to it emerged as a central influencing factor of older adults' blue space use and is facilitated by having blue spaces in the neighborhood which can be encountered more frequently and easily in daily life.

Quality of blue spaces: In terms of blue space quality, this study found that aspects such as comfort/having amenities around, safety and a good ecological quality, including the presence of greenery and wildlife, are major influencing factors of blue space use in later life; reflecting the results of several previous studies (e.g., Pool et al. 2023; Smith et al. 2022; Garrett et al. 2019b; Pitt 2019; Finlay et al. 2015). Importantly, this finding emerged from both, quantitative and qualitative, data analyses in both case studies. For example, in the choice experiments, blue spaces without amenities and those being of poor quality were ranked rather low. While this study did not measure the water quality, previous studies have shown that visible environmental degradation at blue spaces such as surface foam, algal blooms and litter reduce the perceived attractiveness and willingness-to-visit and limit the experience of health benefits (Smith et al. 2022; White et al. 2018; Wilson et al. 1995). Considering activities such as sports courses or cultural events as part of the quality of blue spaces, this study revealed that such offers can influence and facilitate the blue space use of older people, particularly for older migrants in Ruhr Metropolis who seem to be particularly dependent on support services and extrinsic motivation to visit blue spaces.

Feelings related to blue spaces and landscape preferences

An important finding across the two case studies is that older people have various positive feelings about (being exposed to) blue spaces and place value on cities and neighborhoods integrating blue spaces. In fact, over half of both study samples (Ahmedabad: 36 out of 53, Ruhr Metropolis: 26 out of 41 participants) somewhat or strongly agreed that the availability of blue space forms an important reason in choosing their place of residence; in total 62 out of 94 participants. In both case studies, the agreement rates were higher among older men than older women and higher among the rather marginalized groups of older migrants in Germany and older Muslims in India. This might reflect potential gender differences in blue space use resp. existing inequalities in blue space access.

Looking at participants' photographic answers to the question what water means to them resp. how they feel about the presence of water (see fig. 4.4 in chapter 4.1.1.2 and fig. 4.15 in chapter 4.2.1.2), participants in both case studies chose the lakefront or a pond with a spout and surrounding greenery as a common scene. Another similarity across the two cases emerged with regard to participants' photos of their relationship to blue spaces (see fig. 4.5 in chapter 4.1.1.2 and fig. 4.14 in chapter 4.2.1.1); both showing that blue spaces represent popular leisure and travel destinations for older people and places that are associated with positive social interaction (spending time with family and friends). Overall, the photos were accompanied by positive narrations linked to aesthetic enjoyment, restorative experiences, distinct sensory perceptions, activities undertaken at blue spaces and spiritual and symbolic meanings attributed to 'the blue'. Fig. 5.5 summarizes the feelings that older people in both cases reported in relation to blue spaces.

Interestingly, the importance of water for sustaining life was a topic that only emerged among older people in Ahmedabad. A possible explanation for this might be a greater sensitivity to water (and to the lack of water) compared to German older adults due to the respective cultural and development context and climatic conditions. Looking at older people's feelings related to blue spaces from a life course perspective, the results show that positive experiences associated with blue spaces in younger years seem to remain quite stable over time, often reflected in long-standing user routines and strong emotional ties (sense of place). For example, all photowalk participants in Ahmedabad noted to visit the main research site for more than 20 or even more than 30 years and in Germany, the

photowalk participants reported that they had been following the tradition of holidays at the Northern Sea since childhood.

Figure 5.5: Study participants' feelings related to blue spaces (author's compilation)

As aforementioned, a variety of reasons seems to account for the positive feelings older people have when being at blue spaces. This can be exemplary seen in the photographic answers to what makes the main research sites special for participants (see fig. 4.3 in chapter 4.1.1.2 and fig. 4.17 in chapter 4.2.1.2), including concrete landscape elements such as the Banyan tree in Ahmedabad or real estate by the water in Ruhr Metropolis (signifying the participant's wish to live by the water), but also social activities and less tangible issues such as the familiarity with street vendors and the possibility to find tranquility and relaxation. Further information can be derived from the photos in response to which landscape elements affect how participants feel and where their favorite places are (see fig. 4.6, 4.7, 4.8 in chapter 4.1.1.2 and fig. 4.16 in chapter 4.2.1.2). According to those, important blue space features for older people are the presence of greenery such as trees, lawns and planting (including aquatic planting like Lotuses), amenities such as benches/seating options, playgrounds, catering options like cafés or ice cream stalls and public toilets. In addition, the pictures confirm that the provision of activities, social companionship and the presence of wildlife make blue spaces valuable to older adults.

The results are consistent with previous research findings such as Smith et al. (2022) who found that older people appreciated seating options along an urban canal to improve their blue space experiences ("to sit, rest and take in the surroundings") or Pool et al. (2023), Garrett et al. (2019b), Finlay et al. (2015) and others who unanimously demonstrated the significance of blue space quality for a positive blue space-health relationship in later life, including a good ecological quality, safety, amenities and social connections.

While the aforementioned findings confirm previous research applying a preference-based approach (people having a general preference for landscapes containing water), the results of the choice experiment enable to derive in-depth information on older people's blue landscape preferences (see table 4.2 in chapter 4.1.1.2 and table 4.7 in chapter 4.2.1.2). In both cases, participants preferred larger (artificial and natural) blue spaces (e.g., Kankaria Lake, Sabarmati Riverfront, Lake Baldeney, River Ruhr, Lake Niederfeld) as well as landscaped blue-green environments (e.g., Parimal Garden, Law Garden, Grugapark). Least preferred were undeveloped natural blue spaces without any amenities (e.g., Sabarmati River, Borbecker Mühlenbach), small artificial waters without much surrounding greenery (e.g., Vastrapur Fountain, Kaiser-Otto-Platz, Green Center) and polluted/badly maintained blue spaces (e.g., Memnagar Lake, Malav Lake, Emscherpark). Yet, it should be noted that contradictions to the qualitative findings occurred in both case studies, indicating potential methodological limitations of a photo-based stated preference valuation to accurately capture older people's blue landscape preferences. For example, the general preference for blue-green spaces (with a considerable proportion of green) expressed in the interviews and FGDs in both cases is not fully reflected in the choice experiment results in which landscapes where water is the primary aspect of the scene rank even higher or as high as blue-green spaces. In addition, blue spaces that were ranked low were noted to be preferred (e.g., Green Center, generally having small water features within the city). A potential explanation might be that participants were asked to rank the pictures according to perceived attractiveness, which might not fully predict their willingness-to-visit in daily life. As such, blue spaces could have been ranked higher that are only used occasionally, e.g., for family visits and for which issues such as the presence of greenery might be less important. The fact that some participants, in the second step of the choice experiment, chose to visit blue spaces which they previously ranked less attractive than the alternative options supports the

assumption that perceived attractiveness reflects not necessarily the willingness-to-visit. Another explanation could be that participants mixed up the ranking procedure from least to most preferred.

Strong group variations in the ranking were observed in both case studies; confirming previous research findings that blue spaces are perceived differently among (older) people and that the same blue space can evoke distinct emotional responses (e.g., Pitt 2019; Finlay et al. 2015). A general pattern was observed in the way that blue spaces found most attractive (i.e., were most preferred) were associated with positive subjective emotional states. However, it is noteworthy that in both cases, even blue spaces found unattractive were partly linked to neutral or positive feelings which might indicate that blue spaces are widely perceived to be inherently associated with beneficial emotional experiences. Again, potential methodological biases have to be considered such as participants mixing up the pictures least and most preferred and the association of feelings to it.

The importance of greenery and urban green spaces

In accordance with the present results, previous studies (e.g., Pool et al. 2023; Qiu et al. 2021; Coleman & Kearns 2015; Finlay et al. 2015) have demonstrated that greenery at blue spaces is highly valued by older adults and that mixed as well as separate blue-green landscapes entail therapeutic qualities. Yet, research still has to clarify the inconclusive findings on potential differences in the effects of blue and green spaces on older people. Broadly speaking, the findings of this study show that older people consider both landscapes as distinct but complementing each other and both being important in cities. For the majority of the baseline surveys in both cases (39 out of 55 participants), the presence of water makes an important reason to visit the main research sites. In addition, positive experiences of both spaces and common activities undertaken were strongly linked to 'the blue', e.g., aesthetic enjoyment, specific sensory perceptions such as coolness and fresh air, watching and interacting with the distinct nature (aquatic plants and animals) and doing exercise or cycling by the waterfront. This accords with earlier observations highlighting the general attractiveness of the blue-green interface (Kistemann 2018; Völker & Kistemann 2011) and the significance of natural boundaries for promoting health and wellbeing (Lengen 2015).

Perceptions of blue spaces as therapeutic landscapes

The multiple case study found that almost all older participants (81 out of 94) reported obtaining health benefits from blue space visits; more precisely three quarters of the participants in Ahmedabad and all participants in Ruhr Metropolis. As shown in fig. 5.6, mental health benefits such as restoration and stress relief were most important, followed

by physical activity/sense of improved physical health and social interaction. While the prioritization of mental wellbeing was similar in both cases and found to be similar for older men and women, older Amdavadis ranked mental health benefits and physical activity/wellbeing almost equally important (n=25 and n=24 respectively) and strongly over social interaction (n=10) whereas in Ruhr Metropolis, participants ranked social interaction (n=27) higher than physical activity/wellbeing (n=22), but still far behind mental wellbeing (n=38). The findings confirm the results from the baseline surveys showing that in Ahmedabad, activities linked to mental and physical wellbeing are the most common reasons to visit the main research site followed by those related to social wellbeing, while in Ruhr Metropolis, the most common reasons are activities linked to mental and social wellbeing before those related to physical wellbeing (see fig. 5.3). It seems possible that the relatively low prioritization of social interaction in Ahmedabad has been influenced by the fact that older adults are predominantly physically active together, as part of regular yoga/exercise groups which include social interaction and/or because the majority of them lives together with other people.

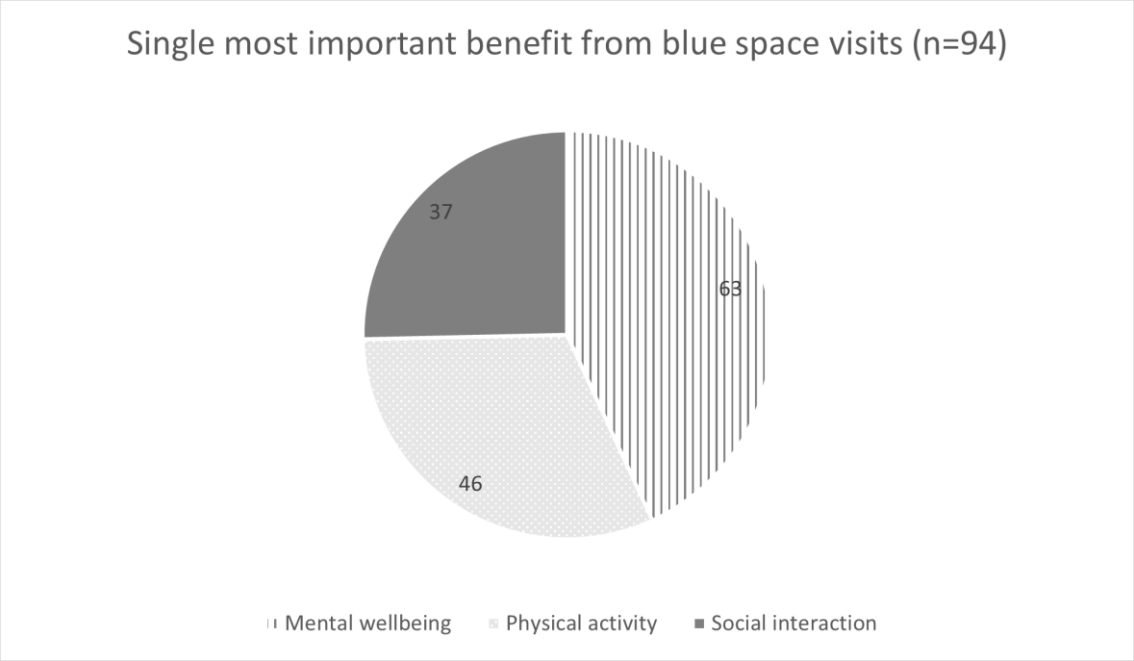


Figure 5.6: Single most important benefit from blue space visits in the multiple case study (author's compilation)

Although participants were asked to tick only one option, almost half of them (n=44) checked two or more options. This implies that older people tend to obtain multiple health

benefits from blue spaces and/or that the relative importance of each health benefit derived is difficult to determine. In both cases, ranking differences occurred with regard to the different sample groups, suggesting that social aspects such as cultural and religious background might influence the relative importance of health benefits from blue space visits.

Overall, the results confirm previous research showing that older people are more likely to report mental health benefits as the single most important benefit of blue space visits (De Bell et al. 2017) and that in comparison to green spaces, blue spaces are particularly appreciated by older adults for mental health benefits (Finlay et al. 2015). Yet, it is noteworthy that in both cases, the health benefits considered least important (social interaction in Ahmedabad, physical activity in Ruhr Metropolis) were still highly valued. Moreover, those activities have been identified as important mediating factors of blue health experiences in later life (e.g., Yang et al. 2024; Chen & Yuan 2020). With regard to the four general mediating pathways linking blue space and health, fig. 5.7 illustrates those salutogenic mechanisms by exemplary quotes from the study participants. Overlaps such as those between physical activity and mental wellbeing or physical activity and social interaction confirm the interconnectedness of the mechanisms widely shown in previous research. This also applies if the more general classification of salutogenic pathways into instoration/capacity building, restoration and mitigation by White et al. (2020) is used. Although a collective experience of nature was not explicitly mentioned by older adults in this study, this interconnectedness between social interaction and environmental quality has been shown in previous research, e.g., by Finlay et al. (2015).

Looking at the qualitative results of this study, older people across both cases expressed how important blue spaces are as popular destinations for individual and joint, regular and irregular, active and passive leisure activities and for providing environmental benefits such as fresh and cool air, contact to nature/wildlife and noise buffering. In addition, aesthetic pleasure and restorative experiences (e.g., relief from stress and negative emotions such as sadness and depressiveness) featured prominently in the data. Water was widely seen as a landscape element that beautifies and upgrades urban landscapes as well as green spaces which in turn enhances mental wellbeing. Participants

reported manifold positive feelings evoked by 'the blue' (see fig. 5.5 in this chapter) which were confirmed by positive affective states measured in valence and arousal ratings in the choice experiments.

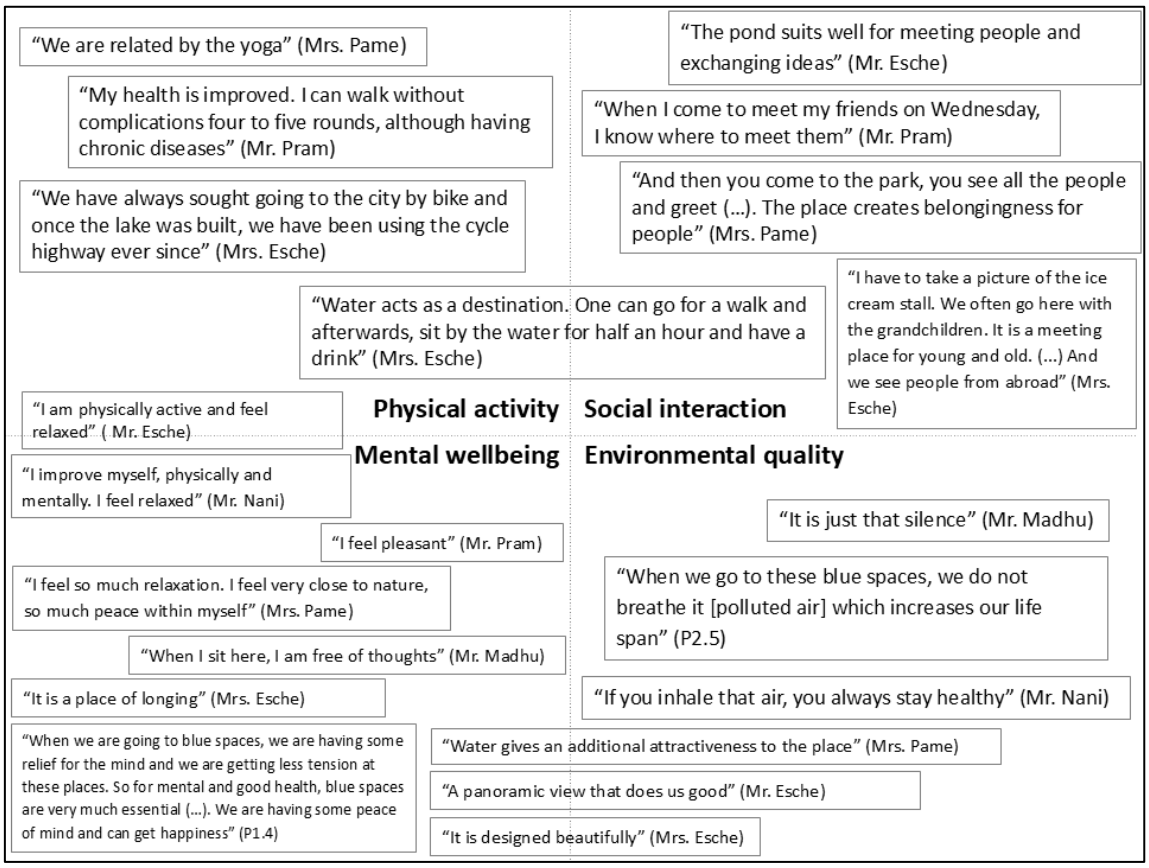


Figure 5.7: Exemplary quotes of study participants structured according to the mediating pathways (author's compilation)

Further, positive place attachments and symbolic or spiritual meanings attributed to (certain) blue spaces were reported, which seem to contribute to older people's wellbeing. Taken together, older adults widely perceived blue spaces as having positive impacts on their perceived health, wellbeing and quality of life as well as the relevance of those landscapes for promoting and protecting health for urban dwellers. These findings generally align with previous research on blue health experiential accounts of older people such as Pool et al. (2023), Coleman & Kearns (2015) and Finlay et al. (2015).

The classification of restorative benefits from blue spaces by Smith et al. (2022) was applied to the qualitative study data to explain this salutogenic mechanism in more detail,

as seen in table 5.2. Empirical evidence was found which supports three of the four categories: improved mood, relaxation and switch off. No evidence was found for the category 'time to think'. A possible explanation could be that in the study by Smith and colleagues, the majority of participants were aged under 65 years and those adults might seek blue spaces more often for having time to think. Generally, the results confirm that blue spaces are preferred in a relaxed and happy mood-state or in a stressed mood-state (for mental restoration) (Regan & Horn 2005).

Table 5.2: Classification of restorative benefits according to Smith et al. (2022) (author's compilation)

Restorative benefits	**Exemplary quotes from study participants**
Improved mood	"Valentina, for example, she is widowed and has no children. She is alone, here in Essen and in Germany. She said that when she is in a bad mood or having depressive thoughts, she goes to this lake and counts ducks [laughs]. For her, it is a leisure activity and calms her" (IG) "If you feel bad, have bad or gloomy thoughts, then go to and look at the water or look at the sky, that blue color (…) to relieve stress" (PGER1) "It is inspiring, the lake with the lotus. (…) I feel pleasant. Pleasant happiness it gives us" (Mr. Pram) "I improve myself, physically and mentally" (Mr. Nani)
Relaxation	"See, this is the age of tension, stress and suffering. When we are going to blue spaces, we are having some relief for the mind and we are getting less tension at these places. So for mental and good health, blue spaces are very much essential (…), are having a very useful purpose for our tensed mind. And when we are looking at the riverside or the pond, that water is flowing and we are having some peace of mind and can get happiness. So it is essential for this purpose" (P1.4) "It is calming" (PGER2) "It is a resting point. (…) I feel relaxed" (Mr. Esche) "Relaxation, restoration" (Mrs. Esche) "I feel so much relaxation. I feel very close to nature, so much peace within myself" (Mrs. Pame) "I feel relaxed" (Mr. Nani) "People generally come here for relaxation" (Mrs. Pame)
Switch off	"And if there is time, I sit here and enjoy life" (Mr. Pram) "When I sit here, I am free of thoughts" (Mr. Madhu) "One can stay in a place; there are no constraints as in the city" (Mr. Madhu)
Time to think	/

Regarding the latter case, this study adds evidence to previous studies (e.g., White et al. 2021) that blue spaces are visited by people with mental illnesses such as depression particularly for their calming, stress-reducing and mood-enhancing powers as part of self-management processes. Eight out of 11 participants with low mental wellbeing (measured by the WHO-5 questionnaire) checked mental health benefits as the most important

benefit from blue space visits. However, this study could not assess whether the restorative benefits of blue space exposure are greater for older people with chronic diseases as shown in previous studies (Liu et al. 2024; De Bell et al. 2017; Finlay et al. 2015).

As the first research question referred to the perception of blue spaces as potentially therapeutic landscapes and sought to determine the health-related dimensions of appropriation, the therapeutic landscape framework adapted by Völker & Kistemann (2011, 2015) is used for summarizing the results. As can be seen in fig. 5.8, all four dimensions of (blue health) appropriation were identified in this multiple case study, meaning that urban blue spaces constitute potentially therapeutic landscapes, which can promote older people's health and wellbeing as they interact with them through activity, social, symbolic and experienced spaces. Just as the salutogenic mechanisms described above, the dimensions are not strictly delineated but can overlap (Völker & Kistemann 2013).

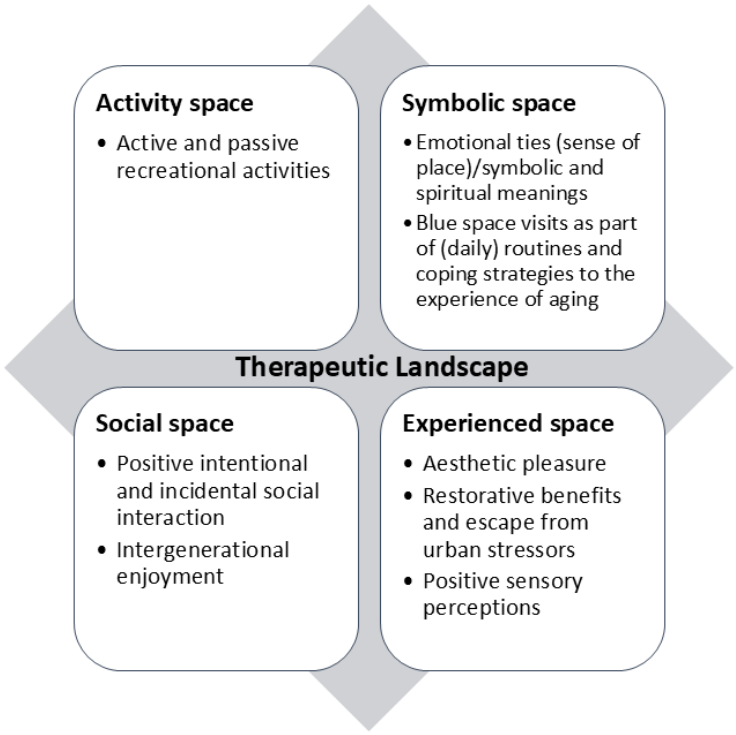


Figure 5.8: Dimensions of blue health appropriation in later life (author's compilation based on Völker & Kistemann 2011, 2015)

Activity space

As aforementioned, blue spaces are widely used by older people in Ahmedabad and Ruhr Metropolis for active and passive recreational activities. In line with previous research, this case study found that older urban dwellers predominantly undertake moderate water-related (cycling or walking along the waterfront) and water-independent (e.g., light exercise, yoga) physical activities at blue spaces. Only a minority of participants reported doing watersports. While other researchers found that positive health outcomes from blue space exposure in later life occur particularly when doing higher intensity activities such as running, swimming or cycling (Garrett et al. 2019b), the benefits of moderate physical activity –as the most common activity type of older adults– should not be underestimated. This counts even more as studies identified walking along blue spaces as a factor partially mediating mental health benefits (Murrin et al. 2023; McDougall et al. 2020; White et al. 2020; Pasanen et al. 2020). Seeking blue spaces for aesthetic enjoyment/watching the scenery, relaxation/contemplation/restoration, socializing and nature/wildlife watching were identified as the most common passive recreational activities at blue spaces.

Social space

Similar to previous studies, this multiple case study found that urban blue spaces constitute places for positive intra- and intergenerational social interaction in later life, including intentional social interaction for shared hobbies or spending time with family and friends and incidental social interaction with strangers. Other research (e.g., Smith et al. 2022; Finlay et al. 2015) has indicated that social interaction occurring at 'the blue' is particularly appreciated by older adults experiencing loneliness and that blue spaces might therefore be able to prevent and/or reduce loneliness and social isolation. While it was not possible to quantitatively assess this linkage, this study provides similar tentative evidence as some participants reported visiting blue spaces particularly because they live alone or when feeling lonely. Notably in Ahmedabad, users of the main research site reported about a high social cohesion among Parimal Garden visitors due to the long-standing user routines established and the cultural activities provided at the amphitheater. Enjoying intergenerational activities such as watching children play/playing with children and going to the ice cream stall was valuable to many participants. In both cases, older adults engaged voluntarily to maintain blue spaces (e.g., by donating benches and plants,

initiating a citizens' neighborhood cleaning initiative). As shown in this and other studies (e.g., Pool et al. 2023), the social connectedness experienced at blue spaces and the voluntary engagement contribute to a sense of pride and social participation in older adults. Pro-environmental behaviors might positively impact individual wellbeing by inducing positive emotions (White et al. 2020; WHO 2016).

Symbolic space

This study has shown that many older people hold strong emotional ties (a sense of place) to blue spaces, including specific meanings, values and symbols which are known to be linked to individual wellbeing (Völker & Kistemann 2013). Parimal Garden, for example, acquires a specific meaning for older individuals through symbolic and spiritual attributions, such as *"I think of Lotus when I see the water here. It is not the season, but when I come here, I think of all the pink Lotus (...). You can say that is Parimal Garden for me: Water and Lotus"* (Mrs. Pame) or *"At the time I am here, there are imaginary effects of natural vibrations"* (Mr. Madhu). In India, many participants further highlighted the religious and spiritual value of waters such as the River Ganges. A strong sense of place can apply to both, blue spaces near-by and far away, as noted by Mrs. Esche (*"Although we are living five kilometers away, the lake is in our thoughts. That is why we go there"* and *"It [the North Sea] is a place of longing"*). Moreover, blue spaces can be linked to a sense of identity, as e.g., reported by the photowalk participants in Ruhr Metropolis (*"Yes, as a citizen of Essen. It [Lake Niederfeld] shows the diversity in the neighborhood and how it changed"* (Mr. Esche), *"We like to show guests how a city can change"* (Mrs. Esche)). Overall, these findings suggest that older people also derive various intangible benefits from blue spaces and that they continue to hold strong emotional bonds despite negative memories shared with these places (e.g., loss of husband) and the challenges or cost potentially associated with blue space visits. Older people or people in general might even possess a "psychological need" (*"a feeling of vibration of existence; the origin, the source of human being"*) for water as argued by participant Mr. Madhu. These results confirm previous research having shown a strong emotional connectedness of older people to blue spaces and perceived wellbeing in later life (e.g., Coleman & Kearns 2015; Finlay et al. 2015). While this study found that blue spaces entail a spiritual value for many participants, it could not confirm previous

research showing that older people seek a spiritual connection with loved ones at blue spaces (Finlay et al. 2015). The potential of blue spaces to provide support in leading an active, independent life, in maintaining (daily) routines and to cope with the experience of aging has been identified as a pivotal benefit for older adults in other studies (e.g., Smith et al. 2022; Coleman & Kearns 2015; Finlay et al. 2015). Likewise, this study found that places such as Parimal Garden or Lake Niederfeld have become part of older people's (everyday) routines and a reason to go out, thereby helping to uphold structure and providing a sense of purpose, familiarity and security. Mrs. Pame in Ahmedabad gives a particularly impressive example of this matter when reporting that she decided to stay in the city after her husband's death *"(...) because living in Ahmedabad means being able to come to this place [Parimal Garden] every morning, starting my day here. I cannot think of my life without coming to this place."* As described by Coleman & Kearns (2015), 'the blue' might not only be a recreational site for many older adults, but "a resource for life itself" and "a fluid context for emotional wellbeing" particularly due to their affective ties with such spaces, involving symbolic connections with the past (e.g., positive memories) and a symbolic/spiritual value ("something larger than oneself") which provides individual sense-making and support to deal with the strains of later life.

Experienced space

Older adults in this study reported to experience positive multisensory perceptions and aesthetic pleasure when being exposed to blue spaces and attach importance to 'the blue' as a landscape design element. The findings align with previous research having widely shown that people are attracted and fascinated by the aesthetic quality of water and generally prefer landscapes containing water. Apart from visual delight, study participants highlighted blue space properties that allow escaping from urban stressors (i.e., the sensory overload perceived in cities) such as providing fresh air, coolness, noise buffering, solitude and tranquility and a distinct contact to nature/wildlife (e.g., aquatic plants and animals) as compared to mere green spaces. As mentioned by older people, these factors enable restorative and contemplative experiences particularly in dense urban settings like Ahmedabad but were also deemed important by older adults in Ruhr Metropolis. This confirms the assumption of other researchers that the perception of

environmental benefits such as an improved microclimate facilitates achieving a state of calm and relaxation (Cao et al. 2023).

Interestingly, many participants in both cases found it difficult to determine concrete health effects from blue spaces and their causes by themselves, although the overwhelming majority affirmed deriving health benefits from blue space visits. A potential explanation could be a still narrow, biomedical understanding of health prevailing in the public, i.e., largely excluding psychological, environmental and social influences. Yet, it also points to the general complexity of the blue space-health relationship and the difficulty identifying the health-enabling factors.

Health-limiting factors

Within the dimensions of appropriation of a therapeutic landscape, human health can be both, positively and negatively, affected (Smith et al. 2022). Looking at the quantitative findings, half of the baseline survey samples (27 out of 55) reported to associate potential health risks with blue space visits. The most common perceived risks were safety concerns (feelings of fear and danger: n=10, criminal and illegal activities: n=7, attack risks from animals and fallen branches/trees: n=9) and the exposure to disease vectors/risk of infection (n=3). Other, less frequently mentioned risks were allergies and other health risks such as heat shocks (n=2), accidents and injuries (n=2), feelings of discomfort, natural hazards such as floods, exposure to greenhouse gases and particulate emissions (n=1 each). Interestingly, the perception of risks varied across both cases. Feelings of fear and danger/criminal and illegal activities were only checked in Ruhr Metropolis, while health concerns (the exposure to disease vectors/risk of infection, allergies and other health risks) and attack risks from animals and fallen branches/trees were almost exclusively noted in Ahmedabad. This pattern was also observed in the qualitative findings. As mentioned above, the analysis of the qualitative data further revealed that negative sensory perceptions such as noise, crowdedness, visible environmental degradation (e.g., presence of algae, waste) and olfactory pollution limit the experience of health and wellbeing benefits, highlighting the critical role of blue space quality for enabling ‘blue health’.

Implications for practice

While this study shows that older people in two distinct urban contexts derive benefits for their (perceived) physical and mental health and wellbeing from blue spaces through therapeutic landscape experiences (interacting with 'the blue' in four ways, as activity, social, symbolic and experienced spaces), the findings also highlight the importance older people attribute to urban blue spaces as therapeutic landscape settings for improved environmental quality in cities (e.g., appreciating clean and cooling air). Although this study did not measure environmental benefits quantitatively and the existing evidence base on this mechanism is still scarce, older people are likely to benefit from such protective effects against urbanization-induced health risks such as air and noise pollution, density and heat islands –even if not actively using blue spaces (Hunter et al. 2023; Kabisch et al. 2017). This might count particularly for reducing the morbidity and mortality related to cardiovascular and respiratory diseases as leading causes of burden of disease and disability in old age, for which exposure to air pollution and heat form risk factors (Jiang et al. 2016; Burkart et al. 2015; WHO 2015). Yet, the potential of urban blue spaces for reducing the mental health burden of older people associated with the urban stressors densification and noise would also be worth investigating further. As the qualitative study data has shown, quite a few older people seek urban blue spaces specifically for finding solitude and tranquility in cities.

Overall, the findings of this study align with the quantitative and qualitative evidence base on positive effects of blue space exposure on older people's general, physical and mental health and wellbeing outlined in chapter 2.5. Taken together, this calls for enabling access to and use of high-quality urban blue spaces for older adults from a public health perspective, in terms of prevention, rehabilitation and therapy, with the ultimate aims to promote health and to compress morbidity and disability in later life. Urban blue spaces provide opportunities for physical activity, social interaction and mental restoration, all being critical leverage points for healthy aging. As noted by the WHO (2020), "healthy aging is about creating the environments and opportunities that enable people to be and do what they value throughout their lives." Based on the results of this study and following the calls of other researchers (e.g., Aliyas 2019), it seems useful to link the provision of urban blue spaces with interventions targeting older people's behavior, e.g.,

by offering sports/fall prevention courses, joint neighborhood walks and social activities. This could be particularly an opportunity for Ruhr Metropolis to learn from the case study of Ahmedabad, where outdoor group activities at blue spaces (at least informal ones) are more common. “Green health prescribing”, “green social prescribing” or “nature prescriptions” (i.e., prescribing nature-based (social) interventions and activities by healthcare professionals) appear to be promising concepts in this regard, which could be extended to urban blue spaces. To distinguish it from ‘blue care’ (i.e., interventions specifically designed and structured with a therapeutic purpose for individuals with a defined need (see Britton et al. (2020)), ‘blue health prescribing’ might be an innovative way for healthcare professionals to prescribe contact to ‘the blue’ as a preventive, health-promoting measure. Depending on the healthcare system, various healthcare professionals are authorized to issue preventive recommendations. However, the necessary dose for health effects, e.g., the time which has to be spent at (which) blue spaces, has yet to be determined and might differ between and within population groups. The health benefits of physical activity, including improved mental wellbeing and preventive effects against various NCDs such as cardiovascular diseases and diabetes as well as associated premature mortality are well established in scientific literature (Völker & Kistemann 2013). For older adults in particular, a systematic review and meta-analysis on the consequences of physical inactivity concluded that physically active older adults face a reduced risk of multiple adverse health outcomes such as all-cause and cardiovascular mortality, breast and prostate cancer, recurrent falls, functional and cognitive decline, dementia and depression (Cunnigham et al. 2020). They also experience healthier aging trajectories and a better quality of life (ibid. 2020). Yet, the global prevalence of insufficient physical activity increased among older adults over the past years and is highest in the oldest age groups (Strain et al. 2024). The WHO, in its toolkit for promoting physical activity for older people (2023), has recommended educating and encouraging older adults and people working with them, adapting programs and services and enabling physical activity every day by providing supportive environments such as public open spaces and parks.

While urban blue spaces function as places of retreat for older people to escape from population densification (particularly in cities in LMICs), they also function the other

way, as popular meeting places for intra- and intergenerational social interaction –"a basis for a healthy and meaningful life" (Beatley & Konijnendijk 2018: 242). Thus, blue spaces hold considerable potential to enhance social wellbeing in later life and to reduce loneliness and social isolation, which are typically described as "urban plagues" associated with negative individual and public health outcomes (ibid. 2018; Lederbogen et al. 2018). Rates of loneliness among older adults differ across countries, yet they mark key risk factors for mental illness in later life (WHO 2023). In the case of LMICs like India, impacts of the increasing erosion of traditional living arrangements and a reduction of intergenerational households cannot yet be foreseen, but several interviewees in this study pointed to potential negative effects on older people's social connectedness to be expected by this development trend. Other "socializing spots" (JP) such as urban blue spaces might therefore become even more important in future.

The high aesthetic value of blue spaces can be used to increase the aesthetic properties of urban areas and thus, to enable aesthetic experiences that seem to positively affect human health and wellbeing. As argued by researchers such as Tursić (2019) and Chiodo (2019), creating aesthetic appreciation in cities should not be underestimated nor considered as a luxury for a few individuals. "The aesthetic experience assumes an importance for its potential to activate the agency of urban actors and fundamentally influences our actions towards the urban environment" (Tursić 2019: 11). In this sense, the aesthetic dimension of urban experience ("the city as an aesthetic space") provides the possibility to produce new meanings of the world individuals are part of:

> *"Since our existence as human beings involves both an alternating involvement with, and detachment from, society, we escape in the realm of the aesthetic only to realize that even the world of our imagination is based on our actual lived experience, which we relentlessly try to overcome. Aesthetics continually gives rise to something new, something that can surprise us, and therefore, creates a new set of meanings within our existing area of societal representations"* (ibid. 2019: 18f).

Similarly, Chiodo (2019) highlights that unbeautiful spaces do not express humans' capacity of and aspiration for self-evolution, but its opposite: "A city deprived of beauty (…) is not ethical, because it is a city which represents us incapable of evolving, and which makes us consequently act" (p. 35). Yet, it has to be considered that just as therapeutic landscape experiences are a relational outcome, aesthetic experiences involve subjectivity and interdependency as aesthetic sensitivities develop through people's

various interactions with spaces (Chiodo 2019; Tursić 2019). “The beauty of any part of an inhabited environment, as an emerging property, is, to a varying degree, flexible and open to constant change, and this further depends on people’s daily practices and their interactions (whether direct or mediated) with other members of society” (Tursić 2019: 18). As revealed in this study, older adults across different geographic contexts might have common landscape preferences such as for urban landscapes containing water in general and for larger blue and landscaped blue-green spaces specifically. Yet, group variations found in both cities point to the importance of having access to different blue space types in later life.

Finally, it should be kept in mind that enabling blue space access and use in cities benefits all population groups, not just older people and that those spaces –if smartly designed– also make cities more resilient and sustainable (Beatley & Konijnendijk 2018).

Importantly, the results of this study confirm previous research that blue health experiences in later life vary, resulting in diverse blue space-health relationships of older adults (Finlay et al. 2015). This can be seen in the differences in interaction with blue spaces (e.g., activities undertaken such as exercise in Ahmedabad, cycling in Ruhr Metropolis), in variations in blue landscape preferences and differences in the relative importance of the health benefits derived. As not all participants stated to obtain health benefits from blue space visits, this study supports speaking of urban blue spaces as ‘potentially therapeutic landscapes’ and to consider the therapeutic landscape experience as a relational outcome (Conradson 2005). ‘Blue health’ is not a pre-determined outcome from blue space exposure, what matters in particular is the interaction between a person and blue space. In this regard, it is important to consider the complexity of the blue space-health relationship and the individual and situational factors that modify the experience of health effects, as shown in this and other studies. For the ‘urban blue’, the results of this study confirm previous research such as Smith et al. (2022b) showing that blue space quality and multi-functionality such as offering opportunities for being physically active while also enabling the enjoyment of the natural environment are decisive for use. With regard to older people, another key influencing factor is the accessibility of blue spaces (see implications for practice in the next chapter).

This study shows that for most older people, the health benefits seem to far outweigh the potential health risks and efforts associated with blue space visits. Yet, urban blue space planning and design needs to face the challenge of integrating a pathogenic view as many of the health threats associated with blue space use such as sunburn, skin cancer, allergies and vector-borne diseases are amplified by increasing environmental degradation and climate change (Grellier et al. 2017). Nonetheless, "increased awareness of the potential hazards of urban green and blue infrastructure should not be a reason to stop or scale back projects. Instead, incorporating public health awareness and interventions into urban planning at the earliest stages can help ensure that green and blue infrastructure achieves full potential for health promotion (Lomus & Balbus 2015: 1)."

5.1.2 Matching of older people's demands and needs with the urban blue space provision in Ahmedabad and Ruhr Metropolis

Assessment of the urban blue space provision in Ahmedabad and Ruhr Metropolis

As shown in table 5.3, this study found high agreement rates (i.e., more than two thirds of all participants) for good access to urban green spaces, the walkability of and the social inclusion within the respective communities in both cities. Access to urban blue spaces was rated lower. Yet, still more than half (23 out of 41) of the sample in Ruhr Metropolis and almost half of the sample (23 out of 53) in Ahmedabad somewhat or strongly agreed with this statement, in total 46 out of 94 participants.

Interestingly, the rating of the living conditions was generally better in Ruhr Metropolis than in Ahmedabad, except for the presence of urban stressors (agreement rates of about half of the sample in India versus two thirds of the sample in Germany). In both case studies, some unexpected variations were found across the respective samples of older adults. For example, the agreement rate of older Turkish migrants for feeling respected and socially included was higher as compared to non-migrants despite their (supposedly) high prevalence of loneliness and social isolation. In Ahmedabad, the majority of members of the senior citizens' association Juhapura rated their access to urban blue and green spaces better than older adults living in other neighborhoods, despite the area being one with the least blue and green cover. A possible explanation for this might be due to different individual understandings of notions like "good access" or

"feeling socially included" which do not specify if e.g., access by walking or by car count as equal.

Table 5.3: Results of participants' rating of their living conditions (author's compilation)

Question	Results	
	Somewhat or strongly agree (n)	Somewhat or strongly disagree (n)
My community provides me with good access to urban green spaces.	73	14
My community provides me with good access to urban blue spaces.	46	38
There are many urban stressors (e.g., air pollution, traffic congestion, noise) in my community.	54	33
Overall, my community is a pleasant place to walk.	63	21
There are major barriers to walking in my neighborhood that make it hard to get from place to place.	40	44
I feel respected and socially included in my community.	70	14

The analysis of the qualitative data revealed a more differentiated picture of older adults' ratings of the respective urban blue space provision. In both cities, participants expressed concerns about the availability, accessibility and quality of blue spaces; however, those emerged particularly prominently in the Indian case study. For Ruhr Metropolis, this study found a generally high satisfaction with the blue-green transformation achieved in the city of Essen, except for some older adults criticizing the lack of blue spaces in the city center and in some Northern areas. In Ahmedabad, the study findings demonstrate that marginalized groups such as Indian Muslims are particularly affected by environmental inequalities, confirming the widespread concern that 'the therapeutic blue' in cities of LMICs becomes more too often an exclusionary space (Hunter et al. 2023; UN 2020; Foley et al. 2019b). Concurrently, many older Amdavadis reported that recent urban blue space regeneration initiatives such as the Sabarmati Riverfront and Kankaria Lake have improved the availability of high-quality blue spaces in the city, with the limitation that this perception depends on factors such as individual landscape

preferences, affordability and the place of residence (and thus, differences in accessibility). The most prominent theme emerging from the qualitative analysis was maintenance problems (i.e., to keep blue spaces clean, functional and safe), which reiterates the critical role of urban blue space quality (both, in terms of ecological quality and quality of amenities provided) as noted previously in this and other studies. While some of the reasons for poor maintenance of blue spaces seem to be regulatory in nature (e.g., lack of action against environmental pollution) or stem from poor management and diffusion of responsibility (structural deficits), others seem to be difficult to change, e.g., the general water scarcity in dry regions.

Older people's demands and needs in relation to blue spaces

Consistent with previous research (e.g., Pool et al. 2023; Garrett et al. 2019b; Pitt 2019; De Bell et al. 2017; Finlay et al. 2015), this study found that the provision of amenities, accessibility to and within blue spaces, objective and perceived safety, the presence of vegetation and animals/perceived biodiversity are decisive factors of blue space use in later life, irrespective of the geographical context. In both cases, the following aspects and elements were identified to be important for visiting blue spaces, based on quantitative and qualitative (photographic and interview) data analysis (see fig. 4.11 in chapter 4.1.2.2 and fig. 4.18 in chapter 4.4.2.2):

- Age-friendly access and design (e.g., barrier-free design, solid pathways and non-slippery grounds, convenient access, good traffic and public transport connections, bike lanes and walkways)
- Amenities such as seating options, drinking water stations, playgrounds and other features for children and youth (e.g., water fountains, skate rinks), public toilets, shade
- Safety
- Maintenance
- Landscape design: ample free space, greenery/vegetation and presence of wildlife

Differences in the importance of certain aspects and elements between the two cases emerged with regard to the role of private transportation (e.g., calls for better general

traffic connections and sufficient parking space in Ahmedabad), the soundscape at blue spaces (ranked more important in Ahmedabad) and the risk perception/perceived safety. In Ahmedabad, participants highlighted the importance of insect control (relating to the risk of infection associated with blue space visits) but ranked the presence of people less important as compared to participants in Ruhr Metropolis. They also pointed to the need to ensure blue space accessibility for older people with disabilities and called for the provision of wheelchairs, assistance and shuttle services. In Ruhr Metropolis, participants called for the provision of catering options such as cafés and addressed safety issues such as traffic safety (e.g., calling for separate cycle and pedestrian paths at Lake Niederfeld), the provision of sufficient lighting and the prevention of misuse and dangers. The variations in perceived safety observed across different geographic contexts confirm previous research findings such as those by Garrett et al. (2019b). It is noteworthy that despite some general safety concerns, both main research sites were mostly considered as extremely or quite safe places. Interestingly, despite being known as an influencing factor of blue space use, weather was ranked least important for blue space visits in both case studies. This accords with previous studies (e.g., Cao et al. 2023; White et al. 2020) having found inconclusive evidence on the concrete impact and importance of weather to blue space visits.

The above-mentioned aspects and landscape elements were perceived as both, age-friendly features and features enabling the experience of health benefits in both cases. They overlap with the landscape elements that shape how participants feel in blue spaces and which places they identify as their favorite (see chapter 5.1.1).

Fits, misfits and changes needed

Interestingly, both main research sites were considered as good examples of age-friendly urban blue spaces by most participants, with high agreement rates in terms of safety and quality (e.g., overall appearance and aesthetics, provision of amenities). In both cities, many participants also rated other blue spaces favorably; yet, variations in landscape preferences (e.g., preference for landscaped vs. rather natural blue space designs) and perceived accessibility occurred.

As table 5.4 shows, this study found certain misfits between older people's demands and needs and the actual urban blue space provision in both cases. Those can be

summarized as obstacles to accessibility (e.g., due to existing environmental injustices/lack of blue spaces, dependency on public or private transport and/or inconvenient public transport connections and lack of barrier-free design), lack of amenities at blue spaces such as public toilets, catering and seating options and maintenance difficulties.

Table 5.4: Misfits between older people's demands and needs and the actual urban blue space provision (author's compilation)

Misfits	**Exemplary quotes from study participants in Ahmedabad and Ruhr Metropolis**
Obstacles to accessibility	"They [the government] develop only certain areas or communities whereas certain areas are totally ignored. The population is large and there is no lake, no swimming pool, no public garden in this area where almost seven lakhs [700,000] people are staying. The development is lopsided" (P1.3 in Ahmedabad) "We are compelled to stay whatever place we get to live in" (P1.3 in Ahmedabad)
	"The Riverfront is a closed place. (…) We have to move across the pollution to enjoy there. I dislike it" (P1.6 in Ahmedabad)
	"Coming to those places through that traffic must be considered. If it is dense, does it make sense to come here? You should forget the inconvenience you have to come here once you have reached. If you have all that still in your mind, you think, 'Why not going to your private balcony?'" (Mrs. Pame in Ahmedabad)
	"The car also needs to be maintained and is costly, but one does not count that, right? [laughing]. (…) They [older adults] do not come [to the riverfront] unless you have a private vehicle. It is too far away" (Mrs. Pame in Ahmedabad)
	"People with a rollator cannot visit the lake" (PGER11 in Ruhr Metropolis)
Lack of amenities	"Shade and seating options are important for older adults, so that they can rest and have an ice cream [laughing]" (PGER7 in Ruhr Metropolis)
	"The smell is unpleasant and there are no seating options" (Mr. Esche in Ruhr Metropolis)
	"(…) for those who are very old, who cannot walk properly, they should be able to reach the water edge, have sitting options there" (Mr. Pram in Ahmedabad)
Maintenance difficulties	"If you see places like Malav Talav and Vastrapur Lake, they are all dried up" (P2.5 in Ahmedabad)
	"So what sense does that make, what is the idea of closing it [the broken elevator at the Riverfront] at all? You know, it happens often in India: They implement facilities, but then…If I think about old people, how to get to the water?" (Mrs. Pame in Ahmedabad)
	"Now we are sitting at Law Garden, look at the benches there. There are 25 sweepers, security and watchmen and money too; the government pays enough salary but look around the employees do not do it" (P2.2 in Ahmedabad)
	"The swimming pools are in a catastrophic condition. Maintenance has become difficult with regard to municipal cultural and sports facilities" (Mr. Esche in Ruhr Metropolis)

In both cases, a large number of those participants rating the current access to blue and green spaces good would yet like to live in bluer and greener communities. However,

moving closer to blue spaces was considered impossible, be it due to the unavailability of such spaces in the wider neighborhood (e.g., Juhapura in Ahmedabad, city center in Ruhr Metropolis) and/or due to the high costs of housing by the water. Contrary to expectations, this study did not find absolute approval for further urban blue space development among older people in Ahmedabad as several participants expressed reservations due to the already prevailing difficulties to maintain the existing blue spaces and the regional water stress. While some of the issues appear to be self-inflicted and relate to general development challenges in LMICs (e.g., the emergence of autocratic management, clientelism, corruption), it has to be considered that cities in those countries face the challenge of tackling multiple urban development needs concurrently, many of which appear to be more important than the provision of blue and green spaces. In this regard, it is important that several participants considered Ahmedabad as a pioneer for public blue and green space development in India, pointing to the potential of transferring lessons learned to other Indian states.

Implications for practice

Based on the results of this and other studies, older people in cities across geographic contexts often face difficulties in accessing safe, well-equipped and well-maintained urban blue spaces, although the challenges are obviously more complex in LMICs. Hence, the current misfits between older people's demands and needs and the actual blue space provision in Ahmedabad and Ruhr Metropolis –summarized as obstacles to accessibility, lack of amenities and maintenance difficulties– represent key intervention points for urban planning and design. With the overarching aim to enable urban blue space access and use for all older people (and beyond), independently of their socio-economic status and their mental and physical capacities, it is important that urban blue space governance –in the same way as the concept of healthy aging (WHO 2020)– incorporates the two key considerations of inequity (in the distribution and accessibility of blue spaces and opportunities to use those) and diversity (e.g., of blue space users and blue landscape preferences). Particularly in cities in LMICs, the dependency of many older adults on private transport to reach blue spaces and as such, the affordability of this mobility can pose central barriers to using blue spaces in later life. Developing and improving public transport as well as the provision of financial support (e.g., vouchers for older people)

can therefore contribute to improving blue space access for older adults. As outlined in chapter 2.5, there is currently no accepted standard in measuring blue space exposure and commonly used availability metrics such as distance or water coverage ratio seem to be insufficient surrogates for blue space use in later life (Lin & Wu 2021; Helbich et al. 2019; Kabisch et al. 2017). To meet the demand of older people to live close to accessible and well-maintained urban blue (and green) spaces, cities –as part of their urban blue and green space planning– should conduct small-scale (neighborhood level) analyses considering other information than the mere proximity and access, most importantly, blue space quality (Hunter et al. 2023; Lin & Wu 2021; Garrett et al. 2019b). As highlighted by Hunter et al. (2023), blue space quality might even be a greater determinant of non-use than the proximity. Planning analyses could assess the potential of neglected or unmanaged urban blue spaces from the perspective of (potential) users as exemplary shown by Wilczynska et al. (2021) in the city of Warsaw or link different spatial characteristics of blue spaces (e.g., surface area, naturality, noise levels) with the ecosystem services provided by using geospatial information (e.g., Guinaudeau et al. 2023 in Geneva, Switzerland). Yet, such studies providing policy-relevant information are scarce (Zhang et al. 2022; McDougall et al. 2020).

Although potential differences in the exposure to blue spaces (e.g., visual vs. physical, incidental vs. intentional exposure) and the health benefits derived could not be investigated in this study, visual access to blue spaces might play a particular role for older people with strong mobility impairments and those in need of care. Further application-oriented research seems useful which could result in developing a 'Blue Window View Index' analogous to urban green spaces to facilitate assessing and comparing visual blue space exposure (Bolte et al. 2024). Whether and to what extent such metrics could eventually become standard in urban planning and building design or how virtual blue space exposure could promote health in old age would be other practical research questions worth investigating.

In line with earlier scientific findings (e.g., Pool et al. 2023; Chen & Yuan 2020; Helbich et al. 2019; Huang et al. 2019; Coleman & Kearns 2015; Finlay et al. 2015), the results of this study support decentralized (small-scale) urban blue space planning approaches wherever possible due to aging-associated changes in health and mobility levels posing

obstacles to reaching blue spaces. Another reason is the strong sense of place, which many older people built over years to those "everyday therapeutic landscapes". However, in many cities, current blue space planning approaches do not seem to meet this demand as flagship projects creating "signature blue spaces" instead of "neighborhood blue spaces" such as the Sabarmati Riverfront in Ahmedabad often prevail. The possibility of introducing legal requirements to designate urban blue spaces (as known for green spaces e.g., in the German Building Code) might work in some cases. Yet, limitations such as existing water stress and natural water scarcity have to be considered.

"Living by the water" is likely to continue as high-priced housing developments. However, the effects of climate change, such as increased flood risks or the spread of mosquitoes into new habitats causing changes in the epidemiology of vector-borne diseases, could also make "living by the water" less attractive and even more expensive in the future, e.g., due to rising insurance rates. In any case, projects such as Lake Niederfeld and others (see e.g., Brückner et al. 2022) show that integrating concerns of social equity is possible, e.g., by ensuring public control over the real estate market and providing social housing in addition to private residential developments. Depending on the city and the availability of larger blue spaces, there are possibilities to facilitate "living on the water" and thus, to better harness the health benefits of blue space exposure.

With regard to landscape design, applying universal design principles could help to create more inclusive blue spaces for all population groups, including for people with disabilities. Appropriate guidelines and recommendations have already been developed that could be adapted to blue spaces, e.g., the universal design guide for public places by the building and construction authority Singapore (BCA Singapore 2016) –an initiative under Singapore's Action Plan for Successful Ageing– or the guide to universal design by the American Society of Landscape Architects (2019). To cater for the variations in blue landscape preferences, it is recommended to integrate different designs at blue spaces as well as enabling access to different types of blue spaces within a city. Despite the difficulty to generalize concrete design requirements due to variations in preferences and in older people's intrinsic capacity and thus, different understandings of age-friendliness, which emerged from the analysis (e.g., varying demands for seating options), this study has shown that the provision of common amenities such as benches, public toilets and

catering options as well as achieving multi-functionality and safety at blue spaces is important to attract older people to use those potentially therapeutic landscapes. Importantly, this does not exclude other population groups. In fact, the results show that older people's perceptions of age-friendly and health-enabling blue spaces include the provision of features for children and youth as many of them prefer multi-generational enjoyment.

The demand for introducing (better) maintenance strategies (targeting the ecological quality of and the quality of amenities at blue spaces) emerged in both case studies. As both cases revealed, a possible part of solutions for the provision of amenities and maintenance of blue spaces could be private donations of equipment and civic engagement by older people (e.g., as "blue space guards"). This supports previous research having observed that blue spaces can become "caring spaces" for which local users felt a collective responsibility to look after, particularly when being involved in the development process (Pool et al. 2023; Smith et al. 2022; Buser et al. 2018). Yet, this voluntary work must be supported by professionals. Further opportunities for the regeneration and support of maintenance of urban blue spaces may be found in the expansion of public-private-partnerships in the context of corporate social responsibility actions as exemplary shown in Ahmedabad. Here, participants suggested other concrete measures such as fighting corruption and preventing the diffusion of responsibility, improving the local sewage management and preventing public misuse, e.g., by introducing restrictions on plastic use and food consumption at blue spaces or by enabling temporary uses of dried out lakes for community gardening and other community-building activities. As the presence of vandalism and litter at public spaces is known to encourage further anti-environmental and anti-social behavior, researchers have called for easy-to-implement measures such as the provision of bins and running awareness campaigns (Schultz et al. 2013). While those seem generally reasonable, it is questionable to what extent such measures are effective in cities in LMICs in which issues such as informal settlements require specific (planning) solutions.

5.1.3 Reflection and consideration of health interests and older people's demands and needs in urban blue space planning and design

Blue space development and management in Ahmedabad and Ruhr Metropolis

Broadly speaking, the urban blue space development and management in both cases reflects trends seen in urban blue space governance elsewhere, particularly the regeneration of waterbodies in the course of large-scale flagship projects (e.g., Emscher restoration, Sabarmati Riverfront) (Brückner et al. 2022; Smith et al. 2022; Samant & Brears 2017; Völker & Kistemann 2013). Other actions include the integration of artificial waters into the urban fabric and green spaces. While both river revitalization projects aimed for multi-dimensional goals, the restoration of the River Emscher in Ruhr Metropolis was predominantly linked to ecological aspirations, whereas ecological aims played a less prominent role in Ahmedabad. In fact, based on the study data, it remains an open question whether ecological improvements have been achieved by the project. In both cases, a multi-actor blue space governance (due to different responsibilities on the governance levels) with different types of public participation (yet, less prevalent in Ahmedabad) and mixed funding schemes prevail. One interesting finding is the positive experiences made with involving the private sector in public urban blue and green space development in Ahmedabad in the course of corporate social responsibility activities. Also in Germany, the project Lake Niederfeld in Ruhr Metropolis shows that involving the private sector such as housing associations can promote urban blue space development.

In accordance with the present results, previous research (e.g., Hunter et al. 2023; Zhang et al. 2022; Brückner et al. 2022; Smith et al. 2021) has demonstrated that blue space development is not yet widely used as a public health intervention. In the present case studies, health interests are noted to be considered in the respective urban planning approaches to some extent, yet the results remain quite vague in this regard. These findings corroborate with those obtained by other researchers such as Baumeister (2017) who identified insufficient governance structures as a key reason for the neglect of health concerns in blue space development planning. So far, urban blue space development planning would rather proceed as a "closed procedure" in which fulfilling the minimum of legal requirements has priority. Hence, voluntary tasks such as integrating concerns of health promotion and collaborating with actors beyond mandatory procedures (e.g.,

public health representatives) would typically not be pursued (ibid. 2017). Interestingly, in Ruhr Metropolis, blue spaces have recently been discovered as settings for behavioral public health interventions as one interviewee reported, referring to an initiative "Healthy along the Emscher" by a health insurance who provided fitness equipment along the river. However, the provision of those facilities was not linked to age-sensitive course offers.
Looking at the planning instruments in place, the study reveals that informal ones such as masterplans (Ruhr Metropolis) and municipal planning goals (e.g., green space cover including artificial waters in Ahmedabad) are more prevalent than formal planning instruments such as legal requirements. Nonetheless, the case study Ruhr Metropolis demonstrates that having a masterplan ("Open space creates urban space") can contribute and drive a successful blue-green urban transformation as reflected in the award as European Green Capital 2017. Interestingly, one interviewee in Ahmedabad referred to existing legal requirements for retaining the city's lakes. Yet, it seems that those requirements currently fail to help maintain these blue spaces, as many of them are in a desolate condition. In the past, a national policy ("National Lake Conservation Plan") at least ensured the provision of some funds for maintaining urban lakes.

Both cities struggle with existing disparities in the blue space distribution (Ahmedabad: East-West, Ruhr Metropolis: North-South), yet the city of Essen can be seen as a regional pioneer in reducing existing environmental injustices promoted by focus planning on deprived communities. Nonetheless, balancing social and economic interests in blue space planning turned out to be a contentious matter in both cases and in public as well as private sector-driven urban blue space development. These results accord with earlier research linking urban blue space development with commodification, privatization and the risk of social exclusion (e.g., displacement of the urban poor, 'blue gentrification') (UN 2020; Kistemann 2018; Samant & Brears 2017).

Perceptions of the health potential of urban blue spaces for older people

Across both case studies, the majority of key informants and experts perceived urban blue spaces to be beneficial for older people's health and wellbeing (and other population groups), with the linkages to health sometimes being perceived more directly and sometimes more indirectly. Many interviewees pointed to strong interlinkages between

urban blue and urban green spaces and their advantages for urban health and wellbeing. The perceived health benefits of urban blue spaces were classified into four dimensions (i. beautification/water as a design element, ii. blue-green spaces as places for recreation, restoration and healthy behaviors, iii. as places for beneficial social interaction and iv. environmental benefits), reflecting those identified by older people themselves (i.e., positive effects on physical activity levels, social interaction, mental health and environmental quality). In Ahmedabad, a fifth dimension occurred with regard to blue spaces as places for health education, e.g., where public awareness campaigns and free health care services such as diabetes screenings are conducted.

Fig. 5.9 illustrates examples of the interview data. Overall, the analysis revealed that actors on the supply side of urban blue spaces also perceive them as potentially therapeutic landscapes, although the theory itself was not mentioned by any of the interviewees.

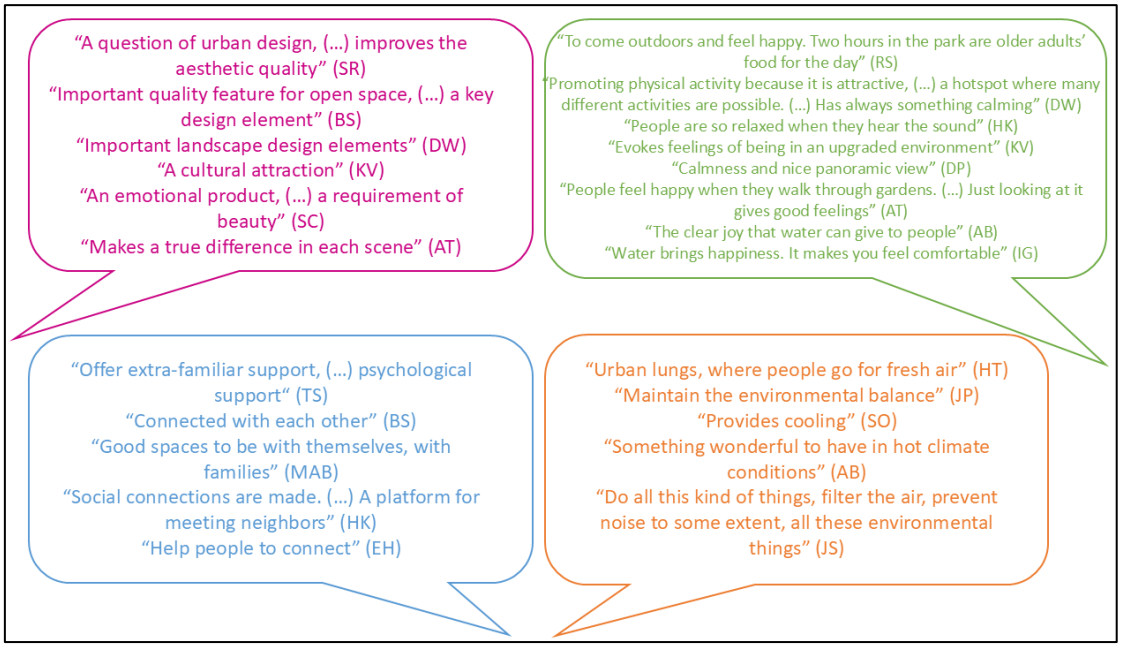


Figure 5.9: Perceptions of key informants and experts about the health potential of urban blue spaces for older people (author's compilation)

While this and other studies have shown that some benefits of blue spaces are particularly relevant for and appreciated by older people such as providing multi-generational enjoyment and contributing to maintaining a daily life structure, only a few key

informants and experts perceived health-related effects specific to older people. These include the protection against urban heat (reported by SO in Ruhr Metropolis) and the provision of extra-family support in times of loosening traditional support systems in India (reported by TS in Ahmedabad).

In Ruhr Metropolis, water was predominantly perceived as something belonging to and thriving in urbanity and blue space regeneration projects such as the Emscher restoration and Lake Niederfeld were considered successful by most participants who highlighted the positive impacts on the surrounding communities and the city of Essen. Among others, those included the transformation from the 'brown 'Köttelbecken into 'the blue', the provision of new blue-green connectivity and the promotion of new residential developments/improvements of living conditions, city image, sense of identity and the quality of life.

In Ahmedabad, many key informants and experts perceived the relationship between 'the blue' and the city to be more intricate and projects such as the Sabarmati Riverfront were perceived more controversial (e.g., from "one of the best examples of urban blue space development" (JP) to "a disaster" (AB, AT) and an "anti-poor development project" (RD)). Urbanity (in its current form as explosive, uncontrolled urbanization) would result in an increase of unhealthy blue spaces, would rather promote exclusionary development ("water as a status symbol in beautification" (IG), "water as a resource and space to appropriate for elite imaginings of the city" (RD)) and would change people's traditional and spiritual relationship to blue spaces (considering them now as "just technical bodies" (MB)). Yet, the latter was not confirmed in other empirical data. In fact, the study revealed that many older Amdavadis have a strong sense of place in relation to certain blue spaces such as Parimal Garden.

The different perceptions between key informants and experts in Ahmedabad and Ruhr Metropolis could be attributed to the more pronounced land contestations in urban India. Nonetheless, conflicts over land occur in cities all over the world and –as noted earlier– balancing different or opposing interests in urban blue space planning and design also remains a challenge for HICs. Intriguingly, the theme of social exclusion and displacement was almost exclusively discussed in relation to socio-economic status, and less related to other social characteristics such as religion. Although several Indian key

informants and experts addressed the eviction of the urban poor in the course of urban blue space regeneration (e.g., "to create somewhat sanitized environments for the middle-class" (RD)) and potential signs of 'blue gentrification' such as fencing and charging entry fees (at Kankaria Lake and Sabarmati Riverfront), they did not mention the risk of 'blue gentrifications' explicitly. In fact, one interviewee noted that in urban India, a blue (or green) space alone would not be sufficient to cause a neighborhood gentrification, "there still needs to be a magnet for other things to come" (AB). Similarly, in Ruhr Metropolis, some interviewees noted that attractions other than a blue space such as better public transport and cultural facilities would be needed to cause gentrification and that this risk would only apply to larger blue spaces.

Interestingly, cross-case variations in the risk perception observed among older adults were also detected in the perceptions of key informants and experts: health concerns such as the exposure to water- and vector-associated diseases were only noted in Ahmedabad. This observation might be explained by the larger prevalence of water-associated morbidity and mortality and enduring development needs (e.g., WASH infrastructure) in India.

In accordance with the perceptions of older people themselves (see above), limitations in their access to and usability of blue spaces were perceived as aspects hindering the experience of benefits for health and wellbeing in both cases (e.g., "Accessibility. Accessibility. Accessibility. It is all about accessibility" (NT)). Yet, there were also some different notions about age-friendliness, e.g., what exactly an age-friendly blue space is. For example, older Amdavadis rated urban blue spaces like the Sabarmati Riverfront better and as more age-friendly than some key informants and experts interviewed, highlighting the importance of participatory healthy blue space research and practice to hear the voices of (potential) users. The rating difference between Indian older people themselves and the interviewees could also be due to the low expectation level among the population, as noted by the architect AB. In both cases, the answers of municipal representatives remained quite vague as to whether and to what extent older people's demands and needs are considered in urban blue space planning and design. Critical voices occurred in both case studies, referring to a lack of or insufficient implementation

of age-friendliness (in blue space planning and beyond) and to a lack of or insufficient participation/advocacy for older people. As a result of the lack of consideration, urban development policies in Ahmedabad would be (largely) "age-blind" (TS) according to several interviewees. In contrast, it was pointed out that "overprotecting older people" (AB) should also be avoided. In Ruhr Metropolis, public participation and as such, the opportunities for older adults to voice their concerns are more common and differentiated (e.g., information, cycling/walking tours, district conferences, storytelling-atelier), representing possible blueprints for other cities. Despite some critical statements, the aspiration of regenerating the River Emscher as a "join-in-Emscher" (SO) in which locals participate appears to be a successful approach. Here, some interviewees criticized the insufficient consideration of mobility impairments in old age in the concept of accessibility and the neglect of blue space quality (e.g., lack of public toilets). In both cases, several interviewees qualified the critical statements, pointing to other (more urgent) development needs, overlaps of age-friendliness with universal design, differences in the perception of age-friendliness and inherent limitations of participation (e.g., dependency on individual motivation).

Facilitators and obstacles to successful urban blue space governance

In each case study, several factors were identified that facilitate or challenge the provision of age-friendly and health-promoting urban blue spaces.

Looking at the **obstacles**, the themes that emerged in both cases were quite similar (see table 5.5). These include the high development and maintenance efforts, the lack of sufficient funding, the difficulty of adopting integrated planning approaches (and reconciling interests), the lack of political will, the diffusion of responsibility and urbanization/other urban development tasks. In addition, natural barriers (e.g., water scarcity, hot climate) and the misuse of blue spaces/social issues (e.g., existing social conflicts transferred to blue spaces) occurred as challenges. Top-down approaches, the prioritization of socially exclusive flagship projects and the lack of knowledge, technologies and awareness (of blue spaces and their benefits for human and ecological health) featured more prominently in Ahmedabad. Here, some interviewees referred to exaggerated expectations (e.g., having perennial waterbodies in monsoon climate), preferences for landscaped waters and reservations about natural blue spaces due to an

incorrect risk perception hindering the development of eco-friendly and sustainable blue spaces. Yet, some interviewees in Ruhr Metropolis also pointed to those issues, e.g., the controversial project "Lake Phoenix" in the city of Dortmund or a potential underutilization of Lake Niederfeld due to lack of public awareness and prejudices and stereotypes about the neighborhood, which seem to be reinforced by local media. Importantly, lacking awareness and knowledge can refer to both, decision-makers and the public, as both case studies revealed.

Table 5.5: Obstacles to successful urban blue space governance (author's compilation)

Theme	Exemplary quotes from Ahmedabad	Exemplary quotes from Ruhr Metropolis
Lack of knowledge, technologies and awareness	"If we do not teach water to planning students, how would they know how to do it?" (MB) "The garden department is stressed. It does not have the manpower, it does not have the contracting abilities and it really often does not have the knowledge" (AB) "Environment is something which is a very recent kind of import in policy discussion" (TS) "They are not giving you response based on ecosystem thinking" (MB)	"People from Essen do not know about the lake" (HK) "Everyone just speaks about the beautiful Essen south" (SS) "It would be nice if people would talk more positively about the neighborhood" (JH)
Development and maintenance efforts; funding	"After we make anything, we are terrible at maintenance. Terrible, terrible!" (MAB) "Almost no city has been able to maintain a semblance of, let us say a decent quality of public parks" (AB) "Most of the money is actually dedicated for roads and bridges. There is very little money for greening and blueing" (MB) "Friendly telling you we are not able to provide public spaces as per norms" (HT)	"We had a tedious task ahead" (SR) "One cannot simply demolish housing estate to have a green lawn" (BS) "Everything that is done additionally requires additional maintenance costs" (SO) "The question remains: What can be funded?" (DW)
Urbanization and other urban development tasks	"The projection did not consider this kind of demographic explosion" (HT) "We are in the shortfall of land" (JP) "We are in a hurry as a country to build things and show the world how great we are" (MAB)	"The competition for land-use is just intensifying" (DW) "It was a big challenge for us to deal with that topic of gentrification" (SS)

Theme	Exemplary quotes from Ahmedabad	Exemplary quotes from Ruhr Metropolis
Top-down approaches and flagship projects	"It is Modi's showcase" (PS) "The project goes back to imaginations of what waterfronts can be like what we saw from waterfronts around the world" (RD) "Very often, what begins to happen is when budget goes get allocated, it gets supped up by mannequin projects" (AB) "Currently, we are not allowing older people to become partners in urban planning" (AD)	"It is always a problem that attempts are made to displace certain people" (DW) "The question is whether the prices of housing in the surrounding would rise and whether those people would then be forced to move away. So basically, the project did not make anything for them because they will go again in an area where there is nothing" (JS)
Adopting integrated planning	"A very contested political history" (TS) "I think the ecological lenses are entirely missing in Ahmedabad" (RD) "It turns out to be a horrible, horrible exercise, because comprehensive planning was not undertaken" (MAB)	"You have to implement all that and you want to involve different experts, you want to involve citizens, it is difficult to organize that, to manage the whole process, to keep the interest" (JS) "In every project, there are conflicts of goals, there are always difficulties and challenges. (…) Everyone has demands and wishes which have to be brought together in planning. There are different interests and framework conditions according to which we have to plan" (SO)
Lacking political will, diffusion of responsibility	"They [the AMC] are stupid. It is a mental block, a heavy mental block" (AT) "The AMC does not do anything on their own. If the laborers in the park do not clean the water pipe, then it does not work. The higher ones should run around and check, but they are not doing it" (IG) "City planning happened considering that these blue spaces are non-existent. Lakes were nobody's baby. Blue spaces are no one's baby" (MB) "Neglected, not fenced, nobody caring for or using it" (MAB)	"Much is possible to think about, but one has to have the courage for doing it" (DW) "Normally it would have taken one year to remove the graffiti, because nobody feels responsible" (AS) "You cannot leave things to take care of itself. It often happens, people construct something and move on to the construction site" (HK)
Misuse of blue spaces and social issues	"If you go and try to look for the lakes, you will not find them. We lost these waterbodies; they are abused" (MAB) "Although there is now law, they are not legally barred from using those spaces, they sometimes do not do it because they just feel they are kind of out of place and they might not be accepted. There might be a segregation perceived by older people themselves" (TS)	"There are people who think 'This is my lake, and others have to go when I want them to go'. These are mostly people living immediately by the water. They are in part egoistic" (SS) "They tried to improve the park, and they did it in a participatory way, but it was not the single problem in that area" (JS)
Natural barriers	"It should not be a barrier, because actually hot climate requires more blue spaces. But it is also evident that hot climate will not allow many blue spaces, because it gets evaporated" (MAB)	"Water is where it is, you cannot easily divert it through the city. You have to find ways to the water or the water has to find ways to us and that is more difficult" (SS)

Counterparts to the above-mentioned obstacles were identified as **facilitators** to age-friendly and health-promoting urban blue space development in both cases, including the availability of up-to-date knowledge, technologies and awareness, the provision of sufficient (predominantly mixed) funds, the availability of water, the successful execution of integrated planning (including multi-actor collaboration and collaboration with the private sector), decentralized and participatory/bottom-up approaches (i.e., refraining from flagship projects) and the political will/courage. As noted earlier, different planning instruments (e.g., a masterplan, a national policy) and different types of participation contributed to successful urban blue space governance in both case study areas. However, the effectiveness of (formal and informal) planning and procedural instruments in urban blue space development has yet to be investigated, particularly with regard to their ability to reconcile different interests.

While the scientific evidence regarding urban blue space governance –particularly beyond waterfront revitalization– is still scarce, the results of this study broadly align with those by other researchers and with available information from non-academic literature (e.g., DPA 2025; Pool et al. 2023; Times of India 2019/2022; Desai 2018; Mbi 2018; Augustin & Schwinning 2017; Baumeister 2017; Mell 2017; Frank & Geiwe 2012). For example, facilitators such as the provision of funds and the availability of water/regeneration areas and obstacles such as funding shortfalls, top-down approaches, the lack of transparency, integrated approaches and collaboration, the dominance of economic interests/conflict of interests, the prioritization of other urban development tasks and poor maintenance have been reported in both research areas and countries (see also chapter 3.2.1 and chapter 3.2.2). Fortuitous coincidences might contribute to successful urban blue space governance as the example of the blue-green transformation of the city of Essen shows. Here, the regional initiative for the Emscher restoration has encouraged the municipality to take action to develop other blue and green spaces, supported by broader driving forces such as de-industrialization, climate change and urban shrinkage and relatively good funding opportunities on different levels (Augustin & Schwinning 2017). Such circumstances form a unique window of opportunity which obviously cannot be transferred to other cities, but the case highlights the value of considering development trends and actions on the regional, national and supranational

level and integrating those in the local urban blue space development planning to harness synergies.

Implications for practice

The urban blue space governance in the cities under study reflect general urban development trends such as the reclamation of nature driven by de-industrialization (in HICs) and the increasing importance of "quality of life variables and manifestations of green living" as competitive factors of cities in a global world, while at the same time, reflecting the enduring power of free-market capitalism in planning, often at the expense of low-income people and the urban poor (Short 2020). Overall, the results provide some tentative evidence on the determinants of success and failure in age-friendly urban blue space governance for health. Despite many existing challenges for planning and design – some of which are difficult or impossible to change–, the present findings are encouraging as they highlight that blue health futures across the world can be shaped for and with aging urban populations. As noted in previous studies (e.g., Hunter et al. 2023; Pool et al. 2023; Chen & Yuan 2020; Enssle & Kabisch 2020; Hohn & Zepp 2012), integrated and participatory planning approaches and a sensible handling of conflicts of interest appear to be important for this. Land-use conflicts are largely unavoidable in the urban context and require a social negotiation process in which decision-makers are called upon to take all interests into account as far as possible and weigh them up sensitively considering the consequences for different sectors and different parts of the population. In line with other research, this multiple case study has shown that common conflicting values in urban blue space use are economic gains versus environmental protection versus recreational uses. While acknowledging that truly inclusive urban blue spaces and "blue health for all" are a difficult-to-reach endeavor, cities can adopt measures to avoid 'the blue' becoming an exclusive space "of reimagining the city, (…) of reimagining a different image for the city" (interviewee RD) and to promote and preserve local identities and meanings, most notably by creating more 'neighborhood' instead of 'flagship blue spaces', involving the local community in the development and upkeep of blue spaces and consistently considering equity concerns (see implications for practice in chapter 5.1.2). For the latter, the framework of the three dimensions of socio-environmental justice by Enssle &

Kabisch (2020)[50] –based on urban green space research for health and wellbeing of older people– might guide urban blue space planning.

As noted earlier, for LMICs, there is great potential for promoting healthy urban blue spaces by higher investment into the provision of effective sewage management as this might reduce conflicts of use and groundwater losses. The provision of adequate housing and WASH infrastructure was also highlighted as part of socially inclusive blue space planning by some interviewees (e.g., *"You need to provide those water and sanitation infrastructure to them [the urban poor]"* (RD)). Regardless of their level of income, cities are advised to use synergies for ecological and human health and combine blue and green space provision with sustainable urban drainage systems where possible to respond to converging planning paradigms of healthy and sustainable cities.

In this study, actors on the supply side widely perceived the same health benefits (and risks) of urban blue spaces as older adults themselves. Yet, they did not consider urban blue space development as a possible direct public health intervention, nor did they see the potential to (more strongly) promote healthy behaviors at blue spaces. This finding aligns with previous research such as Finlay et al. (2025) who concluded: "Public health and urban development strategies have yet to conceive of ways that optimize nature as a health resource for older adults and to realize the full benefits of contact with nature contact as an upstream health promotion intervention" (p. 104) or Grace et al. (2023) who noted: "Despite the proven potential of exposure to nature for improving both mental and physical health outcomes, research findings from blue space studies are only just beginning to be translated into policy. Blue spaces along with other natural environments are currently undervalued resources that remain significantly underutilized in public health policy" (p. 1f). At the same time, it should be noted that there are already politically relevant starting points for a stronger salutogenic orientation of water management in the sense of Health in All Policies, e.g., the legally binding Protocol on Water and Health in the WHO-Region Europe (Kistemann 2020). This inconsistency may be explained by decision-makers feeling overwhelmed by how to unfold the recognized health potential,

[50] The framework integrates the following dimensions of socio-environmental justice: distributive (fair allocation/availability), interactional (addressing different groups' needs and preferences) and procedural (active participation). It aims to "contribute to a just provision of ecosystem services and social cohesion in the context of planning for age-friendly and just cities" (Enssle & Kabisch 2020: 39).

uncertainty about how to proceed and competing pressures from other sectors (Hunter et al. 2023).

Introducing (mandatory) health impact assessments (HIAs) in urban blue space planning could contribute to systematically identifying and considering the health-related impacts of blue space development projects, to facilitate the integration of health promotion interests and to better inform policymakers and planners as proposed by previous researchers (e.g., Baumeister 2017). This could further strengthen the role of public health experts in urban blue space planning as potential 'guards' for socially inclusive and health-promoting blue space development, including how to deal with health risks such as water-associated diseases. However, further research is needed to clarify the role and the impact of involving the public health service and of introducing HIAs in urban blue space planning as the evidence is so far weak (Brückner et al. 2022). As suggested by Baumeister (2017), transdisciplinary research approaches entail the potential to take the actors involved in blue space planning out of their duty-driven activities and to improve collaborative planning processes. Additional research is needed to assess the effectiveness of (formal) health education and behavioral prevention activities targeting older people at urban blue spaces. It would also be interesting to explore the extent to which the effects of urban blue spaces on health and wellbeing can be better differentiated and what potential and risks exist in terms of focusing the (scientific and practical) discourse on health or wellbeing. Health might be a stronger impetus for action than wellbeing, but the WHO's Geneva Charter for Wellbeing (WHO 2021b) –promoting the concept of "wellbeing societies" which prioritize equitable health, social wellbeing and ecological sustainability– shows that the latest formulation of health promotion ideals are shifting.

Based on the results of this study, awareness campaigns, education and training measures seem to be strategic intervention points to enhance knowledge on the health benefits of urban blue spaces in old age and to improve the integration of age-friendliness into urban blue space planning and design. As seen in this and other studies, leveraging the health potential of urban blue spaces requires the willingness and knowledge among responsible actors to actively shape the social determinants of health such as the living environment. While interviewees in both cases argued that professionals in urban planning and landscape architecture would be increasingly aware of the health impacts of

their work –not least due to global initiatives driving the integration of health into planning such as the UN New Urban Agenda and the Agenda 2030– there is scope to improve understanding. For example, specific effects of 'the blue' appreciated by older people such as providing multi-generational enjoyment and contributing to maintaining a daily life structure were not known by actors on the supply side. The target groups of such measures should be broadly defined to include older people themselves, multipliers in the work with older people such as NGOs, representatives of local authorities, planners and architects. Importantly, the communication and education measures should also highlight the contributions of blue spaces for the ecological quality in cities to increase "environmental awakening" (MB). Further research may include the impact of awareness-raising and knowledge-building activities on age-friendly urban blue space governance for health.

5.2 Research strengths and limitations

This PhD study was an exploratory investigation on the blue space-health relationship of older people in two distinct urban settings. It contributed to 'healthy blue space research' in various ways:

- Advancing empirical research on the health and wellbeing effects of urban freshwaters, which is still a neglected blue space type (Zhang et al. 2022; Hermanski et al. 2021; Smith et al. 2021; McDougall et al. 2020).
- Generating evidence from LMICs, where 'blue health' is virtually unexplored (Hunter et al. 2023; White et al. 2021; Gascon et al. 2017). To the author's knowledge, this study was the first to investigate the health effects of urban blue spaces in India.
- Adding to "comparative cultural geographies of water" (Foley & Kistemann 2015) by contrasting two major manifestations of "the urban now" (Short 2020) with different urbanization patterns.
- Refining the scientific knowledge on 'blue health' considering particular population groups such as older people who are underrepresented in studies in relation to their rapidly growing share of the world population (Wang & Sani 2024; Grace et al. 2023; Zhang et al. 2022; Freeman et al. 2019).

- Acknowledging equity concerns and the need for including marginalized and minority groups (Hunter et al. 2023; Foley et al. 2019; Schüle et al. 2019). At least attempts were undertaken to diversify the samples and to include vulnerable groups of older adults in both cases.
- Based on the recommendations of other researchers (e.g., Grace et al. 2023; Hunter et al. 2023; Zhang et al. 2022; Foley et al. 2019b), applying a highly participatory, application-oriented research design integrating different blue health research approaches (preference-based, experiential and experimental), using mixed methods and involving actors from both the demand and supply side. The multi-case photovoice study design in particular provides methodological guidance for future blue health studies using a community engagement approach.[51] In addition, by integrating different modes of photographic research ("auto-photography"/participatory photo-elicitation and the use of images in choice experiments to infer landscape preferences), this study adds to other photographic blue space research (e.g., Luo et al. 2022; Qiu et al. 2021; Coleman & Kearns 2015; White et al. 2010; Wilson et al. 1995) and contributes to its refining.

Beyond healthy blue space research, this study –as part of the graduate school 'One Health and Urban Transformation'– contributed to enhance the understanding on salutogenic environmental and human health interactions and thus, to further develop the concept of one health (and other integrated health concepts) in this way. For one health, the fundamental questions addressed so far have been predominantly of a pathogenetic nature such as the control of zoonotic diseases and antimicrobial resistance (Talukder et al. 2024).

Given the predominantly qualitative research approach, the following epistemic considerations for qualitative research according to Bazeley (2013) are answered to demonstrate "(…) that there is a sound basis for the researcher's inferences about the phenomenon being investigated" (p. 402), which corresponds to checking for traditional data quality standards such as validity and reliability.

[51] The advantages of a multi-case photovoice research design have been outlined in chapter 3.

Quality of process

The choice and the design of the research design and methodology were determined by several aspects, including the exploratory nature of the research questions and convenience. Further, existing scientific evidence guided the process. Although various difficulties arose during implementation, which should be addressed in future studies, the researcher nevertheless considered the procedural decisions made to be appropriate. To account for transparency, the methodological procedures were described as detailed as possible (see chapter 3), considering the need for precisely recording the research process, providing clear explanations and using critical self-reflection. Several strategies were applied to increase the credibility of the work. As recommended by other researchers in the field, methodological triangulation (i.e., synthesizing data from multiple sources) was used "to achieve a resilient image of reality" (Völker & Kistemann 2011: 456). In fact, the researcher found that methodological triangulation enabled a more comprehensive understanding and better control of biases. For example, by comparing the results from the different methods, more precise statements about the relative importance of health benefits of blue spaces were made and inconclusive findings regarding blue landscape preferences were identified. Other strategies included aiming for the involvement of diverse actors, aiming for deep engagement with participants and seeking feedback and communicative validation from participants. Further, emphasis was given to providing coherent explanations for interpretations and inconsistent data and checking for complementary data from literature reviews. Moreover, the quality of process and thus, the quality of data, was ensured by following systematic approaches, semi-structured methods and established rules where possible, e.g., integrating standardized tools such as SOPARC and the WHO-5 Wellbeing Index, using existing tentative theory and instruments in the field such as the theory of therapeutic landscapes, and applying interview guidelines and structural coding. These measures also facilitated the comparability between cases.

Quality of data

Overall, the data collected was suitable, useful and sufficient to answer the research questions. As confirmed by other researchers, qualitative studies can reach saturation at relatively small sample sizes (Hennink & Kaiser 2022). Purposive sampling was used to

try to diversify the non-representative samples and to include older adults from disadvantaged groups. To deal with potential issues related to being a cultural outsider, attempts were made to recruit cultural insiders as research assistants and to collaborate with community workers. Sufficient contextual information from literature review was obtained for interpreting and contrasting the multiple case study data. As noted by other researchers in the field, different types of data have distinct qualities for investigating 'blue health'. Due to the variety of methods used, the data of different types collected are considered as a strength of this study. For example, by analyzing people's narrative accounts and photos, the qualitative methods applied were particularly useful to assess the experiential aspects of urban blue space exposure (e.g., emotional, sensory experiences), to explore the meanings those spaces hold for older people as well as their needs and to provide rich contextual knowledge (Grace et al. 2023; WHO 2023; Doughty 2019). Moreover, this study succeeded in investigating older people's blue space/health experiences from different exposure types by integrating the less researched direct (in situ) and indirect (e.g., photographic) contact with urban blue spaces. As noted in chapter 2.5, the type of exposure matters to the exploration of the blue space-health relationship (Huang et al. 2019). For example, recording first-hand experiences allows to better account for the dynamic nature of blue space encounters and potential effect modifiers and to more accurately reflect therapeutic landscape experiences (Wang & Sani 2024; Lin & Wu 2021; Helbich et al. 2019).

Quality of outcome

The findings were clearly structured and adequately contextualized to allow readers to confirm their meaning. Overall, the results were useful for the intended exploratory purpose as they provide valuable insights into the urban blue space-health relationship of older adults in two different geographic settings. Being a hardly investigated subject, the results of this study deepen the understanding of 'blue health' in old age and allow to derive ideas for future research. In addition to contributions to knowledge within the field, the study findings were translated into implications and recommendations for practice. As highlighted by other researchers, there is still a great demand for "(…) policy-relevant knowledge production that is sensitive to differential experiences and needs" (Doughty 2019: 90).

As noted earlier (see chapter 3), participatory photographic research includes potential benefits for participants. Positive impacts associated with photovoice such as empowerment, promotion of critical reflection and dialogue and increased sense of responsibility (Latz 2017; Wang & Burris 1997) were not investigated in this study. Yet, many participants reported gratifying experiences linked to their participation, e.g., increased awareness for blue spaces and their health benefits as well as needs assessments, the opportunity of getting around/discovering unknown blue spaces, the opportunity of having someone to talk to/the feeling of being heard and positive mental stimuli ("You two brought me to other places, not only physically but also mentally" (Mrs. Pame)). Those can be considered as supporting indicators of decent process and outcome quality.

Limitations

The empirical results of this study have to be seen in light of several limitations. The major ones are methodological and analytical limitations which limit the quality of the data and the accuracy and significance of the results (outcome quality), respectively. In addition, the research process proved to be challenging and needed short-term adjustments, e.g., in the selection of blue spaces due to the lack of water or in the methodology due to the lacking willingness of many older adults to participate in an experimental approach. Such difficulties are also outlined below.

Sample and participants

A selection bias might have been introduced due to the sampling strategies applied. Given the small and non-representative samples of older adults, the findings might not apply to the broader population of older adults in both case study areas. While the multi-case photovoice research design allows a transfer of lessons learned and the opportunity for theory-building (Wright et al. 2018; Ridder 2017), the results cannot be generalized. In fact, the power of both, case studies and photovoice, is the attention to the local situation and thus, the generation of 'local evidence' (Wright et al. 2018; Stake 2006). For transferring lessons learned, it is important to understand the contextual conditions at any new setting and the consequences resulting from differences to the original setting under study (Wright et al. 2018). For the baseline surveys at the main research sites, only urban

blue space users were considered. It is possible that due to this –and the strong salutogenic focus of the work– 'hydrophobias' and adverse health effects of urban blue spaces were underestimated. Selection effects such as relying on people who already know and like certain blue spaces are a well-known criticism in experiential healthy blue space research (White et al. 2018). Yet, as mentioned above, assigning people randomly to blue spaces was not fully accepted by participants in this study.

Despite attempts were made to diversify the samples in both cases and to include perspectives from vulnerable groups of older adults, this research did not succeed in providing a full picture of voices from all groups of older adults. For example, the study falls short of integrating the perspectives from older women, socially excluded older people (not participating in any group activities[52]) and other cultural/religious minorities than those included. People aged 80+ years were only poorly represented. Participants may have intentionally or unintentionally altered their behavior at urban blue spaces or deviated their responses and thus, may have influenced the results of this study (participant bias, recall bias). Recruiting participants emerged as a major challenge during data collection, although approved practices in photovoice such as face-to-face recruitment and incentives were applied (Latz 2017). The latter even encountered incomprehension, particularly in India, where many older people refused to accept any gifts. The search for participants ultimately delayed the research process and required a great investment of effort, e.g., joining specific communities of older people such as a yoga group to build trust over several weeks. The sampling of participants (older people, key informants and experts) was further limited by a certain dependency on gatekeepers and other circumstances such as the time availability.

Finally, an element of arbitrariness also applies to the selection of urban blue spaces, which was, among others, guided by practical restrictions such as accessibility, safety and water availability[53] and the concern about what is manageable for participants. The final selection includes blue-green spaces, which may have made it difficult for participants to focus on the effects of 'the blue'.

[52] Participants were not brought together for research purposes; all group samples were already existing (formal or informal) groups.
[53] In Ahmedabad, blue spaces had to be included which are known to be filled with water only in monsoon times or which were not filled with water (e.g., fountains).

Research design and data collection

The author of this thesis acknowledges that the research design and the different methods applied have several limitations. First, the numerous gaps in knowledge in the field impeded effective guidance such as how to assess urban blue space governance from a normative perspective and in a standardized manner. Relevant tools like the BlueHealth Toolbox were developed at about the same time as the research was conducted. Similarly, there is little work available to guide the analysis and presentation of photovoice data, which forces researchers to apply more general ways for those steps (Latz 2017). The comparative analysis in this study has been widely limited to a narrative synthesis. As typical for case studies, the results have to be presented in detailed case descriptions (Ridder 2017; Stake 2006).

Due to the observational and cross-sectional research design, uncontrolled confounding might have emerged, and causalities could not be inferred. In addition, long-term effects of urban blue space exposure and possible changes over time could not be assessed. Among others, it would have been interesting to investigate the health effects across different seasons as the fieldwork was limited to spring in India and summer/autumn in Germany to ensure comparable climatic conditions. Yet, these seasons are likely to be linked to higher outdoor activities. Although various effect modifiers were generally considered in the data collection (e.g., age, gender, urban blue space type), a differentiated analysis was only possible to a very limited extent. For example, it would have been interesting to link the investigation of landscape preferences and health benefits of different urban blue spaces with the measurement of the ecological/water quality or to assess potential differences between blue space exposure types such as visual vs. physical or incidental vs. intentional exposure and the health benefits perceived.

While the photovoice methodology seemed initially appealing, several difficulties and limitations were observed during the actual implementation. Most importantly, those include the elaborate process of data collection and analysis and the high degree of dependence on the participants. The high level of effort was evident, for example, in achieving socially inclusive conditions of participation (e.g., providing questionnaires and informed consent forms in four languages, employing translators), in following high demands of data security (e.g., having different kinds of consent and release forms), in developing pictures of disposable cameras (e.g., loss of photos due to bad quality,

requiring postal shipping to Mumbai) and in organizing the interviews/FGDs. As Latz (2017) noted, the complexities in photovoice studies also come with a "notorious messiness" of qualitative research due to the amount and diversity of the data collected and the non-linear research process. Furthermore, photovoice is not yet universally recognized as a scientific methodology, and established scientific procedures, such as common requirements for journal articles, are not well suited to such studies, e.g., because photos are typically not included in the presentation of results or require high costs (Latz 2017).

As a research approach that leaves power almost entirely in the hands of the participants, it became apparent that the original proposal of using an experimental approach could not be implemented well since many participants refused to visit different blue spaces than the main research site. In consequence (and due to practical limitations), we worked with different types of exposure to blue spaces (real-life and photographic) which are known to cause different environmental perceptions and emotional experiences (Hurtubia et al. 2015; Heft 2010). The main reasons given by those who refused were health and mobility restrictions (despite checking for those in advance), anxiety about leaving familiar spaces and lack of time. Another difficulty was adapting to individual needs as participants required different types of assistance and instruction and different amounts of breaks. Interestingly, we observed a certain shyness about taking pictures among several participants who needed encouragement and reminders. Nevertheless, acceptance of photography as a research medium was generally high; only one participant expressed some reservations (e.g., *"Can I ask you: Do you think you can capture this moment [pointing to the scenery of the lake, birds flying around, trees moving] in the photo? You cannot keep the beauty of nature in it. It is the moment!"* (Mr. Madhu)). While photovoice –in its original sense– is characterized as a joint knowledge production in which the role of the researcher is decentralized and participants are actively involved in all phases of the research process, this study did not achieve such a high level of participation. Above all, participatory analysis was very limited. It should be noted, however, that this limitation is known in photovoice research, as experienced by Latz (2017): "Depending on the circumstances, some participants may not want to be involved in certain phases of the process such as analysis" (p. 93). Other key elements or aims of photovoice such as

critical consciousness building and empowerment were also only achieved to a limited extent in this study. Instead of feeling empowered themselves, many older people considered the investigator as a potential advocate for their demands and needs who could present those to policymakers (e.g., *"If you can make a presentation to some of the authorities (...)"* (P1.3)).

As mentioned earlier, this study relied on two different modes of environmental perception, i.e., real-life, by letting participants actively engage with blue spaces and recording their first-hand experiences, and by exposing them to images of blue spaces for deriving landscape preferences. Despite clear advantages of photographic surrogates (e.g., easy to implement, beneficial when dealing with complex scenarios such as public spaces and urban design since pictures more accurately represent the space under study than texts), the use of images introduces new complexities in environmental perception research (Hurtubia et al. 2015). It must therefore be noted that images are naturally limited in their ability to convey landscapes in a completely realistic way as spaces and perceivers are extracted from the (urban) context. Images cannot depict dynamics such as the movement of people or objects, nor the nature of all features (quantitative and qualitative such as sound, texture, temperature) the space has in reality (ibid. 2015). For the stated preference choice experiment in this study, this means that the results might not adequately reflect blue landscape preferences, particularly which blue spaces older people are really willing to visit even if blue spaces were ranked high regarding their attractiveness. This is particularly the case due to the high importance of accessibility. Notable findings in the analysis, such as a gap between perceived attractiveness and willingness to visit, show that hypothetical decisions have their weaknesses, even though the method is frequently used in environmental perception research. Another flaw of choice experiments is the high cognitive load and thus rapid fatigue of the participants, leading to early participant attrition. This was also confirmed in the present study, as a frequent feedback was that the large number of images made it difficult for participants to decide.

With regard to the other methods applied in this study, exemplary limitations leading to potentially biased findings include inherent flaws of participant observation and FGDs such as the selectivity and subjectivity of the observer (despite using a validated

systematic observation tool enabling standardized procedures), dominant participants and groupthink (group dynamics were not analyzed at all) (Yin 2014; Bazeley 2013). Overall, this study involved various samples from which different data were collected, e.g., physical activity levels were only assessed from the baseline survey participants. Retrospectively, there was potential to create greater comparability and to improve the questionnaire design. For example, the questionnaire response options for the common activities undertaken at the main research sites were not fully distinctive as seen in the case of "aesthetics/watching the scenery" and "nature/wildlife watching". Another key limitation of this study is the reliance on subjective ratings (e.g., of access to blue spaces) and self-reported data (e.g., self-reported health status, self-reported physical activity levels, self-reported number and duration of blue space visits) which could not be verified, making it prone to issues like subjectivity, selective memory and exaggeration. Yet, as Conradson (2005) has noted for therapeutic landscape studies with people with physical impairments, the focus of such research lies on "wellbeing in whole-person sense, including its psychosocial dimensions" (p. 338) rather than "biomedical notions of healing", which is why self-narratives of health, energy levels and degrees of mobility become essential. Considering that there is a wellbeing paradox in later life, it would have been interesting to measure health effects subjectively and objectively (e.g., behavioral tracking, using vital signs and biomarkers to monitor physiological changes) and to see how comparable the results are. The same applies to the rating of the living environment, which was based solely on subjective perceptions.

Researcher-related limitations

The findings of this study might be further limited by issues related to the research team, including e.g., their beliefs and expectations, disciplinary training, skills and cultural background, which can support biased views on the research process and data. This limitation permeates throughout the different methods applied. For example, the researcher's personal beliefs and experiences can influence what is observed in a participant observation and how the data are interpreted (observer bias). The researcher of this study was not experienced in doing participant observations; yet the researcher's skills and stress resilience are influencing factors for data reliability. Similarly, the researcher was not trained in moderating FGDs, but good moderator skills such as the

ability to build trust, empowering silent participants and asking the right questions are critical to their success. The subjective researcher's analytic lens also influences the types of questions asked in interviews and how those data are analyzed (Bazeley 2013; Saldaña 2013). Yet, experts in qualitative research such as Bazeley (2013) have highlighted that "it is reasonable to expect some consistency in coding done by the same person across a whole project, and that any early vagueness in codes has been clarified and "tidied up" by the time final analyses are undertaken" (p. 150f). Given the multicultural composition of the research team and the participants, language barriers might have skewed results, e.g., because the translation in other languages than English could not be verified.

Others

Finally, this study was limited by the common research limitations of time and funding constraints as those forced the researcher e.g., to limit the sample size and the amount of research assistants and to choose a cross-sectional research design and methodology. The Covid-19 pandemic forced changes in the research plan and led to a premature end of the data collection.

A note on the Covid-19 pandemic

This study could not investigate any potential impacts of the COVID-19 pandemic on urban blue space use and the blue space-health relationship of older adults. However, there is some tentative evidence that public blue and green space use has increased during the pandemic; thus, potentially preventing negative health effects of physical inactivity and buffering the burden of disease coming along with the pandemic (Finlay et al. 2023; Labib et al. 2022). In contrast, lockdown restrictions (depending on national regulations) and the fear of infection impeded people to seek public blue and green spaces as places of refuge. While this applies generally to all population groups, older people across the world were particularly affected by infection control and pandemic management as they were considered as a high-risk group. It would be worth reflecting on those questions in future research to explore which implications can be drawn for handling future pandemics.

5.3 Recommendations for action

This chapter summarizes the key recommendations for action which were developed based on the results of this study (see chapter 5.1), differentiated between recommendations for practice and for research. As with green spaces, and perhaps even more so, recommendations for healthy blue space planning and design must currently remain on a more general level due to the significant knowledge gaps such as moderating factors (Van den Bosch et al. 2018).

Recommendations for practice

Support blue space exposure for healthy aging

Blue spaces are potentially therapeutic landscapes for older adults. On the one hand, they offer therapeutic landscape experiences, i.e., the experience of physical and mental health benefits by interacting with 'the blue' in four ways, as activity, social, symbolic and experienced spaces. On the other hand, blue spaces can be therapeutic landscape settings, meaning they entail the potential to improve the local environmental quality. By promoting physical activity, social interaction and mental wellbeing and providing perceived and objective environmental benefits, blue spaces can represent "environments and opportunities that enable people to be and do what they value throughout their lives", thus contributing to maintain "the functional ability to enable wellbeing in older age" (WHO 2020). In other words: Blue spaces are significant chances for supporting healthy aging and for compressing morbidity in old age. Promoting blue space exposure across the life course, including in old age, should feature more prominently in international and national health, aging and urban policies. As part of aging policies, blue spaces ultimately benefit all population groups, not only older people.

Promote urban health

Health benefits of blue spaces in cities seem to matter particularly because they represent places of refuge offering aesthetic and restorative experiences and thus, 'antidotes' to common urban stressors such as air and noise pollution, high population density, loneliness/social isolation, and lack of contact with nature. Blue spaces can contribute to reducing urban-rural health disparities.

Give blue spaces more recognition

The growing scientific evidence for specific health effects of blue spaces justifies distinguishing 'the blue' from 'the green'. For example, 'the blue' merits greater (explicit) consideration in the WHO work on healthy and age-friendly cities. Both concepts still refer to green spaces only. A stronger emphasis on blue landscapes can lead to greater awareness of their health benefits.

Link blue space provision to behavioral health measures

For leveraging the full health potential of urban blue spaces in old age, the provision of urban blue spaces should be linked to behavioral health measures targeting older people such as fitness programs or social and cultural activities. Informal group activities at urban blue spaces can reach many older people as exemplary seen at Parimal Garden in Ahmedabad, but for others, formally organized activities accompanied by external facilitators are needed, as has been seen in the case of older migrants in Ruhr Metropolis. Municipalities are advised to invest in free support services for/social work with older people. Older adults' urban blue space use could be also harnessed for targeted health education as seen in the case study of Ahmedabad.

Use synergies for people and nature

Urban blue space planning and design cannot proceed without sustainability considerations. Ecological concerns must be integrated in urban blue space governance, e.g., how sustainable urban drainage systems can be linked to the provision of blue spaces. In addition to water usage, this also applies to the design of the surroundings, e.g., the choice of plants. Urban blue space governance for the health of people and nature also means that depending on the local water situation, refraining from the installation of blue spaces or enabling only temporary uses need to be options for action.

Ensure accessibility and blue space quality

To make urban blue space use an easy choice for all older people and to increase their blue space visits, it is important to ensure accessibility, a high blue space quality (including the provision of practical amenities, aesthetic value, ecological quality/perceived biodiversity and safety) as well as continuous maintenance. Those issues were identified as key intervention points for planning and policy in this study. It has been shown that if those factors are not considered, older adults' urban blue space use is much left to individual motivation and resources and reinforces existing environmental injustices. Regarding accessibility, different dimensions than the mere physical access (availability of barrier-free blue spaces) have to be considered, including affordability (e.g., of transportation needed, of potential entrance fees) and perceived accessibility (e.g., feeling comfortable and welcome). Effective maintenance strategies depend on

local circumstances but can involve a range of actors, including older people as volunteers and the private sector (e.g., as part of corporate social responsibility).

Reduce health risks associated with blue space visits

While older adults perceive much greater health benefits than risks in blue space use, it is important to consider that those spaces can also be health-constraining environments. Urban planning and policy need to consider and reduce health threats associated with blue space visits, not least because some of which (e.g., vector-borne diseases) will amplify by climate change, loss of biodiversity and increasing environmental degradation. Importantly, the perception of safety varies across geographic contexts and requires local prioritizations and solutions. For example, while personal and traffic safety (e.g., feelings of fear and danger, presence of illegal activities, lack of walkability) featured prominently among older adults in Ruhr Metropolis, the exposure to disease vectors, allergens and heat as well as attack risks from animals and fallen branches/trees were key topics in Ahmedabad.

Consider diversity

Older people are a highly heterogenous group; varying e.g., in health, abilities, experiences, attitudes, social and cultural background and needs. In addition, there is a diversity in older people's blue health manifestations as well as their blue landscape preferences. To cater for the diverse (and potentially contrasting) demands, needs and preferences (within and beyond the group of older adults), it is recommended to provide multi-functional and universally designed blue spaces of different types, with different aesthetic qualities.

Consider inequity

A good urban blue space governance for health must consider inequity. Existing health inequity often involves environmental injustices, i.e., that environmental health resources such as high-quality and well-maintained blue spaces are not equally distributed. Inequity increases and even intensifies in old age, because inequalities from earlier stages of life (e.g., income, wealth, education) accumulate and manifest themselves in poorer health, lower life expectancy, higher risk of poverty, and limited participation, which can be

further exacerbated by poor social policies and unequal inheritances. Due to the high attractiveness and economic valuation of blue spaces as well as pronounced land contestations within cities, social exclusion is a significant risk in urban blue space planning and policy. To minimize and avoid adverse developments which could reinforce existing health disparities, measures such as integrated planning approaches and focused planning on deprived communities should be adopted. The development of a reliable database, including quantitative and qualitative criteria of urban blue spaces, can provide municipalities with an overview of investment needs and priorities. In addition, urban blue space planning should integrate not only distributive, but also interactional (addressing different groups' needs and preferences) and procedural (enabling active participation) dimensions of environmental justice. A stronger involvement of public health representatives in urban blue space planning could contribute to better reconciling economic, social and ecological interests. In many cases, living by and on the water is currently a high-priced and therefore rather exclusive residential building. Yet, in some cases such as Lake Niederfeld in Ruhr Metropolis, these residential developments are intended to upgrade certain neighborhoods. There is still a lack of scientific evidence for formulating general preventive measures against 'blue gentrifications', but ensuring public access to blue spaces and some public control over the real estate market (e.g., by imposing public/social housing) seems reasonable.

Implement evidence-informed urban blue space planning sensitive to the local context

The translation of urban planning visions to other places has always been fraught with problems to some extent, particularly if urban development neglects to follow strategic development needs, to handle conflicts of interests with sensitivity and to carefully consider the local context. This also applies to urban blue space development projects which might become politicized, for example, to appeal to certain population (voter) groups or to show off on the national and international stage. Although it is possible to transfer lessons learned from one place to the other, it is important that urban blue space planning engages with the local context, e.g., with local needs and circumstances and cultural particularities. This study identified some tentative facilitators and obstacles to age-friendly and health-promoting urban blue space development, which can be used for

guidance. For example, general favorable factors are the availability of up-to-date knowledge, technologies and awareness, the provision of sufficient (mixed) funds, the prevention of misuse of blue spaces and multi-actor collaboration, including the participation of local communities. Instead of investing in flagship projects that benefit only some, the provision of 'neighborhood blue spaces' (if context-appropriate) seems to ease access for more. Depending on local circumstances, other measures to improve the urban blue space provision in terms of quantity and quality might be introducing legal requirements for integrating blue spaces and health impact assessments, improving the local sewage management, developing resilient governance structures to avoid corruption, promoting the connectivity of blue-green spaces and collaborating with the private sector.

Accept and communicate limitations

While balancing competing interests and agreeing on trade-offs is a central component of political decision-making, which in the case of urban blue space governance, can be certainly optimized in many cases, providing sufficient, high-quality and well-maintained age-friendly urban blue spaces for improved health is likely to remain an intricate affair. Cities are confronted with various planning paradigms and austerity budgets and land-use conflicts are largely unavoidable. Good practice in urban blue space governance might be determined by the extent to which the plurality of interests, demands and needs can be integrated into planning and design; yet possibly not all conflicts of interests and contradicting planning and design requirements can be solved. Transparent communication can increase acceptance.

Inform about 'blue health' and provide education and training

Awareness-raising in the public, among decision-makers, multipliers for specific population groups and health professionals as well as education and training for planning and architectural professionals are needed to improve knowledge on the health benefits of blue spaces, to inform about good practice in planning and design and to prevent adverse developments. In light of population aging worldwide, those measures should include aging issues ("mainstreaming aging" into urban blue space planning and design) to advance the consideration of older adults' demands and needs.

Support healthy urban blue space development for and with older people worldwide

In LMICs, rampant urbanization, low funding bases and more pressing issues associated with fulfilling basic human needs pose major challenges for cities to integrate and maintain public blue and green spaces. In addition, they have to adapt to aging populations at a much quicker pace than HICs. Global development cooperation should address these challenges and promote mutual learning. For example, Germany's development cooperation with India (formalized under the Green and Sustainable Development Partnership in 2022), could be strengthened regarding sustainable urban water management including the provision of healthy blue (and green) spaces and the adaptation of cities to aging populations.

Recommendations for research

The limitations of healthy blue space research in general and focused on older adults in particular have been outlined in chapters 2.3 and 2.5, respectively. Based on these and on the own empirical results, the following suggestions for advancing blue health research in old age are made:

- There is abundant room for further progress in understanding the factors moderating the urban blue space-health relationship of older people, including the factors determining the "uptake" of blue space (i.e., frequency, duration, type of exposure) and the individual and situational effect modifiers (e.g., age, socioeconomic status, health status, gender, cultural/religious background, blue space type, environmental/water quality, weather, season). For example, future studies could evaluate the health effects of different blue space types for different groups of older people or refine the information which individual characteristics among older people influence blue space use, and how. Overall, blue health studies focused on old age need to consider the pronounced heterogeneity in older people. When differentiating according to age, future investigations should take into account that people aged 80+ years will make up the biggest increase among older adults in the coming decades but are one of the least studied user groups. Older people with chronic diseases, disabilities and those in need of care might benefit particularly from blue space exposure but are likely to be excluded from

studies outside specific health care research. While visual and virtual exposure to blue spaces is easier to implement for these groups, research should apply a multi-sensory perspective and take their physical blue space exposure into account.

- At present, most studies have been conducted in HICs and locations with a (relatively) high availability of water, particularly coastal blue spaces. Future healthy blue space research on and with older people in different geographic contexts (e.g., with different cultural, socio-economic and climatic conditions), particularly in LMICs, is recommended.

- Additional research is needed to establish a more robust evidence base regarding the causal (mediating) pathways of the urban blue space-health relationship of older people, especially, but not exclusively, regarding the mechanisms of social interaction and ecosystem services/environmental quality.

- The behavioral responses and physiological and psychological reactions of older people to blue space exposure need to be further investigated and should include standardized data collection tools. The comparability of current research is diminished by the fact that various health outcomes are measured by different methods. Health outcome measurements should consider multi-source data and different levels, e.g., individual and public health and one or planetary health. Further work is needed to explore how health and wellbeing outcomes could be better differentiated. As this study recommended to link urban blue space provision to behavioral prevention measures, additional studies will be needed that assess the effectiveness of those measures. Despite promising results of salutogenic research on blue spaces, studies need to consider the inherent pathogenic nature of water. In future investigations, it might be possible to further ascertain why older people do not use and/or do not benefit from blue spaces, even if those are available and accessible in principle.

- Overall, further healthy blue space research on and with older people of all types of research strands (i.e., the experiential, preference-based, experimental and

quantitative-spatial approaches) is needed to confirm and validate the existing findings. This should include quantitative, qualitative and mixed methods approaches as each of them have distinct advantages. Future photographic healthy blue space research could address the potential advantages of using multi-angle (3D) images or virtual reality devices to provide a more realistic exposure to the blue spaces under study. Studies using availability metrics should consider the high importance of blue space accessibility and quality for older people and should integrate those into data collection. The collection of both objective and subjective data is an important issue for future research to enable cross-validation e.g., regarding health outcomes such as biomarkers vs. self-reported health and environmental aspects such as perceived vs. objective biodiversity or water quality. To develop a clearer picture of the causal linkages between blue space exposure and health, additional longitudinal studies and those applying an experimental or pre-/post intervention design will be needed. By longitudinal research such as cohort and panel studies, it might be possible to explore how blue space exposure and use (and changes over life course) affect the (biologic and social) aging process and healthy aging. Research questions that could be asked include whether there are differences of blue space effects on female and male longevity.

- In general, further application-oriented studies with a strong focus on providing policy-relevant information are recommended as many practical questions regarding the harnessing of the health potential of blue spaces remain unanswered at present. Research demonstrating the cost-effectiveness of strategic blue space development by proving public health benefits such as a reduction of health costs and disease burden as well as those investigating blue health equity questions (and solutions) would be particularly valuable. Further work is needed to better understand successful urban blue space governance approaches and to develop normative standards, including the question of how to improve the consideration of health concerns (e.g., importance of involving the public health service and of conducting impact assessments), as well as to explore the impacts of awareness-

raising and knowledge-building activities on decision-makers and practitioners in planning and design.

6 CONCLUSION

This PhD thesis set out to explore the linkages between urban blue spaces and older adults' health and wellbeing. More precisely, the aim was to assess how older people in different geographic settings (Germany and India) experience and use urban blue spaces, if they perceive those as 'potentially therapeutic landscapes' and which factors influence their blue space-health relationship. In addition, the thesis aimed to examine how the local urban blue space provision in Ahmedabad and Ruhr Metropolis meets older adults' demands and needs and how those are considered and reflected in the local urban blue space planning and design. By gaining a better understanding of the phenomenon 'blue health' in old age and its manifestations in exemplary cities, the ultimate aim was to derive recommendations for action to inform about a health-enabling blue space provision for aging urban populations.

In the first part of the thesis (see chapter 2), results of a literature review were presented to obtain an overview of the most recent scientific evidence on the (urban) blue space-health relationship in general and specifically in later life. Regarding the latter, the results of this review show that blue space use is influenced by common age-associated changes such as changes in living circumstances, health and mobility. However, the precise effects of age as an influencing factor in the blue space-health relationship remain largely unclear. A key finding of previous research is that older people value the following aspects: practicalities, i.e., accessibility (to and within blue spaces), safety (both, objective and subjective), the provision of amenities at blue spaces and a good ecological quality as well as having a personal meaning/sense of connectedness to blue spaces (Pool et al. 2023; Smith et al. 2022; Garrett et al. 2019). Effects of blue space exposure on health and wellbeing in old age can be classified into general health and wellbeing (including social wellbeing and other positive impacts such as pleasant sensory perceptions), physical health outcomes and mental health outcomes (Wang & Sani 2024; Finlay et al. 2015). There is growing evidence for all these effects, but still many inconsistent findings that call for further research (Wang & Sani 2024; Chen et al. 2022). The major mediating mechanisms are physical activity, social interaction, stress recovery/mental wellbeing and environmental quality or in other –more general– words: mitigation of harm, instoration/capacity building and restoration (White et al. 2020, White et al. 2018).

Chapters 3 and 4 dealt with the empirical research work of this PhD thesis. The findings reported here add to the increasing but still little evidence base on the blue space-health relationship of older adults by providing insights from experiential, experimental and preference-based research approaches. In addition, this research sheds new light on 'blue health' in later life by extending our knowledge to the context of rapidly urbanizing LMICs. Before this study, evidence of health benefits of urban blue spaces in India was purely anecdotal. The results of both case studies were compared and discussed in relation to the existing scientific literature in chapter 5. This research confirmed that older people perceive urban blue spaces as 'potentially therapeutic landscapes' across distinct geographic settings and can benefit from urban blue space exposure in terms of positive effects on their physical, mental and social wellbeing which could foster processes of healthy aging. Using the theory of therapeutic landscapes, the present study showed that all dimensions of blue health appropriation apply to the interaction with blue spaces in later life, meaning that older adults interact with those spaces as activity, social, symbolic and experienced spaces. However, various factors such as accessibility and blue space quality must be considered to make these environmental health resources available to all older people as the actual provision of urban blue spaces does not yet fully meet their demands and needs. There appears to be scope for improving the consideration of public health interests and older people's demands and needs in urban blue space planning and design. In this regard, another contribution of this study was to thoroughly examine potential facilitators and obstacles to successful age-friendly urban blue space governance for health. Finally, despite its limitations (see chapter 5.2), the present work contributed to the methodological advancement of healthy blue space research, particularly such studies using participatory and photographic approaches.

While considerably more research will need to be done to clarify pending questions on how to fully unfold the health potential of blue spaces for older people and healthy aging, the results of this study have several important implications for future practice (see chapter 5.1). Here is what matters most: "good health adds life to years" and adding life to years is an outstanding task in today's societies of longevity (WHO 2020b). Although remarkable global success in increasing life expectancy has been achieved, the gap between lifespan and healthspan (life expectancy vs. healthy life expectancy) has yet to

be bridged (Crimmins 2015). In addition, inequalities in the distribution of good health between and within populations still need to be resolved (WHO 2020b). The urgency to act on healthy aging applies to countries at all levels of income and all regions but is particularly high in LMICs and urban areas where most older people will live in future. Preventing and reducing morbidity, disability and premature mortality in old age goes beyond fulfilling the human right to health, it is about enabling aging-in-place and older adults' participation and harnessing their potential for their families, communities and society. Obviously, economic incentives for more sustained action on promoting health and wellbeing in old age also exist. High levels of morbidity increase the demand for long-term care, a sector which has been requiring rising public expenditure while at the same time, there are increasing fiscal pressures.

If healthy aging is defined as "creating the environments and opportunities that enable people to be and do what they value throughout their lives" (WHO 2020), then urban blue spaces must be considered as those environments and opportunities. As this and other research has shown, blue spaces can help to develop and maintain the functional ability that enables wellbeing in old age –e.g., by promoting physical activity, social interaction and mental health and providing protection from environmental hazards–, while they can also function as resources to cope with the strains of later life. Importantly, benefits such as aesthetic, contemplative, and restorative experiences may not be immediately apparent to outsiders, but they have a major impact on health and wellbeing. Now is the time to recognize blue spaces as potential health resources (and not as luxury good or nice-to-have) and –particularly in the urban context– as a possible part of "access to a clean, healthy and sustainable environment" which has been declared as a human right by the UN in 2022. This does not rule out the possibility of health risks and that 'blue health' may not unfold everywhere. Among the many challenges involved, key ones are to provide blue spaces in a world of inequalities, to cater for diverse demands and needs and to manage land-use conflicts. But instead of being overwhelmed, it is important to take action. For example, in many cities, it is possible to first improve the data basis about blue space availability, accessibility and quality. In many cases, it might not even be so important to provide "more blue", but to make the existing waterscapes health-enabling spaces, e.g., by making them more accessible, safer, more comfortable and welcoming, which ultimately makes them age-friendlier. In addition, there might be

starting points to improve the maintenance and to increase the exposure of older adults to blue spaces and their use, e.g., as part of municipal, social welfare or health promotion work with older people. This study has suggested a number of recommendations for action (see chapter 5.3), which can already be adopted in planning and policymaking.

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8 APPENDICES

The following digital appendices are published on bonndoc:

Annex I	Ethical clearances
Annex II	Participant observation tool
Annex III	Baseline survey questionnaires
Annex IV	Informed consent forms
Annex V	Interview guidelines for photowalks
Annex VI	Photograph release forms
Annex VII	Focus group discussion questionnaires
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Annex X	Table 4.5
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