Introduction

Simon Bell, Lora E. Fleming and James Grellier

This book came about as a major dissemination output of the BlueHealth Project (https://bluehealth2020.eu), a large, integrated interdisciplinary research project carried out under the European Union Horizon 2020 Research Framework Programme between 2016 and 2020. The project took an international and innovative, interdisciplinary and cross-sectoral approach to health promotion and disease prevention by exploring how to use Europe's aquatic 'blue' infrastructure to reduce threats and particularly to foster improvements in the health and well-being of its citizens (and beyond into the wider world), now and into the future.

Most urban areas in Europe (where the majority of people live) are strongly associated with inland waterways, lakes, or sea coasts (see the following). BlueHealth focused on blue infrastructure primarily in urban contexts, and this will be a key feature throughout the book. Much of Europe's blue infrastructure spans national boundaries (for example, rivers such as the Rhine or Danube or certain lakes and substantial coastline), making the international recognition of the issues and cross-border cooperation essential.

Dealing with the health implications of the growing importance of blue infrastructure is key to the European Union's 'Health in All Policies' Agenda. European blue infrastructure offers not only significant but relatively unexplored health- and well-being–related opportunities and benefits (e.g. urban cooling, increased recreational opportunities) but also a means of mitigating threats (e.g. from flooding and microbial and chemical pollution). The project investigated these synergies and trade-offs, with the aim of developing targeted environmental, health and well-being assessment indicators, illustrative case studies, best practices, decision support tools and guidelines to inform and improve decision-making for current blue infrastructure as well as future blue infrastructure interventions in light of climate and other environmental change.

In addition, there are many blue infrastructure-related policies at the European level, such as the EU Water Framework Directive and Marine Strategy Framework Directive, as well as the EU Blue Growth strategy together with contributions to international policies such as the Rio+20 agenda, the United Nations Sustainable Development Goals (SDGs), and the World Health Organization Parma Declaration 2010, to which the work carried out by this project adds considerable value.

The BlueHealth project brought together interdisciplinary teams of experts in a broad consortium to apply mixed-methods research in fields including public and environmental health, ecosystems management, epidemiology, landscape and urban planning and design, environmental psychology, climate change modelling, social geography, virtual reality, health and environmental economics and policy. The Partners in the project came from seven EU member states together with the World Health Organisation (WHO) Regional Office for Environment and Health in Europe. A lot of the work of this wide-ranging group, although not all, is represented here.

At the heart of the project was the detailed and systematic consideration of blue infrastructure case studies and experimental interventions which, together with a set of research and assessment tools, form the heart of this book. Blue infrastructure initiatives were evaluated systematically and from different perspectives.

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The diverse case studies presented a range of interventions and locations for the exploration of varying climatic and environmental conditions, examining challenges at multiple levels from individual behaviour, through communities to cultural aspects at the population level. Important challenges such as how urban blue infrastructure can be used to address socioeconomic, ethnic and gender inequalities in health and well-being were explored. The integration of urban blue infrastructure into spatial design and local policy was also addressed. Finally, the innovation potential for reducing health and well-being risks and the gain in benefits through modifying the ways people interact with the environment and climate were explored, assessed and quantified in terms of economic and social costs.

The importance of blue space

With 91,000 km of coastline, Europe has considerable access to very different marine and other blue environments, including the Atlantic Ocean, the North Sea, the Irish Sea, the Mediterranean Sea, the Black Sea and the Baltic Sea. Approximately 50% of the European population lives within 50 km of a coastline, while the average urban European lives only 2.5 km from a freshwater source such as a river, lake or canal.

Although Europe's blue infrastructure is sometimes considered a subset of its 'green' infrastructure, this conception ignores blue infrastructure's unique cross-sectoral roles (e.g. river and marine transport, trade, fisheries and aquaculture, tourism and health). Moreover, growing evidence shows that the health promotion and disease prevention opportunities of blue infrastructure are distinct from, and in some cases synergistic with, those provided by 'green' and 'grey' infrastructure. Blue infrastructure may also be more vulnerable to short- and long-term climate and other environmental change and stressors (e.g. rivers drying up, sea levels rising, pollution), as well as becoming of increasing global importance with regard to water availability and quality.

Urban blue spaces are ubiquitous across Europe. They have been and continue to be exploited for many functions, including the transport of people and goods and the provision of water for industry, fisheries and aquaculture, building and energy generation. They are also crucial pillars of urban public health, providing direct benefits to health through the provision of drinking water and by aiding waste and sewage treatment. What is far less well understood is whether and how urban blue spaces can also play a role in tackling the major public health challenges of the 21st century, such as obesity, physical inactivity, chronic diseases and mental health disorders.

The aim of BlueHealth was to explore these possibilities systematically and to investigate whether the careful design and implementation of urban blue infrastructure can promote benefits to public health and prevent disease by, for instance, encouraging people to take more exercise or by helping to reduce the stress and anxiety known to be created by living in highly urbanised settings. When we initiated BlueHealth, initial evidence suggested that these benefits could be substantial and widespread (White et al. 2013a, 2014; MacKerron and Mourato 2013; Wheeler et al. 2015) and could be especially important for vulnerable populations such as children (Amoly 2014), those with underlying poor health (Weimann et al. 2015) and those in deprived communities (Wheeler et al. 2012). BlueHealth was the first attempt to characterise or quantify these benefits systematically and to use this information to inform and improve the design of urban blue infrastructure to aid in the promotion of health and prevent disease.

The BlueHealth Consortium brought together for the first time leading research, public health and policy institutes at the forefront of understanding the relationships between the environment and human health across Europe in order to address opportunities for BlueHealth interventions with interactive cross-sector stakeholder engagement.

Key questions to be addressed (and included in this book) were:

- How are the unexplored benefits of urban blue infrastructure (e.g. promotion of physical activity and stress reduction) distributed across the EU, and will these address the public health challenges of the 21st century?
- Which social groups derive the most benefit, and are there pockets of good practice that promote more equitable distribution?

- Can these benefits of blue infrastructure programmes be assessed in ways that inform good design (e.g. through the use of prospective longitudinal evaluation of ongoing and planned environmental interventions)?
- How might different climate and environmental futures influence the ability of urban blue infrastructures to deliver these benefits to public health and well-being?
- How can existing health and environmental planning policies be built upon to best ensure that these benefits to health and well-being are factored into the policies for maintenance and retrofitting of existing, and the development of future, urban blue infrastructures?

The aim of the BlueHealth Project was to quantify the impacts on population health and well-being of existing and novel interventions and policy initiatives connected to urban blue infrastructure and to identify opportunities and obstacles for cross-sectoral collaboration in this area. We recognised that assessments of the health and well-being (and environmental) benefits, risks, trade-offs and costs should improve our understanding of the role of urban blue infrastructures, both positive and negative, on health promotion and disease prevention.

Many of these infrastructures were originally designed for other policy goals (e.g. transport, flood prevention). However, innovative design and planning can promote health by ensuring that the co-benefits are captured. For example, walking and cycle paths can become integrated features of existing and future blue infrastructure; promoting better access to water bodies for recreation can foster better mental health and increases in physical activity. Blue infrastructure can also aid sustainability and connectivity with other transport networks.

Given peoples' preferences for blue spaces and their willingness to visit them (White et al. 2010; Völker and Kistemann 2013), the evidence suggested that the population uptake of blue infrastructure initiatives that encourage, for instance, greater levels of active recreation, should be particularly high and thus important for disease prevention and health promotion at the individual, community and population levels. Conversely, the predicted increased use of water in urban areas introduces new challenges for improving human health and well-being (e.g. as exposures to known and unknown environmental stressors such as flooding, pathogens and chemical pollutants increase), as well as making the attainment of the long-term sustainability of urban blue ecosystems more difficult.

Throughout the project, we developed innovative indicators and other measures to demonstrate the health, economic, environmental and social impacts of the community-level interventions, policies and best practices. The book is structured around these assessment tools, as well as around what we learned from best practices from around the world and our own experimental planning and design interventions.

BlueHealth concept and approach

Although often considered a source of disease and a threat to health (e.g. the stressors of microbial and chemical pollution, flooding, risk of drowning), at the time of beginning BlueHealth, there was growing evidence that blue infrastructures can directly and indirectly promote health and prevent disease (Völker and Kistemann 2011; Wheeler et al. 2015). As with earlier research around green spaces, epidemiological evidence showed that people who live near the coasts are generally healthier than those who live inland (Wheeler et al. 2012) and that mental and physical health can improve following a relocation nearer to water (White et al. 2013b). Furthermore, coastal and inland water bodies are prime leisure and tourism destinations, and homes with water views are significantly more expensive (Luttik 2000), leading to extensive waterside development (as well as growing access equity issues for more deprived individuals and communities) across many European countries.

Mechanisms and pathways appeared to include greater stress reduction (White et al. 2013a), a greater propensity to engage in recommended levels of physical activity (White et al. 2014) and the positive effects from social engagement. Given the very strong associations between these factors, well-designed blue infrastructure that encourages

recreation could offer significant health promotion and disease prevention opportunities, as well as direct and indirect cost co-benefits and innovation opportunities (e.g. climate change adaptation measures of urban cooling and flood prevention).

The importance of urban blue space

Partly for historical and economic reasons, many of Europe's urban centres are situated on or near water, including along major rivers (e.g. Danube, Vienna; Elbe, Hamburg; Liffey, Dublin; Rhein, Rotterdam; Po, Turin; Seine, Paris; Thames, London), on the banks of major lakes (e.g. Geneva; Zurich) or on the coast (including 194 cities bordering Europe's five major seas, e.g. the Atlantic, Lisbon; Baltic, Helsinki; Black, Istanbul; Mediterranean, Barcelona; and North, Edinburgh). Furthermore, many of these rivers, lakes and coastal cities are connected by a network of canals and man-made waterways (e.g. Amsterdam, Annecy, Birmingham, Bruges, Stockholm, Utrecht, Venice) and have a broad array of open reservoirs to supply water to these rapidly growing 'blue' urban centres. Importantly for public health, many urban waterfronts have been 'regenerated', starting in the 1980s (Jauhiainen 1995; Breen 1996), transformed from docks and warehouses into housing and open public spaces with major potential implications for the health and well-being of urban populations (Sairinen and Kumpulainen 2006; Völker and Kistemann 2011).

Many of these benefits may also be linked to other sectoral goals such as transport. For instance, a new cycle network along the main riparian and canal arteries in a city, established to reduce car use and associated negative environmental impacts, may also have positive health benefits if it promotes active travel in a less polluted environment (e.g. Toccolini 2006). Importantly, there is also growing development pressure on many urban green spaces, suggesting that urban blue spaces may become increasingly important health- and well-being-promoting pockets of outdoor space in otherwise 'grey' urban settings for tackling the key 21st-century public health challenges.

Although supplies of fresh water (e.g. rivers), food (e.g. fish) and transport (e.g. canals) opportunities were undoubtedly important in the development of these major urban centres, for many modern city dwellers, their relationships with these urban blue spaces are now quite different from those in previous centuries (Van Leeuwen 2013). In particular, where once they were almost exclusively associated with work and industry, today, they are increasingly likely to be associated with leisure, recreation and tourism, supporting the general contention that people like to be and are willing to pay to be near water, even or particularly in urban settings.

What do we mean by blue space?

Early in the project, we defined blue space as outdoor environments – either natural or manmade – that prominently feature water and are accessible to humans either proximally (being in, on or near water) or distally/virtually (being able to see, hear or otherwise sense water) (Grellier et al. 2017). So far a number of different types of such blue spaces have been mentioned – broad and generally easily recognised categories. However, so far, there has been no comprehensive typology of blue spaces available (unlike those for green and public spaces), so for many aspects of the research undertaken in the BlueHealth project where, for example, the specific benefits or threats related to different categories of blue space varied, a blue space typology became necessary. Table 0.1 summarises the comprehensive typology we used, and Appendix 1 presents it in much greater detail.

The blue space typology is represented in the project review chapters in Part Three of the book. There each type is described in detail in terms of the characteristics which define them, the associated blue infrastructure usually associated with them, the health and well-being benefits, the risks associated with them and ecological aspects and sensitivities.

Table 0.1 **Summary of the blue space typology used in BlueHealth**

Main categories	*Types within the category*
Constructed coastal spaces	Promenade, pier
Natural coastal spaces	Sandy beach, stony beach, sand dunes, sea cliffs, salt marsh, estuary
Lakes and other still water bodies	Natural lake, artificial lake, reservoir, pond, wetland, fen, marsh, bog
Rivers, streams and canals	Large river with artificial banks, large river with natural banks, medium-sized river with artificial banks, medium-sized river with natural banks, stream with a mix of artificial or natural banks, urban canal, rural canal, waterfall or rapids
Docks, ports and marinas	Dock, harbour, marina
Other blue infrastructure	Ornamental water feature or fountain, mineral spring, thermal spring, outdoor skating, curling or ice hockey rink, lido/open-air swimming pool

What do we mean by 'exposure' to urban blue space?

For the purposes of our research, we considered three types of exposure to urban blue space (Kenniger et al. 2013):

- *Intentional* (i.e. deliberately chosen direct exposure that could be *in* [e.g. bathing], *on* [e.g. boating] or *by* [e.g. resting, cycling, walking alongside] the water);
- *Indirect* (e.g. a view from a home/office/building window or benefits such as urban cooling even without visual exposure); and
- *Incidental* (e.g. visual exposure during a commute; if the route is chosen specifically because of its proximity to water, this would be considered 'intentional').

For research purposes, 'exposure' may be operationalised as the proximity of home, school or workplace to urban blue space (Amoly 2014); self-reported frequency and duration of visits (White et al. 2013b); and/or monitoring visitor behaviour at selected urban blue sites (Bell 2008).

Of note at the beginning of BlueHealth, evidence in the United Kingdom suggested that only a relatively small number of visits to any aquatic environment (urban or rural) involve actually getting *in*, or *on*, the water. For instance, only 4.1% of the 260 million annual visits to the coast, and as little as 0.6% of visits to inland waters, involve swimming, and water sports (e.g. canoeing, sailing) account for as little as 2.0% of coastal visits and 2.6% of inland water visits (White et al. 2015). Rather, the vast majority of UK leisure visits involved people taking a walk alongside blue spaces (62.6% beaches and 74.5% inland waters). While this may reflect the United Kingdom's relatively cool and wet climate compared to other EU Member States where bathing may be higher (and, indeed, there are some 15,363 designated coastal bathing water sites and 6,473 inland bathing water sites across Europe), it suggests that many of the health-related benefits (discussed in the following and in Chapter 2) may come from being *by* water or through indirect or incidental exposure.

As such, the investigation of the potential opportunities for health can still be explored in situations where no bathing takes place but where, for instance, the banks of major rivers such as the Rhine or Elbe are used as public open spaces (e.g. in Köln or Hamburg; Völker and Kistemann, 2013). In addition, urban water features such as fountains and splash parks to play *in* or pass *by* are more and more common; some health hazards associated with these features had been identified in the Netherlands (De Man 2014) but not in combination with the positive trade-offs of their health benefits.

What are the potential health outcomes and pathways?

At the time of beginning BlueHealth, several authors had developed conceptual frameworks for the ways in which urban green space could affect health and well-being (e.g. Pretty 2011; Lachowycz and Jones 2013; Church et al. 2014; Hartig et al. 2014; Keniger et al. 2013), and we expected that many of the potential benefits to health and well-being from exposure to urban blue space would be the same as those for exposure to urban green space (e.g. lower obesity rates, improved mental health, etc.).

However, there are two important caveats. First, some of the environmental conditions believed to be important for health and well-being in relation to urban green space (e.g. lower air pollution) may be less applicable to urban blue spaces where other factors such the urban cooling effect may be particularly strong for some aquatic environments (i.e. not just through urban tree cover). Second, research suggests that people are particularly motivated to spend time in blue spaces (including urban ones, e.g. Korpela et al. 2010) compared to green, grey or even mixed blue/green spaces and that the experiences in blue spaces may be particularly beneficial, even relative to green or mixed spaces (e.g. White et al. 2013b).

Therefore, it should not be assumed that blue and green spaces are one and the same thing. Our BlueHealth conceptual model developed throughout the project (discussed at the end of Chapter 1) details the different ways to measure the 'blue' exposures (e.g. type, quality [including biodiversity and other ecosystem services] and health and well-being outcomes [e.g. physical, mental, social]), as well as the possible mechanisms underpinning the apparent benefits of interacting with health and well-being (e.g. physical activity, stress reduction, a sense of place).

Contextual issues (e.g. age, gender, socioeconomics/deprivation, cross-sector considerations, etc.) are also very important to understanding the pathways to health and well-being. However, interactions with blue infrastructure are not always inherently positive, since these interactions can also involve risks as already noted (e.g. flooding, poor water quality from microbes and chemicals, biodiversity loss) that have negative impacts on health (e.g. drowning, poor mental health, waterborne diseases). The trade-offs of both positive and negative impacts from interactions with blue infrastructure were taken into account in BlueHealth and are included in this book. Finally, key to this conceptual model from the point of view of behaviour change, health promotion and disease prevention is the potential for a feedback loop from the health outcome(s) to the exposure(s) that can influence future interactions with the blue environment (e.g. if a walk along a canal helps people feel more relaxed, they may be more likely to repeat the visit).

Book structure

This book focuses on the findings of the BlueHealth project, which are especially relevant to the theme of planning and designing blue spaces for health and well-being. The primary aim is to help planners and designers to implement evidence-based design – in effect, how to use the research evidence and the planning tools to create the best blue spaces possible.

To this end, it is structured in three main parts, starting with the historical context of public health and the environment and the main general research evidence supporting the notion that blue space has an important role to play together with a discussion and illustration of co-design principles. The second part follows with a number of planning/research tools which can be used to collect information about a site and its users at different spatial scales as well as to evaluate the effectiveness of a planning or design intervention and finally to assess the risks and benefits associated with such an intervention. Part three, the largest part, focuses on the design of a range of types of blue spaces (from the blue space typology; Appendix 1), bringing evidence from reviews of completed projects to identify key principles which can be used by planners and designers to inform and inspire their own projects.

Part I: water, blue space and health and well-being: the evidence base and how to use it

This section starts the book off with three chapters that explore, in their own ways, a series of overviews of the main evidence bases to be applied later on.

Chapter 1: Blue space as an essential factor in environment and health

In this chapter, George P. Morris, Himansu S. Mishra and Lora E. Fleming locate the growing knowledge about the public health importance of urban blue spaces within a much longer evolution and history of understanding about the environment and human health, including discussion of conceptual models and theoretical frameworks, ending with specific discussion of the use of conceptual models within the BlueHealth project.

Chapter 2: Potential benefits of blue space for human health and well-being

In this chapter, Mathew P. White, Lewis R. Elliott, Mireia Gascon, Bethany Roberts and Lora E. Fleming present an overarching review of the evidence from the current research literature and from the findings of the research carried out in the BlueHealth project in order to provide the best evidence which planners and designers can use to support their policies, plans and projects. It is essentially an overview of the current knowledge, extensively but not exhaustively referenced and presented in a way which is accessible to professional and student readers. It integrates the benefits and risks by showing that the one often come with the other.

Chapter 3: Co-design with local stakeholders

The aim of this chapter by Mart Külvik, Mireia Gascon, Marina Cervera Alonso de Medina, Lewis R. Elliott, Jekaterina Balicka, Frederico Meireles Rodrigues and Monika Suškevičs is to present the ways in which co-design and public participation can be undertaken, with examples of stakeholder and local community involvement using the BlueHealth case studies in Plymouth in the United Kingdom, Rubí near Barcelona in Spain, Guimarães in Portugal and Tallinn in Estonia. It covers the theoretical aspects of co-design and participation with stakeholders, discussing stakeholder identification, different modes of engagement and the specifics of co-design.

Part II: tools, indicators and models for planning and design

This set of chapters is used to present the range of tools developed within the BlueHealth project and demonstrates their application for policy makers, planners and designers and also local communities.

Chapter 4: Generating evidence in support of site planning and design: the BlueHealth toolbox

In this chapter, James Grellier, Himansu S. Mishra, Lewis R. Elliott, Susanne Wuijts and Matthias F.W. Braubach set the scene for the rest of the chapters in Part Two and connect the individual tools into a comprehensive approach or system for assisting in planning, design and management of blue spaces for health and well-being. By applying all of them, it is possible to provide a comprehensive means of establishing a baseline; deciding what to do; assessing the risks and benefits; and, having done a project, evaluating its success and what difference it has made. Many of the tools are also available to download or use via two project websites – the main website (https://bluehealth2020.eu) and a specific one for the tools and project reviews (https://bluehealth.tools/).

Chapter 5: Assessing the land-water environment

This chapter by Himansu S. Mishra, Katrin Saar and Simon Bell presents the development and application of the BlueHealth Environmental Assessment Tool (BEAT), illustrated with examples from the pilot testing and later application. It describes, in a "how to do it" form, the development and application of the BEAT. It also introduces the online tool, which is an output of the project and free to use by readers.

Chapter 6: Observing behaviour for site planning and design
In this chapter, Peeter Vassiljev, Cristina Vert and Simon Bell focus on two tools used to assess behaviour in blue spaces. One is an existing tool – the System for Observing Play and Recreation in Communities (SOPARC) – and the other is a method which was further developed for the project – the BlueHealth Behaviour Assessment Tool (BBAT). The theory, development and application as well as how to apply and analyse the results are presented for both tools, based on the examples of application in BlueHealth case study sites in Barcelona, Spain (for SOPARC) and Tallinn, Estonia (for BBAT). The chapter is illustrated with different approaches to analysis and presentation as well as interpretation of the results using the two case studies.

Chapter 7: Capturing affordances for health and well-being at the city scale
In this chapter, Gloria Niin, Peeter Vassiljev, Tiina Rinne and Simon Bell focus on the application of Public Participatory Geographic Information Systems (PPGIS), sometimes known as "SoftGIS", using the 'Maptionnaire' tool (an existing system originating in Aalto University in Finland and now commercially available to license) for city-level capture of the blue spaces which local people value the most, explaining how to apply it and how to interpret the results for planning purposes, illustrated using the example of Plymouth, United Kingdom.

Chapter 8: Assessing city-wide and local health and well-being benefits
In this chapter, Lewis R. Elliott, Mathew P. White, Cristina Vert, Wilma Zijlema and Peeter Vassiljev summarise the development and application of the two survey tools, the BlueHealth Survey (BIS) (international but could be applied at a national level) and the BlueHealth Community Level Survey (BCLS) – a questionnaire for use in local areas to capture the benefits of the presence of and access to blue spaces (based on a synthesis of a number of existing survey instruments and validated questions), with an overview of the results from Bulgaria (for the BIS) and Plymouth (for the BCLS) as illustrative of the efficacy of the tools, their ease or difficulty of application and the limitations of what they can tell us, together with information on protocols. The idea is that local authorities, communities and others could use the survey tools to gather their own data and interpret their own results.

Chapter 9: A decision support tool for optimising blue space design and management for health
In this final chapter in Part II, Arnt Diener, Marco Martuzzi, Francesco Palermo, Laura Mancini, Giovanni Coppini and Matthias F.W. Braubach introduce the decision support tool (DST) for BlueHealth, explaining the rationale behind it and how it can be used. It introduces the concept of DSTs in general, some background to the development of this particular DST and the way it works, with some demonstration of results from different locations and some discussion of its limits and generalisability.

Part III: inspirational practice for planning and design
The aim of this third part, the largest of the book, is to present, under different major categories from the blue space typology (Appendix 1), a number of principles for designing blue spaces which arose from a detailed and comprehensive review of projects from around the world. The aim is to bring the evidence and tools together with best practice and to help planners and designers use all of these to achieve the best possible solutions at a range of scales. In Chapters 11–15, a number of representative projects are presented in text, together with a short critical analysis and a set of analytical sketches. Jekaterina Balicka and Anna Wilczyńska created the sketches for each project, while different authors wrote the text and interpreted the critical assessment.

Chapter 10: Reviewing the evidence for good planning and design
This chapter by Himansu S. Mishra, Simon Bell, Jekaterina Balicka and Anna Wilczyńska focuses on the project reviews, the methods used and the overall results, leading into the more specific and thematic coverage of the next set of chapters, where key examples from the review will be presented, critiqued and discussed.

Chapter 11: Urban river revitalisation
In this chapter, Friedrich Kuhlmann, Jekaterina Balicka and Anna Wilczyńska cover the aspects related to different types of rivers as found in the project reviews and also through first-hand experience. It starts with an overview of urban rivers, a history of how they have been mistreated, regulated, polluted, buried and rediscovered. The main risks and benefits for health and well-being are described. Some principles being adopted for restoration are presented. Then a selection of inspirational projects is introduced, and each is evaluated and compared with the others against the set of criteria already defined in Chapter 10.

Chapter 12: Seafronts, beaches, lakesides and promenades
This chapter by Simon Bell, Himansu S. Mishra, Anna Wilczyńska and Jekaterina Balicka starts with an overview of seafronts, beaches, lakesides and promenades and a short history of how they have been developed and used for bathing and recreation, highlighting some famous historical and contemporary examples. The main risks and benefits for health and well-being associated with beaches are described. Some principles being adopted for their re-development, management and maintenance are summarised. Then a selection of innovative projects is introduced, and each is evaluated and compared with the others against the set of criteria defined in Chapter 10.

Chapter 13: Urban wetlands and storm water management
In this chapter, Himansu S. Mishra, Simon Bell, Anna Wilczyńska and Jekaterina Balicka look at the growing popularity of combining storm and other ecological water treatment systems with recreational aspects in urban wetland parks. It starts with a review of the problems facing urban areas in terms of storm water management and urban drainage, leading to extensive sustainable urban drainage systems (SUDS) and special storm water wetland parks and how they can be used for recreation. The risks of their use for health (e.g. if using bio-remediation to clean polluted water) are covered, and an inspirational selection of projects are introduced and evaluated using the criteria defined in Chapter 10.

Chapter 14: Docklands, harbours and post-industrial sites
This chapter by Simon Bell, Anna Wilczyńska and Jekaterina Balicka focuses on the recent wave of rejuvenation of docklands and ports, which are often the largest scale of blue space planning and design being undertaken at present, often being part of whole urban regeneration areas. It starts with an overview of docklands and ports, a history of how they developed and how many old port and docklands have been released from industry and made available for redevelopment. The main risks and benefits for health and well-being are described. Some principles being adopted for redevelopment into mixed use urban settings are summarised. Then a selection of iconic projects is introduced, and each is evaluated and compared with the others against the set of criteria already defined in Chapter 10.

Chapter 15: Tactical urbanism, urban acupuncture and small-scale projects
In this chapter, Jekaterina Balicka, Joanna Tamar Storie, Friedrich Kuhlmann, Anna Wilczyńska and Simon Bell deal with the smallest end of the scale, that of small interventions under the concept of "urban acupuncture". It starts with

some theory, definitions and examples of urban acupuncture/tactical urbanism from other fields (permanent and temporary) of urban design and then leads to the application of the concept in blue spaces. The selected projects are evaluated and compared with the others against the set of criteria already defined in Chapter 10.

Chapter 16: Future outlook studies: the use of scenarios to create healthy blue cities
This final stand-alone chapter by Judith Hin and Susanne Wuijts look at some scenarios developed in the BlueHealth project and then indicates areas for policy interventions around the challenges and opportunities for blue space urban planning. It starts with some of the major issues facing urban areas, then introduces the concept of scenarios and how to develop them. The examples of city profiles and results of scenario workshops in several of the BlueHealth research cities are summarised. From this analysis, the challenges for urban blue space planning are identified, leading to potential policy interventions and future research areas and the practical challenges associated with blue spaces. The importance of inter/transdisciplinary and trans-sector approaches across groups and institutions is emphasised.

Who should read this book?

As the subject area is already rather topical and as the whole area of the relationship between nature, landscape and human health and well-being is growing in research and practice importance, we believe that the readership is very wide. We consider that urban planners, landscape architects, urban designers, urban ecologists, specialists in health and well-being working in national or regional and local community and governmental organisations (city councils, etc.) and professional companies (architects, planners, landscape architects) should all find the book valuable.

We also hope that students of all these subjects will find the book inspiring in their learning and, for design students especially, in their studio projects and eventual practice.

Links to the evidence, online tools and project database

The book is linked to various online tools and websites, as well as a growing evidence base of peer-reviewed articles (https://bluehealth2020.eu/publications/) prepared by the project researchers which should remain active and available after the book is published. The BlueHealth Toolbox (Grellier et al. 2020) is on the main project website at: https://bluehealth2020.eu/resources/toolbox/. The BlueHealth Tools website (managed by a separate organisation) can be found here: https://bluehealth.tools/, from which readers can gain access to the BEAT, information and materials for the BBAT and the full database of inspiring BlueProfiles. The BlueHealth Decision Support Tool is available here: https://bluehealth2020.eu/projects/decision-support-tool/.

References

Amoly E. Green and blue spaces and behavioral development. *Environmental Health Perspective*, 2014;122(12):1351.

Bell S. *Design for outdooor recreation*. Abingdon: Routledge, 2008.

Breen A. 1996. *The new waterfront: A worldwide urban success story*. New York: McGraw-Hill Professional Publishing, 1996.

Church A, Fish R, Haines-Young R, et al. *UK national ecosystem assessment follow-on phase*. Work Package Report 5: Cultural Ecosystem Services and Indicators. 2014. http://uknea.unep

De Man H. *Best urban water management practices to prevent waterborne infectious diseases under current and future scenarios*. Thesis Utrecht University, 2014.

Grellier J, Mishra HS, Elliott LR, Wuijts S, Braubach MFW, Hall KL, Bell S, White MP, Fleming LE. The BlueHealth Toolbox – Guidance for urban planners and designers. 2020. doi:10.5281/zenodo.3786387

Grellier J, White MP, Albin M, Bell S, Elliott LR, Gascon M, Gualdi S, Mancini L, Nieuwenhuijsen MJ, Sarigiannis DA, van den Bosch M, Wolf T, Wuijts S, Fleming LE. BlueHealth: A study programme protocol for mapping and quantifying the potential benefits to public health and well-being from Europe's blue spaces. *BMJ Open*, 2017;7(e016188):1–10. doi:10.1136/bmjopen-2017-016188

Hartig T, Mitchell R, de Vries S, et al. Nature and health. *Annual Review of Public Health*, 2014;35:207–228.

Jauhiainen JS. Waterfront redevelopment and urban policy: The case of Barcelona, Cardiff and Genoa. *European Planning Studies*, 1995;3:3–23. doi:10.1080/09654319508720287

Keniger LE, Gaston KJ, Irvine KN, et al. What are the benefits of interacting with nature? *International Journal of Environmental Research and Public Health*, 2013;10:913–935. doi:10.3390/ijerph10030913

Korpela KM, Ylén M, Tyrväinen L, et al. Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland. *Health Promotion International*, 2010;25:200–209.

Lachowycz K, Jones AP. Towards a better understanding of the relationship between greenspace and health: Development of a theoretical framework. *Landscape and Urban Planning*, 2013;118:62–69.

Luttik J. The value of trees, water and open space as reflected by house prices in the Netherlands. *Landscape and Urban Planning*, 2000;48(3):161.

MacKerron G, Mourato S. Happiness is greater in natural environments. *Global Environmental Change*, 2013;23:992–1000.

Pretty J. Health values from ecosystems. In: *UK National Ecosystem Assessment: Technical report*. Cambridge, UK: WCMC-UNEP, 2011:1–48.

Sairinen R, Kumpulainen S. Assessing social impacts in urban waterfront regeneration. *Environmental Impact Assessment Review*, 2006;26:120–135.

Toccolini A. Greenways planning in Italy. *Landscape Urban Planning*, 2006;76(1):98.

Van Leeuwen CJ. City blueprints: Baseline assessment for water management. *Water Resources Management*, 2013;27:5191–5206.

Völker S, Kistemann T. The impact of blue space on human health and well-being – Salutogenetic health effects of inland surface waters: A review. *International Journal of Hygiene and Environmental Health*, 2011;214:449–460.

Völker S, Kistemann T. Reprint of: 'I'm always entirely happy when I'm here!' Urban blue enhancing human health and well-being in Cologne and Düsseldorf, Germany. *Social Science & Medicine*, 2013;91:141–152.

Weimann H, Rylander L, Albin M, Skärbäck E, Grahn P, Östergren P-O, et al. Effects of changing exposure to neighbourhood greenness on general and mental health: A longitudinal study. *Health & Place*, 2015;33:48–56.

Wheeler BW, Lovell R, Higgins SL, et al. Beyond greenspace: An ecological study of population general health and indicators of natural environment type and quality. *International Journal of Health Geography*, 2015;14:17.

Wheeler BW, White MP, Stahl-Timmins W, et al. Does living by the coast improve health and wellbeing. *Health Place*, 2012;18:1198–1201.

White MP, Alcock I, Wheeler BW, et al. Coastal proximity, health and well-being: Results from a longitudinal panel survey. *Health Place*, 2013a;23:97–103.

White MP, Pahl S, Ashbullby KJ, et al. Feelings of restoration from recent nature visits. *Journal of Environmental Psychology*, 2013b;35:40–51.

White MP, Pahl S, Ashbullby KJ, et al. The effects of exercising in different natural environments on psycho-physiological outcomes in post-menopausal women: A simulation study. *International Journal of Environmental Research Public Health*, 2015;12:11929–11953.

White MP, Smith A, Humphryes K, et al. Blue space: The importance of water for preference, affect, and restorativeness ratings of natural and built scenes. *Journal of Environmental Psychology*, 2010;30:482–493.

White MP, Wheeler BW, Herbert S, et al. Coastal proximity and physical activity: Is the coast an under-appreciated public health resource? *Preventive Medicine (Baltimore)*, 2014;69:135–140.