World Health Organization

European Region

Assessing the value of urban green and blue spaces for health and well-being

University of Exeter

European Centre for Environment & Human Health

WHO Collaborating Centre on Natural Environments and Health

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Abstract

A growing body of evidence demonstrates the potential of urban green and blue spaces to support and promote health and well-being. These impacts can be used to value the multifunctional benefits (and risks) derived from these spaces. Valuing green and blue spaces is particularly important for policy-makers and practitioners owing to land scarcity and competing land usages. These constraints call for the efficient resource allocation of natural and financial capitals. Therefore, urban planning and design should take account of the value of nature – for environmental, social and health benefits, and in economic terms. This report outlines the range of benefits from urban green and blue spaces and the different approaches, both qualitative and quantitative, that policy-makers and practitioners can use to assess the value of urban green and blue spaces and their impacts on health and well-being.

KEYWORDS

ENVIRONMENT AND PUBLIC HEALTH – NATURE – BIODIVERSITY – URBAN HEALTH – ECONOMICS

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The report was prepared by Tim Taylor, Ruth Garside, Matilda Attrill and Lora E. Fleming (WHO Collaborating Centre on Natural Environments and Health, European Centre for Environment and Human Health, University of Exeter, Truro, United Kingdom).

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Abbreviations

DALY	disability-adjusted life-year
DPSEEA	Drivers–Pressures–State–Exposure–Effect–Action (framework)
eDPSEEA	ecosystems-enriched Drivers–Pressures–State–Exposure–Effect–Action (framework)
EU	European Union
InVEST	Integrated Valuation of Ecosystem Services and Tradeoffs
LGBTQ+	lesbian, gay, bisexual, transgender, queer and intersex
QALY	quality-adjusted life-year
VSL	value of a statistical life

Glossary

In this report, the following terms are defined as shown below. The authors acknowledge that different definitions may exist in the literature. Each term is shown in **bold** at the first mention in the main text.

Bequest value	The value placed on benefits for future generations (e.g. that in 100 years' time a park will be available for use).
Choice experiment	A valuation method based around stated preferences. Individuals are presented with a choice card, detailing the options or scenarios for an intervention or policy change, often compared with keeping the current situation (e.g. a change to green spaces in a city). These options are described by a number of characteristics, and include a costs attribute associated with each of the proposed options. Statistical analysis is used to identify how much each of the characteristics affects people's preferences for urban green space and how much people's willingness to pay is affected by changes in each of these attributes (e.g. proportion of trees, or children's play equipment).
Citizen science	The practice of public participation and collaboration in scientific research to increase scientific knowledge.
Contingent behaviour method	Technique that can be used to value the environment through changes in stated behaviour in response to a change in that environment (e.g. changes in number of visits to parks due to improved facilities). This can, for example, be combined with willingness to pay estimates for visits to give an economic value.
Direct-use value	The value associated with physical interaction with a blue or green space.
Disability-adjusted life-year (DALY)	One DALY represents the loss of the equivalent of 1 year of full health. DALYs for a disease or health condition are the sum of the years of life lost owing to premature mortality and the years lived with a disability due to prevalent cases of the disease or health condition in a population.
Ecosystem services	The varied benefits to humans provided by the natural environment and healthy natural ecosystems, including agricultural, aquatic, marine, forest, park and other natural spaces. They are divided into regulating and maintenance services (e.g. climate regulation, water and air purification, and soil formation), provisioning services (e.g. food and raw materials), and cultural services (e.g. recreation and tourism).
Existence value	The value associated with knowing something exists, even if you never visit it. It goes beyond other use and non-use values associated with urban nature.
Go-along interviews	Interviews conducted with participants while they are interacting with a green or blue space.
Indirect-use value	The value associated with a green or blue space that is not derived from actual interaction with the space. An examples is the benefit people derive from having a view of a park from their window.
Instrumental values	These relate to the benefits that flow from the specific use or exploitation of a space by an individual, community or society.

Market-based valuation	Technique by which monetary values can be assessed by analysing market data (e.g. the value of foraged food).
Narrative mapping	Process of getting participants to map their narrative around a green or blue space interaction by giving them the resources to write or draw about their thoughts, feelings and emotions when engaging with these spaces. The maps support qualitative interviews to gain insight into the values that people place on urban green and blue spaces.
Objective intrinsic value	Value of something in and of itself; does not rely on an individuals' judgement.
Photovoice	Method combining photography of interactions with green and blue spaces and using the photographs to get people to think back and reflect on how and why they value the engagement.
Quality-adjusted life-year (QALY)	One QALY is equal to 1 year of life in perfect health. QALYs are calculated by estimating the years of life remaining for a person following a particular treatment or intervention and weighting each year with a quality-of-life score.
Relational values	Values that are not inherent to spaces or things, but relate to the accumulation and expressions of the interpretations, meaning, history and representations of the resource.
Subjective intrinsic value	A judgement made by someone that something has value in and of itself.
Travel cost method	A pricing method that seeks to estimate a monetary value based on the amount that people actually pay (in money and time) to gain access to sites.
Urban green and blue spaces	This report uses urban green space as a generic term for natural features within urban environments, including open spaces such as parks and gardens, green walls, street trees, and planting within built structures. Urban blue space refers to any water body such as the coastal margins of cities, natural or canalized rivers, ponds within city parks, and fountains.
Value of a life-year lost	The value of a year of life lost due to premature mortality.
Value of a prevented fatality	The maximum value that it is reasonable to pay for a measure that will reduce by one the expected number of preventable premature deaths in a population.
Value of a statistical life	The maximum value that it is reasonable to pay for a measure that will reduce the number of fatalities by one.
Willingness to pay	The amount of money that an individual is willing to pay to bring about a change in the quality or quantity of a good or service (e.g. a green or blue space).

Executive summary

Introduction

A growing body of evidence demonstrates the potential of **urban green and blue spaces** to generate better health and well-being. Better quality spaces are linked to better human health outcomes, and poorer quality spaces to poorer outcomes. This report outlines the health and well-being impacts (both positive and negative) of urban green and blue spaces that might contribute to assessments of its value, and presents methodologies that policy-makers and practitioners can use to value these impacts.

Defining urban green and blue spaces and their human health impacts

This report uses **urban green space** as a generic term for natural features within urban environments, such as parks, gardens, green walls and street trees. **Urban blue space** refers to any water body, such as coastal margins of cities, natural or canalized rivers, ponds within city parks, and fountains.

Benefits and risks from urban green and blue spaces

A range of human health and well-being impacts exist. Potential benefits can be:

- **environmental,** such as carbon capture and storage and improved water quality;
- linked to **health and well-being,** including physical health (directly, e.g. reduced air pollution and cooling effects; indirectly, e.g. through increased opportunities for physical activity) and mental health and well-being (e.g. stress relief or reducing harms such as noise);
- **social,** such as supporting social contact and cohesion; and
- **cultural and spiritual,** such as education, heritage and creative benefits.

Types of potential risks include:

- **injuries, death and safety** (e.g. drownings and impacts associated with extreme weather events);
- **pollen and allergies** (e.g. from street trees and other planting);
- **vectors and zoonotic diseases** (e.g. Lyme disease from tick bites); and
- **infections and antimicrobial resistance** (e.g. from exposure to organisms in soil, water and other media).

Why value and who should take it into account?

Space in urban areas is limited and competition over its usages is growing. Understanding and valuing the multifaceted benefits (and risks) of urban green and blue spaces may support better decision-making about allocating resources to protect or enhance such spaces.

Methods to assess the value of urban green and blue spaces

A number of different approaches, both qualitative and quantitative, can be used to assess the value of urban green and blue spaces. Qualitative approaches (e.g. using interviews or focus groups) can capture aspects such as the meanings that spaces hold for people or the emotional experiences they cause, which are not easily enumerated. Quantitative studies can include estimating health outcomes or numbers of users or the monetary valuation of benefits. A range of quantitative, economic valuation methods exist, including **market based** (using market costs), stated preference (using people's stated **willingness to pay** for features or improvements, e.g. through **choice experiments**); and revealed preference (using the actual costs incurred, e.g. cost to travel to a green space or house prices near a blue space).

Estimating the health values of urban green and blue spaces

Techniques from economics can be used to value the health benefits of urban green and blue spaces. These include 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, or using the **value of a statistical life (VSL)** to value changes in mortality. Wider concepts of value such as social and cultural values may also be incorporated.

Steps to value the health benefits of urban green and blue spaces

1. Identification of the green/blue space to be valued
2. Identification of the health impact to be quantified
3. Identification and quantification of the affected population
4. Quantification of health and well-being impacts (positive and negative)
5. Valuation
6. Use in decision support

Several tools are available to support the valuation of green spaces and their health benefits. When assessing existing valuations, specific tools can be used to critically appraise the methods used and understand their strengths and weaknesses, which is key to ensuring that good evidence informs decision-making.

Challenges in valuation

The decision as to which method is most appropriate depends on factors such as the time available, financial resources and specific nature of the investment being considered.

Equity issues

Benefits and risks are not distributed equitably. Communities with lower socioeconomic status and neighbourhoods with higher migrant and Black and minority ethnic populations often experience poorer quality environmental conditions and, therefore, have less access to potential benefits of urban green and blue spaces. Elderly and disabled people; women; and lesbian, gay, bisexual, transgender, queer and intersex (LGBTQ+) communities may also make less use of spaces with few facilities or those perceived as unsafe. These inequities may be exacerbated in spaces where entrance fees are charged.

Evidence gaps and needs for research

Further research is needed on the use of green space, dose–response for exercise and health outcomes, negative impacts, valuation of morbidity, and well-being valuation methods. The use of consistent methodology would improve the transferability of results between settings. More studies are needed from countries in eastern and southern areas of the WHO European Region and from non-European Union (non-EU) countries and on the relative costs and benefits of improving green and blue spaces, considering both the capital costs and operating/maintenance costs.

Key messages

- Use the available tools to quantitatively and qualitatively value the health benefits of urban green and blue spaces, and use this information to improve policy-making.
- Design green and blue spaces that enable physical activity and improve mental health and well-being to give the greatest benefit for health.
- Critically appraise the quantitative and qualitative evidence on nature benefits so that policy-makers can understand the quality of the evidence on the health value of green and blue spaces.
- Involve a range of stakeholders who place different values on urban green and blue spaces in developing appropriate strategies.
- Ensure that all policies that impact green and blue spaces (from climate adaptation to urban development policies) consider the health and well-being implications for urban populations, as well as the environmental and social impacts.
- Promote knowledge-sharing and training on valuation of the health and well-being benefits of green and blue spaces, including on economic valuation and qualitative methods.

1. Introduction

The natural environment impacts health and well-being, both positively and negatively. Complex interactions between the environment, society and economics affect individuals and are influenced by wider social, cultural and political factors that determine the effects of these interactions on health. Growing evidence supports the potential of **urban green and blue spaces** to generate better health and well-being (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2022; Jimenez et al., 2021; WHO Regional Office for Europe, 2021a). Better quality spaces (in terms of their ecology and/or upkeep) are linked to better health outcomes, and poorer quality spaces to poorer health outcomes. Such impacts contribute to the value of urban green and blue spaces to society.

However, the benefits and risks of natural environments, and the associated investments are not distributed equitably. Communities with lower socioeconomic status tend to experience poorer quality environmental conditions (European Environment Agency, 2022) . Such environmental inequity contributes to health inequities and results in broader well-being injustices. The environmental and health policy challenge for the 21st century is to navigate the unprecedented level of complexity (in terms of interconnections between social, cultural, political, environmental and individual factors in the context of climate change) to deliver improved health and well-being, equity and environmental sustainability, while identifying and countering risks from the consequences of policies and actions.

This report first outlines the potential health and well-being impacts (both benefits and risks) of urban green and blue spaces that might contribute to assessments of its value. It provides an example of a conceptual model that can be used by decision-makers to identify and present the ways in which activities may impact urban green and blue spaces and their effects on health and well-being. It then presents the rationales and methodologies that policy-makers and practitioners can use to value these impacts. Throughout, it includes case studies from across the WHO European Region to show how these methods have been applied to value health and well-being impacts of urban green and blue spaces.

This report is intended to stimulate discussion and action among policy-makers and practitioners – including mayors, council officials, public health practitioners and other local and national government officials – who are interested in the interconnected areas of urban planning, health and environment to further investigate and capitalize on the benefits of green and blue spaces for health and well-being.

2. Defining urban green and blue spaces and their human health impacts

There are no universally accepted definitions of urban green and blue spaces with relevance to their value for public health (Taylor and Hochuli, 2017; WHO, 2016). This report uses the term urban green space as a generic term for natural features within urban environments, not only open spaces such as parks and gardens but also green walls, street trees, planting within built structures. Similarly, urban blue space refers to any water body, such as coastal margins of cities, natural or canalized rivers, ponds within city parks, or even fountains (see Glossary). These spaces may be publicly accessible (such as parks) or private (such as domestic gardens or areas restricted to local residents or requiring an entry fee). In some climate zones, relatively natural spaces may have limited vegetation and low greenness, but still afford health and well-being benefits in similar ways to greener and bluer spaces.

Green and blue urban spaces can impact health and well-being through a range of mechanisms, and so impact a broad range of health and well-being outcomes (discussed in section 3). Equally, urban green and blue spaces may pose human health risks (described in section 4). Furthermore, natural environment interventions (such as rewilding, park restructuring or coastal developments) have the potential to widen health inequities (Anguelovski et al., 2019).

The health and well-being impacts of green and blue spaces depend not only on their presence and quantity (for example, the size or area of the park) but also on other factors such as their qualities. However, evidence is limited on the importance of different green/blue space qualities for their health impacts (Knobel et al., 2021; Vandergert et al., 2021).

These qualities include the characteristics of the natural environment itself, such as their biodiversity or water quality (Case study 1 shows the impact of perceived water quality on the recreational value of

Case Study 1

Recreational value of blue spaces and the impact of water quality perception

Location

Blue space sites (including lakes, reservoirs, urban rivers/canals, harbours and outdoor public pools) across 14 EU countries (Bulgaria, Czechia, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom).

Time frame

Published in 2021, data collected 2017–2018.

Methods

Recreational value (travel cost and contingent behaviour method). Travel costs were used to estimate the recreational value of visits through calculation of the consumer surplus. Data were collected through an international online survey distributed in four seasonal waves during 2017 and 2018 as part of the EU Horizon 2020 BlueHealth project (BlueHealth, 2020a).

Liverpool waterfront, United Kingdom

© Fiona French

Key results

The annual value of recreational visits to blue spaces across the 14 EU countries was estimated to be €631 billion when extrapolated to the total adult population, equivalent to an annual benefit of €1938 per adult in each country (ranging from €1071 in France to €3527 in Germany). Each recreational visit to a blue space site had an estimated value of €41.32. Improving the water quality was estimated to lead to 3.13 more visits annually, thereby increasing the recreational value by €129.25 per adult per year.

Source: Börger et al., 2021.

blue space). They also include the facilities that can make spaces more attractive or usable such as paths, benches, lighting, toilets and cafes. These physical characteristics combined with maintenance regimes, environmental incivilities such as litter, and the urban context shape less tangible, but critically important, qualities such as safety, both perceived and objective (Sreetheran and van den Bosch, 2014).

Alongside the physical proximity and availability, the qualities of a green/blue space impact the perceived accessibility. Spaces may be more or less inclusive, and the physical, social, cultural and historic characteristics of spaces (including racism) may lead to inequitable access and consequences for health and environmental inequities (Jennings et al., 2019; Phoenix et al., 2021).

The wider context of urban green and blue spaces (for example the rarity/scarcity or accessibility/proximity of such spaces) also impacts their value for health and well-being. Within dense urban areas with limited green/blue space availability, the value of any single natural space will be higher than in an area with a greater availability of alternative spaces (Bockarjova et al., 2020). Spaces within central city areas that are easily accessible to large populations may have a greater overall health impact than similar spaces in periurban areas that are only accessible by public or private transport and so may be used by fewer people.

This complexity suggests that a single, precise definition of urban green and blue spaces may not be useful to capture their health value. Instead, it is important to consider the characteristics of the natural environment features within their built, social and economic context when attempting to understand their value for health.

3. Benefits from urban green and blue spaces

This section outlines the various direct and indirect health and well-being benefits that people may gain from urban green and blue spaces and which have been, or could be, used to inform the valuation of such spaces.

3.1 Environmental benefits

Urban green and blue spaces provide a wide range of environmental benefits. These benefits are often experienced at a larger spatial and temporal scale than other more direct impacts. Such spaces can also provide co-benefits by contributing to climate change mitigation efforts, with the potential to reduce harm to human health globally. For example, urban green space (particularly in terms of trees, vegetation and soils) can provide substantial carbon capture and storage. One study estimated that 956 000 tonnes of carbon is stored in Beijing's green spaces (Sun et al., 2019). Another study estimated that four parks in Rome sequester 664–998 Mg carbon dioxide per hectare per year (Gratani et al., 2016). Carbon capture can be valued in several ways, for example, in the United Kingdom carbon values (which reflect the societal value placed on emissions reductions) reflect the estimated marginal abatement costs to meet targets for carbon mitigation.

Another example of the wider environmental benefit is the value of urban green and blue spaces for improving water quality. In Finland, urban wetland restoration has been implemented in order to deliver multiple benefits, including improved surface water quality (Wahlroos et al., 2015). The urban forest also plays a part, with the tree canopy intercepting precipitation and changing its chemical composition and the way it flows through a city, although these impacts can be both positive and negative (Decina et al., 2020). Urban trees also provide shade and an improved microclimate. Case study 2 gives an example of valuation of urban tree shading using a replacement cost approach.

Case Study 2

Using replacement cost to value shading from urban trees

Location
Prague, Czechia.

Time frame
Published in 2021, time horizons of 20, 30, 40 and 50 years.

Methods
Replacement cost method. Drawing on a model of the shading provided by trees and estimating the cost of an alternative (parasols) as a proxy for benefits, this study estimated the value of trees for shading in Czechia.

Key results
The discounted present value of tree shade was between €4362 and €9163, depending on the discount rate and length of the period considered. Compared with the costs, this suggests for certain scenarios that only considering the tree shade value (and not the other benefits of an urban tree) can lead to the benefits exceeding the costs (although for higher discount rates this was not the case).

Trees in Prague, Czechia

© Eva Horváthová

Source: Horváthová et al., 2021.

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3.2 Health and well-being benefits

The environmental benefits outlined above and the urban environments to which people are exposed have a range of direct and indirect impacts on human health and well-being. These are discussed separately below, but are often interlinked. For example, physical and mental health can impact each other or present as comorbidities, and social and cultural benefits also interact with mental health and well-being.

3.2.1 Physical health benefits

Safe, accessible and high-quality green and blue spaces in cities can have positive impacts on human health and well-being through both direct and indirect pathways. Vegetation of different kinds can directly reduce human exposure to environmental stressors that cause harm to health. For example, street trees can lessen exposure to air pollution, heat and perceived noise (Salmond et al., 2016). These environmental stressors are causally implicated in a huge range of health outcomes, ranging from neurodevelopmental effects to cancers, diabetes and cardiovascular disease. Exposure to air pollution alone affects almost every organ in the body, and controlling this could reduce or prevent the considerable resultant disease burden (Schraufnagel et al., 2019). Case study 3 illustrates the value of trees to reduce air pollution. Furthermore, the cooling effect of green spaces and trees reduces the impact of urban heat islands on health, particularly mortality. Recent research indicates that spending at least 120 minutes per week in natural environments is associated with significantly better health and well-being (White et al., 2019).

Case Study 3

Valuing air pollution removal by urban trees

Location
Warsaw, Poland.

Time frame
Published in 2016, fieldwork carried out in 2010.

Methods
Used the i-Tree Eco v5 model to estimate the ability of the 932 trees in Krasiński Gardens in the centre of Warsaw to remove air pollution. A benefit transfer was then used to estimate the monetary value of the air pollution removal by the trees.

Key results
The total air purification had an estimated economic value of 26245.74 Polish złoty per year (€6,016 per year).

Source Szkop, 2016.

Krasiński Gardens, Warsaw, Poland

© Zbigniew Szkop

In addition to these direct benefits, green and blue spaces such as parks provide indirect benefits to physical (and mental) health through supporting physical activity (Pearce et al., 2022; Smith et al., 2016) and social interactions, particularly among elderly people (Enssle and Kabisch, 2020). Spending time in natural environments and being involved in physical activity depend on individual choice and behaviour; when active behaviour through exercise takes place, there is a greater possibility to exploit the full potential of access to natural environments. Case study 4 is an example of valuation of green space physical activity opportunities.

Not all health benefits stem from amenities such as parks and street trees. For example, infrastructure (such as sustainable urban drainage systems) makes use of natural materials, vegetation and water-sensitive landscape engineering to mitigate flooding (Davis and Naumann, 2017). Various direct and indirect impacts of floods can otherwise have serious negative impacts on psychological and physiological health, ranging from respiratory problems caused by contact with mould to post-traumatic stress related to flood events and evacuation (Lane et al., 2013; Walker-Springett et al., 2017). Such green and blue infrastructure can also increase groundwater recharge, improve water quality, reduce soil erosion and boost biodiversity, thereby potentially conferring considerable indirect co-benefits to human health and well-being.

3.2.2 Mental health and well-being benefits

Evidence suggests that urban green and blue spaces are protective against poor mental health (Alcock et al., 2014; McEachan et al., 2016; Roberts et al., 2019; South et al., 2018; WHO Regional Office for Europe, 2021b), promote mental well-being (Vert et al., 2020; White et al., 2021) and are also spaces for nature-based health interventions or social prescribing (Britton et al., 2020; Leavell et al., 2019).

The mental health benefits of urban blue and green spaces are not only relevant to the population in general but also for specific groups such as children and teenagers (Tillmann et al., 2018; Zhang et al., 2020), older adults (Dempsey et al., 2018) and those from lower socioeconomic groups (Garrett et al., 2019). Exposure to nature in childhood is related to mental health and well-being in later life (Engemann et al., 2019, 2020).

Case Study 4

The economic benefits of physical activity from providing citizens access to urban green space

Location
Thinking Fadura project, Getxo, Spain.

Time frame
Published in 2020, time horizon of 20 years.

Methods
Participatory cost–benefit analysis, including a QALY approach to assess the benefits of green space on physical activity, supported by qualitative indicators to complement the economic assessment.

Key results
The study highlights the economic costs and benefits of providing citizens with access to urban green spaces through a variety of measures, including reducing air and noise pollution, and the health effects of physical activity for citizens. It estimated that 30 minutes of moderate–intense physical activity per week would be equivalent to 0.010677 QALYs per person per year. Based on an estimated social value of 1 QALY of €22 400, the monetary value of the physical activity was estimated at €597 033 over a 20-year time horizon.

Source: García de Jalón et al., 2020.

Thinking Fadura project, Getxo, Spain

© Silvestre García de Jalón

Urban green and blue spaces may confer benefits to mental health and psychological well-being by:

- **reducing harms**, such as noise annoyance (Dzhambov and Dimitrova, 2014);
- **enabling building capacities**, for example, for physical activity and social interaction (Brito et al., 2022; Markevych et al., 2017; Mitchell, 2013; Thompson Coon et al., 2011; Zhang et al., 2021); and
- **restoring capacities**, such as stress recovery, cognitive restoration (Mygind et al., 2021; Ohly et al., 2016; Stevenson et al., 2018), including improved working memory, directed attention and cognitive flexibility (Stevenson et al., 2018).

The benefits of physical activity to mental health and well-being from may be greater when done in a natural environment rather than indoors (Brito et al., 2022; Mitchell, 2013; Pearce et al., 2022; Thompson Coon et al., 2011), perhaps because of lower exposure to air pollutants and noise (Wickham et al., 2014). Case study 5 gives a valuation example of the combined physical and mental health benefits (and other economic benefits) of urban parks.

Visiting urban blue and green space seems to be particularly important (White et al., 2021), but even having a view of these spaces may benefit mental health and well-being (Dempsey et al., 2018; Nutsford et al., 2013). Although the beneficial relationship between urban blue and green space and mental health and well-being has mostly been evaluated around the home, there can also be benefits in workplace (Gritzka et al., 2020) and educational settings (Vella-Brodrick and Gilowska, 2022). Furthermore, the quality of urban green and blue spaces, such as biodiversity levels (Houlden et al., 2021) and water quality (Pope et al., 2018), may enhance health and well-being benefits.

3.3 Social benefits

Public green and blue spaces in urban environments contribute to social aspects of quality of life and place, play a role in developing a sense of community (Francis et al., 2012), and are linked to a range of social values such as social cohesion and contact. Green spaces play a complex and reciprocal role in the development and expression or realization of social capital for different groups, such as for older people (Hong et al., 2018). They have also been linked to the development of pro-social behaviours in children and adolescents (Francis et al., 2012; Putra et al., 2020).

Case Study 5

The value of public parks and green spaces in London, England (United Kingdom)

Location
London, England (United Kingdom).

Time frame
Published in 2017, values were evaluated over a 30-year period.

Methods
Assessed various sources of economic value including recreation, health (mental and physical), carbon (soil and trees) and residential property.

Key results
Highlights the economic and well-being value of public parks and green spaces in London. The study found that London avoids £950 million (€1.08 billion) per year in health costs because of public parks: £580 million (€662 million) per year associated with being in better physical health and £370 million (€422 million) per year through reduced mental health costs. Furthermore, public parks in London were estimated to have a recreational value of £926 million (€1.06 billion) per year. The value of the carbon stored in soil and trees in the Greater London area was estimated at £18 million (€20.5 million) per year.

St James's Park, London, United Kingdom

© Matilda Attrill

Source: Vivid Economics, 2017.

The social value of urban green and blue spaces is highly variable. It depends on the match between individual or community needs and expectations and the qualities and accessibility of the space. Realization of the social value of a green or blue space can rely on factors such as the presence of built infrastructure such as paths and benches, which enable contact (Błaszczyk et al., 2020; Perry et al., 2018). Social value can also be affected by the dynamics of different users, with the legitimate use of a space by some community members deterring or interfering with that of others (Dinnie et al., 2013).

Green and blue space interventions can improve social cohesion and other related outcomes such as crime rates and perceptions of safety (Hunter et al., 2019). However, poorly designed interventions can exacerbate social challenges and worsen inequities through processes such as green gentrification (Jelks et al., 2021).

3.4 Cultural and spiritual benefits

Nature-based spirituality (both religious and more secular) is a benefit related to nature encounters and outdoor recreation experiences in urban green and blue spaces (Naor and Mayseless, 2020), and is increasingly linked to nature-based therapy. This important dimension of well-being involves using such spaces to contemplate or meditate; inspire creativity; feel at one with nature or positively towards oneself or nature; experience sacredness or something greater than oneself; and experience a sense of meaning, purpose, acceptance or connectedness (Baur, 2018; Chiesura, 2004).

As much of the wider understanding around spiritual benefits has been developed in relation to remote wilderness experiences, particular qualities of the green and blue spaces might be important in supporting spiritual experiences (Ashley, 2007; Cheesbrough et al., 2019). Research also highlights the importance of perceiving such spaces as beautiful or relaxing or of gaining spiritual benefits by engaging in cultural activities or nature recreation, which may also be experienced in urban areas (Heintzman, 2009).

Nature-based spirituality can also be linked to cultural benefits; for example, particular landscapes can have great spiritual significance linked to cultural identity for certain population groups (Stephenson, 2008). Conversely, there is an increasingly critical literature on urban green and blue spaces as exclusionary, particularly in diverse neighbourhoods, where they can be contested or segregating spaces (Plüschke-Altof and Sooväli-Sepping, 2022; Stodolska et al., 2011).

Other cultural benefits may include education and heritage benefits. The growth of forest schools is an example of the educational value of green space (Garden and Downes, 2021). Heritage benefits include a sense of place (Jones et al., 2020).

4. Risks associated with urban green and blue spaces

Despite the potential for multiple health and well-being benefits from interacting with urban blue and green spaces, there also are tangible risks and disbenefits. This is particularly true for disadvantaged people, such as those of a lower socioeconomic status, Black and minority ethnic groups, recent migrants, elderly people and people with disabilities, who may have limited access to high-quality blue and green spaces in urban environments.

In addition, there are increasing impacts on the quality of urban areas from climate, extreme weather events and other environmental changes (including water, air and soil pollution); increasing population density; biodiversity loss; decreased maintenance and infrastructure investment in green and blue spaces; and other types of environmental quality degradation (European Environment Agency, 2019). Case study 6 shows how addressing infrastructure degradation can increase the value of riversides.

4.1 Injuries, death and safety

The most obvious and easily quantifiable impacts on human health are injuries and deaths. The most dramatic impacts are from extreme natural events, such as cyclones, floods, tornados, wildfires, droughts and tsunamis, which can impact urban areas. Due to climate change, such extreme events and related injuries/deaths are increasing in frequency and/or duration (WHO, 2014) and, therefore, in the scale of impact, particularly as many human populations globally inhabit high-risk coastal, river and desert areas. Beyond the acute deaths, injuries and morbidity during and following extreme events, survivors are at a greater risk of mental health impacts (such as depression) and infectious diseases (Ebi et al., 2021).

Case Study 6

Promoting physical activity through urban riverside regeneration

Location
Barcelona, Spain.

Time frame
Published in 2019; based on data from 2014–2015.

Methods
QALY/DALY approach. Data from the Barcelona local authorities and a meta-analysis of physical activity and health outcomes were used to develop and apply the Blue Active Tool to estimate health and health-related economic benefits of physical activity. The Tool estimates the health impacts in terms of all-cause mortality, morbidity and DALYs. A health economic assessment was estimated in terms of the VSL and direct health costs.

Besòs River, Barcelona, Spain

© Cristina Vert Roca

Key results
The estimated annual benefit for park users was 11.1 DALYs, with the greatest benefit found in terms of dementia – 3.5 DALYs avoided. The overall benefits to population health when converted into estimates of health-related economic benefits were an estimated reduction of €23 403 186 per year. Cycling and walking for leisure had the greatest health-related economic impact.

Source: Vert et al., 2019.

In addition to these dramatic and traumatic events, humans interacting with nature are always at risk of injury and death. For example, drownings and near-drownings are associated with all types of water bodies (WHO, 2014), and burns and respiratory diseases with wildfires. In urban areas, especially those with poor maintenance and management of areas such as parks and river or canal banks, there are safety issues (including the risk, and perception of risk, from assault and other violence), particularly for women, recent migrants and minority ethnic groups, and older people and people with disabilities (Sreetheran and van den Bosch, 2014)). Lastly, although green and blue spaces may mitigate urban heat islands, with rising temperatures they can also increase exposure to the harmful effects of sun (ultraviolet radiation), leading to injuries such as heat stroke and sunburn (and the associated skin cancer risk) (Braubach et al., 2017).

4.2 Pollen and allergies

The number of people with allergies and autoimmune diseases such as asthma is increasing, particularly in highly industrialized and urbanized settings. Theories to account for this include the hygiene hypothesis (i.e. historically, children have been exposed earlier to more allergens and microbes), the extensive use of antibiotics and other antimicrobial products, air pollution, and the cumulative impacts of these factors on individual microbiomes.

In the northern hemisphere in particular, increasing carbon dioxide levels and global warming are encouraging the northward migration of exotic plants. Many of these are major pollen producers that may exacerbate allergies or add to the burden of allergies to native plants. In addition, spring is starting earlier and lasting longer, leading to longer pollen exposure times. Moreover, pollen binding to air pollutants increases its allergic and toxic impacts when inhaled, particularly in urban areas (D'Amato et al., 2020). Increased light pollution (particularly in urban areas) can lead to prolonged growing seasons and, potentially, also increasing the allergic impact of pollen (Ray and Ming, 2022).

4.3 Vectors and zoonotic diseases

Climate change combined with increased urbanization and inconsistent policies for wildlife management and international trade increase the risk that interactions between disease vectors (such as ticks and mosquitos), other animals and humans will occur in places where this is currently unknown (Hansford et al., 2022). Many of these vectors carry infectious diseases that can affect the health and well-being of humans and other animals. Thus, tick-borne Lyme disease (caused by the bacterium *Borrelia burgdorferi*) is now endemic in human, deer and rodent populations in many places in the northern hemisphere, including urban areas such as large parks. Malaria carried by the *Anopheles* mosquito had been eradicated in the northern Mediterranean but is now being found again (Medlock and Leach, 2015).

Recent outbreaks of Ebola in Africa are believed to be associated with the encroachment of human settlements into wild natural environments, leading to the transmission to humans of previously unknown or extremely rare zoonotic diseases. The increased population density associated with urbanization, international trade, decreased biodiversity, historical and current colonization, and other globalization activities can lead to the rapid global spread of infectious disease, as witnessed with the COVID-19 pandemic (Keesing and Ostfeld, 2021). The One Health approach provides an insight into such human–animal–environment interconnections (WHO Regional Office for Europe, 2022).

4.4 Infections and antimicrobial resistance

There is growing evidence globally of infectious diseases that are resistant to current medications, such as antimicrobials. A complex, system-wide picture is emerging of inappropriate use and overuse of these medications in both health care and the domestic animal food industry, potential synergistic interactions with environmental pollutants (including plastics), the natural evolution of antimicrobial resistance in the environment, and the lack of new microbial therapies being developed.

In green and blue spaces, people are exposed to antimicrobial-resistant organisms through aerosols of human and animal waste, untreated water (including through swimming or at work) and person-to-person contact. This has already led to rapid increases in death and morbidity rates secondary to infection, with multiple antimicrobial resistance increasingly found in urban areas with a high population density (United Nations Environment Programme, 2017).

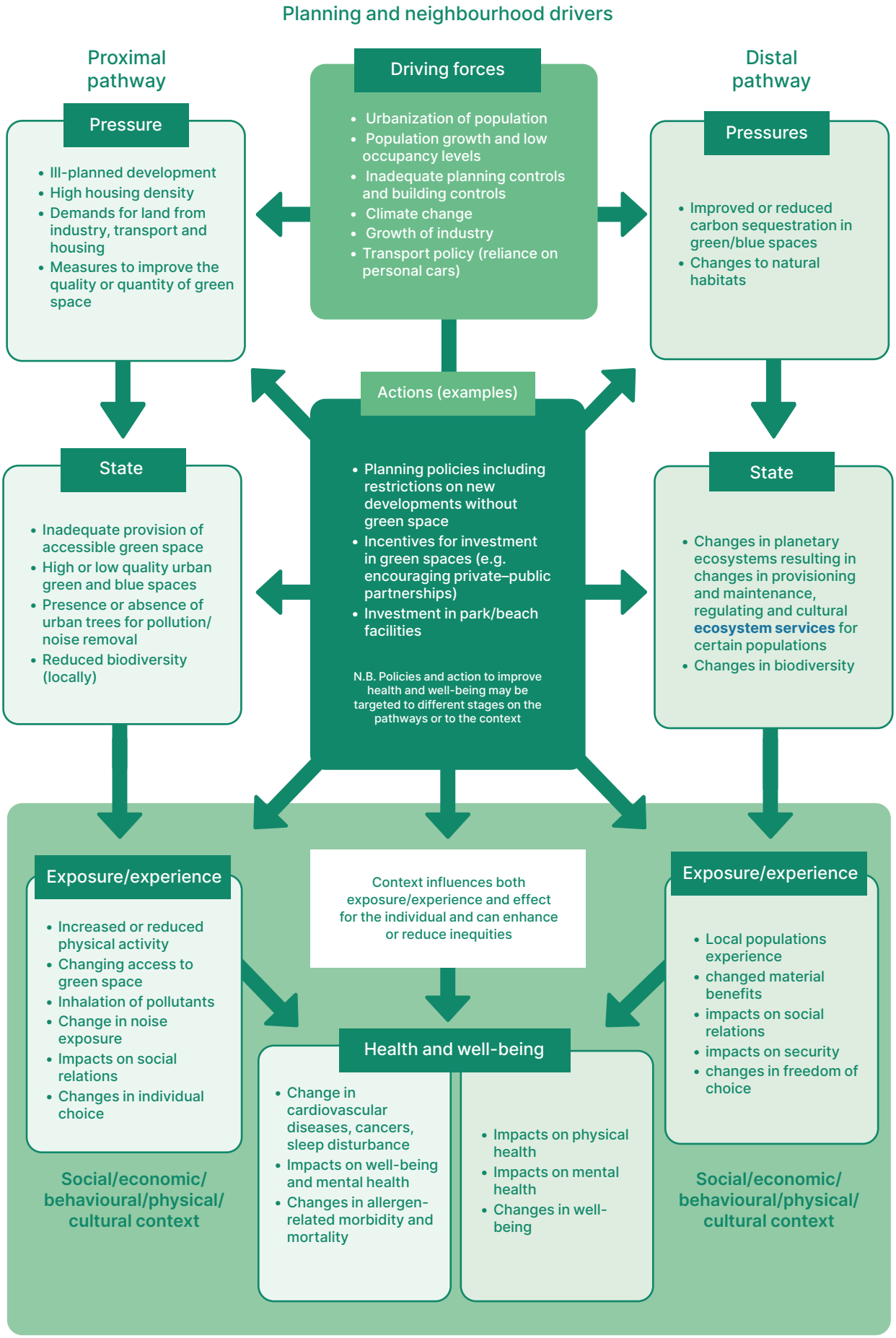
5. Visualizing complex connections between environment and health

The risks and benefits to human health from urban green and blue spaces (as described in section 4) are often interconnected, and may have complex links to local policy and other actions that impact such spaces. Conceptual models can be useful to represent and visualize complex relationships among relevant factors that influence an outcome of concern. In addition, co-developing such models with different stakeholders could help to work through relevant issues and support decision-making.

In the field of environment and health, a family of conceptual models has been produced from the Drivers–Pressures–State–Exposure–Effect–Action (DPSEEA) framework (Kjellström and Corvalán, 1995). The ecosystems-enriched DPSEEA (eDPSEEA) model represents both socioeconomic complexity and the health and well-being effects of damage to global ecosystems (Reis et al., 2015). It does this by showing two pathways from higher-level interacting driving forces to health and well-being outcomes. In the proximal pathway, driving forces create pressures that change health-relevant characteristics of the environmental state near to a community. In the distal pathway, the same driving forces impact ecosystems and the services they provide, and the health and well-being of people who may live in places far away from the community whose activities generate the harm (Morris et al., 2017).

Fig. 1 shows the eDPSEEA model populated for green and blue spaces in urban areas. Policies and actions that aim to provide good-quality accessible green and blue spaces have the greatest potential to deliver the triple win of health/well-being, reduced inequity and global environmental sustainability (alongside interventions to encourage the local production of wholesome food and create sustainable/active travel).

Fig. 1. The eDPSEEA model populated for green and blue spaces in urban areas



Source: modified from Morris et al., 2019.

6. Why should we value urban green and blue spaces and who should do this?

Space is limited in urban areas and competition over its usages is growing. Therefore, understanding the multifunctional benefits of urban green and blue spaces, as well as the potential trade-offs inherent in their provision, may contribute to more consistent decision-making about urban spaces. In a world of trade-offs and competing interests, the lack of health-related evidence on the societal value of benefits and risks associated with urban green and blue spaces can easily result in suboptimal policy.

Policy-makers and other decision-makers face numerous constraints and conflicting priorities from various stakeholders when allocating urban space and investment in, for example, housing, industry, and green and blue spaces. Such spaces impact the quality of life, and environments can reduce, or even prevent, the disease burden if appropriately designed and maintained. Hence, inappropriate planning choices and management may have negative consequences for health and well-being. Valuation (quantitative or qualitative) of urban nature space is needed to ensure that its importance is better understood by those making decisions on resource allocation to protect or enhance such spaces (Tinch et al., 2019). This includes consideration of the benefits for future generations (including **bequest value**).

Green and blue spaces are important to meet several policy objectives. As described in section 3.2, parks and other green and blue spaces are locations for recreation that enable physical activity, mental well-being and social interactions, which in turn reduce the burden of noncommunicable disease (White et al., 2016, 2018). They function as nature-based solutions for carbon mitigation and climate change adaptation through, for example, providing urban cooling and reducing flood risks (Chiabai et al., 2018). They also provide habitats for biodiversity, which can also improve the well-being and health of visitors (Cameron et al., 2020).

Recent studies, including the Dasgupta Review, have highlighted the potential value of nature to society (Dasgupta, 2021). gaining insight into these values is important for mayors, planners and other policy-makers. However, not all values can be assessed and expressed in monetary units, such as the spiritual value of the awe and feelings of inspiration that some people experience when looking at nature (Baur, 2018; Severin et al., 2022). Furthermore, major gaps still exist in assessing the value of benefits.

The stories that people tell and the connection they have with the green and blue spaces in their neighbourhoods also need to be heard, alongside other forms of value attributable to these spaces. For example, limiting the value of green space to price increases of the surrounding residential property would not capture the multitude of benefits that can be attributed to such spaces.

Even with advances in environmental and public health economics, a monetary value cannot be placed all benefits to health and society. Therefore, a mixture of methods is required to understand the value that people attach to urban green and blue spaces.

7. Methods to assess values

This section outlines some of the key approaches that decision-makers can use to assess the impact of urban green and blue spaces on human health and well-being, using both qualitative and quantitative methods.

7.1 Qualitative approaches to understanding value

Benefits are often expressed in physical or monetary terms, but these do not always capture the way that people perceive, measure and value nature (see section 6). Qualitative research can identify the critical aspects (features and functions) of such spaces, as well as the meanings they hold for people and how and why people value them. This might include exploring preferences for vegetation types and how these relate to activities (Talal et al., 2021) or understanding people's motivations for visiting parks and the perceived benefits (Irvine et al., 2013). Such methods do not rely on predetermined expectations about what these might be; instead, they aim to explore the experiential aspects of nature encounters and pay attention to the perceived meaning, importance and impact of these through collecting and analysing people's narrative accounts.

Qualitative research may be particularly useful to uncover less-dominant perspectives and understand the experiences and needs of marginalized groups. Case study 7 shows how qualitative methods were used to explore how young people valued urban nature and their perceptions of how it supports their mental health and well-being.

Qualitative research methodologies also include **go-along interviews** (Carpiano, 2009) and **narrative mapping** (Bell et al., 2017), which link people's experiences and observations of green and blue spaces in real time.

Case Study 7

"Nature doesn't judge you" – how urban nature supports young people's mental health and well-being

Location
Sheffield, England (United Kingdom).

Time frame
Published in 2020.

Methods
24 participants aged 17–27 years took part in semi-structured interviews to explore "feeling good and not so good in Sheffield". The participants also took part in art workshops that used a range of creative methods to explore ideas relating to their memories of nature, experiences they had had with others in nature and the value of nature for coping with mental health difficulties. Data were analysed using a thematic and diffractive analysis.

Key results
Participants valued trees and plants, water, and views and open spaces. Three kinds of well-being benefits from urban nature were identified: sense of self, sense of escape and sense of connection and care. However, participants also said that sometimes nature cannot help with mental health problems.

Bolehill Recreation Ground, Sheffield, United Kingdom

© Harriet Ann Patrick

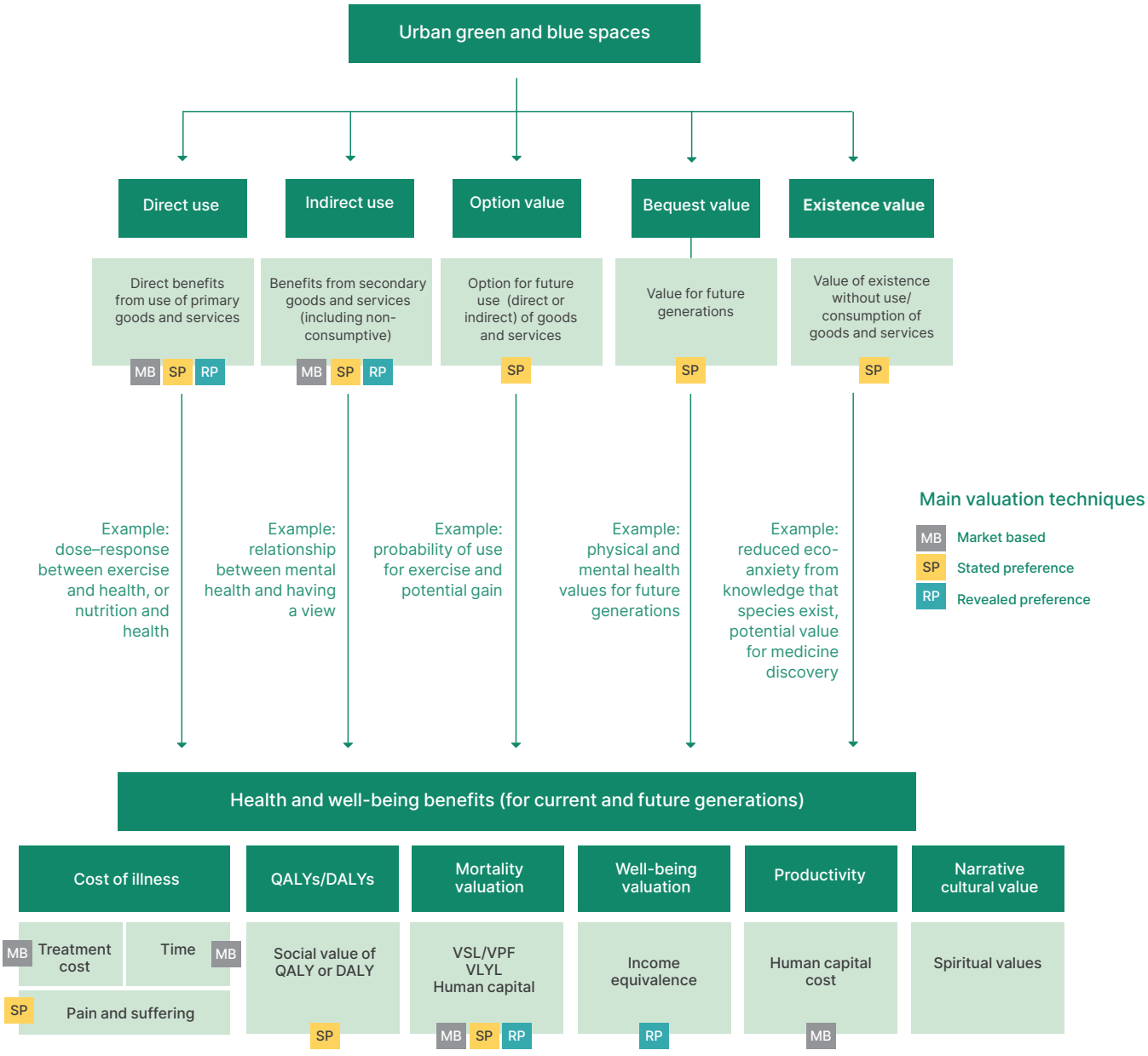
Source: Birch et al., 2020.

Similarly, participatory and **citizen science** methods may enhance the collected data. For example, **photovoice** invites participants to collect and curate their own visual and narrative data on their perceptions of their environments. Such methods can inform or evaluate green and blue space schemes or initiatives based on community preferences and promote community-level advocacy for policy change (King et al., 2020).

7.2 Quantitative economic approaches to understanding value

Economic values derived from green and blue spaces take many forms. Fig. 2 gives an overview of different **ecosystem services** and the values that can be derived from urban green spaces. The concept of total economic value encompasses several value types, some of which pass through markets and are traded but also many that do not (e.g. in general, there is no entry fee for visiting a park for recreation).

Fig. 2. Overview of different ecosystem services and the values that can be derived from urban green and blue spaces



Note: VPF: **value of a prevented fatality**; VLYL: **value of a life-year lost**.

The economic valuation of the benefits of urban green spaces uses a range of methodologies:

- **market-based methods,** which include the market price (e.g. in the case of paid walking tours) and the avoided damage or replacement cost (e.g. the cost of replacing a tree or of replacing the benefits of green spaces with other technologies; see Case study 2);
- **stated preference methods**, in which people are asked to value certain services using their stated willingness to pay for a good (Kalfas et al., 2022) or to choose between green spaces with different attributes (i.e. choice experiments) (Tu et al., 2016); for example, people may be asked how much they are willing to pay in increased local taxes for green spaces with different improvements made (e.g. improved access or amenities) – applying these methods in contexts where the disposable income is low may lead to inequities if equity is not considered in another way, or if the survey instrument is not appropriately designed; and
- **revealed preference methods**, such as the travel costs associated with visiting a green or blue space (Börger et al., 2021) or the hedonic price method, which assesses the relationship between residential property price and distance to green space or the area of green space around a property (Czembrowski and Kronenberg, 2016).

Several tools attempt to quantify and place monetary values on some benefits of ecosystem services (see section 10). It is beyond the scope of this report to detail the methods used to determine monetary estimates of the value of non-health-related benefits and costs of urban green and blue spaces. However, it is important to consider these alongside health benefits (in either monetary value terms or not) so that such spaces are given appropriate weight in decision-making.

There is a risk of double-counting when adding together the monetary values of health and other benefits. For example, if people consider the health benefit when choosing to walk in a green space, then this would imply that health benefits form part of recreational value estimates. However, this depends on people being able to fully understand the benefit of exercise to health and take that into account when deciding to go to a park.

Notably, economic valuation approaches often focus on the marginal value (valuing small changes to environments), which may make valuing larger changes difficult. Therefore, care is needed when adding monetary values of the health and other benefits of green spaces.

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7.3 Estimating the health values of urban green and blue spaces

Several valuation techniques from health and environmental economics can be used to value the health benefits of urban green and blue spaces.

7.3.1 Cost of illness

This approach estimates the resources used in dealing with a health issue. It can be used to value the benefits (e.g. fewer hospital visits or reducing the costs of certain diseases through exercise) or costs (e.g. more allergies or injuries) associated with the use or existence of green spaces (Van Den Eeden et al., 2022). Cost-of-illness approaches include considering health sector costs (e.g. diagnosis and treatment) and time and associated productivity losses (including leisure time). Such studies rarely consider the cost of pain and suffering.

7.3.2 QALYs/DALYs

In order to compare changes in health states across different diseases, health economists have developed measures that encompass both the morbidity and mortality impacts of a condition by considering its impact on both quality of life and life expectancy. Composite measures of this type include QALYs and DALYs (EUFIC, 2011), where 1 QALY is equivalent to 1 year lived in perfect health.

The economic valuation of QALYs and DALYs uses the social value of a QALY (Donaldson et al., 2011) or DALY. Such values have been derived from stated preference studies of the value of these benefits, in which choice experiments use QALYs or DALYs as an attribute and compare them to the cost of a proposed intervention. Case study 8 shows an example in which the improvement in QALYs from physical activity was used to value green spaces.

Case Study 8

Valuing health benefits of exercise in green spaces in England (United Kingdom)

Location
England (United Kingdom).

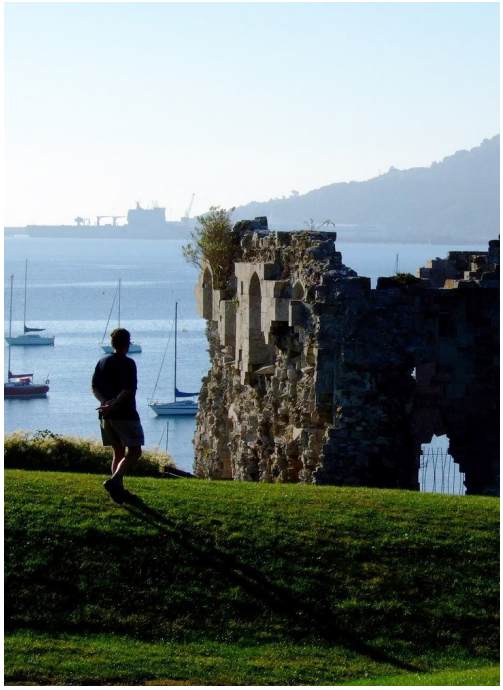
Time frame
Published in 2016, based on a survey conducted from 2009–2010 to 2014–2015.

Methods
QALY/DALY approach. Drawing on a nationally representative survey of the duration of visits, activities undertaken and environment type, the study estimated that 109 164 QALYs (range: 101 736–116 592) were gained from the 1.23 billion active visits to green space that took place each year. The economic valuation used a social value of QALY based on the value placed on a QALY for health care rationing (£20 000 in the United Kingdom at the time; equivalent to €24 400).

Key results
The estimated annual value of the health benefits of exercise in green spaces in England was £2.18 billion (range: £2.03–2.33 billion), equivalent to €2.66 billion (range: €2.48–2.84 billion). Use of the WHO Health Economic Assessment Tool as a sensitivity check (WHO, 2017a) gave similar estimates of value. This study highlights the benefits of green spaces for health and the need to protect and manage such spaces.

Source: White et al., 2016.

Costal walk in Cornwall, United Kingdom



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7.3.3 Mortality valuation

The valuation of changes in mortality risk attributable to green and blue spaces draws on extensive literature that has derived estimates of the VSL or the **value of a prevented fatality**. These values are commonly derived using either revealed preferences for risk (by comparing income differences for jobs with different risk levels) (Hintermann et al., 2010) or stated preferences around mortality risk reduction (Alberini et al., 2006).

Human capital approaches, which estimate the productivity of individuals, are also sometimes used, particularly when primary estimates of the VSL are not available (Grosse and Krueger, 2011). Such approaches place a value on life using the present value of all future earnings, which is rather controversial since it does not consider the wider benefits of life for the individual and society and undervalues elderly, sick and young people.

In cases where the impact on mortality is to delay death by a few months (e.g. air pollution), some researchers have suggested using the **value of a life-year lost** (Desaigues et al., 2011), which considers life expectancy when valuing mortality. Therefore, the impact of, for example, reducing air pollution (which diminishes life expectancy by 3 months) should not be valued the same as, for example, reducing traffic accidents (where the life expectancy reduction is likely to be much greater). Case study 9 describes an example of valuation of the impact of green spaces on mortality.

Case Study 9

Assessing the impact of green space on mortality in European cities

Location

31 European countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom).

Time frame

Published in 2021, based on data from 2015.

Methods

Used two green space proxies to estimate the preventable mortality burden for 2015 at a city level. The study focused on adults (aged >20 years) in 31 European countries. The proxies (normalized difference vegetation index and percentage of green area) were used to estimate how many deaths could be prevented annually by increasing the amount of green space in European cities. The beneficial health effects of green spaces included enhanced psychological restoration, improved well-being and mental health, a reduction in cardiovascular disease, and an association between green spaces and decreased natural-cause mortality.

Parc des Buttes-Chaumont, Paris, France

© Lynda Harris

Key results

If the suggested maximum distance for access to green space were achieved, an estimated 42 968 deaths could be prevented annually when using the normalized difference vegetation index proxy. Based on the estimated EU VSL of €2.877 (Kahlmeier et al., 2017), the economic benefit of this would be €123 billion (2015 prices). Use of the percentage of green area proxy estimated that 17 947 deaths could be prevented annually, correlating to an estimated €52 billion. This highlights the importance of increasing green spaces in European cities to reduce mortality. Cities with the highest mortality burdens associated with a lack of green spaces were Athens, Brussels, Budapest, Copenhagen and Riga. In these cities, green spaces were inequitably distributed, with parks located on the city outskirts or concentrated in specific areas. Limited tree coverage elsewhere limited the access to green space for people living in these areas.

Source: Pereira Barboza et al., 2021.

7.3.4 Well-being valuation

There are increasing efforts to estimate the well-being impacts of changes to green and blue spaces. Validated measures of mental and subjective well-being have been used to estimate the impact of improvements to green and blue spaces on the well-being of users and residents living around remediated waste and other degraded sites (van den Bogerd et al., 2021). These estimates can be converted to monetary values using income equivalence approaches, that is, by transferring the results of studies on the impact of changes in income on well-being scores (Maccagnan et al., 2020). For an example of this approach, see Case study 10.

7.3.5 Wider concepts of value

The intrinsic values of natural environments, and the ecosystems and species of which they comprise, relate to the inherent value of such spaces and can be independent of the people who use or experience them and of any benefits they may gain from them (Sandler, 2012). There are two approaches to measuring intrinsic value: the **subjective intrinsic value** is based on when the judgement of a valuer (i.e. a person considering or expressing the value) that something is intrinsically valuable; and the **objective intrinsic value** is independent of anyone's attitudes or judgements, that is, it is not conditional on an individual's opinion (Arias-Arévalo et al., 2017).

Instrumental values relate to the benefits derived from the specific use or exploitation of a green or blue space by an individual, community or society. Ecosystem service valuation is a type of instrumental value expression.

Relational values (also called shared or plural values) are not inherent to spaces or things, but instead relate to the accumulation and expression of the interpretations, meaning, history and representations of the resource (Chan et al., 2016). Relational values can be **individual** (express how important a space is to a person) or **collective** (i.e. a shared perception that a green or blue space has historically been an important centre of a community).

As part of ecosystem services, cultural values (these are shared by people within a community and relate to their sense of identity or world-view) are considered a form of relational value. Green and blue spaces can have multiple, and often conflicting, cultural values (for example, parks may be valued differently by those

Case Study 10

The role of urban green space for human well-being

Location
Berlin, Germany.

Time frame
Published in 2015, based on survey data from 2012.

Methods
Used a life satisfaction approach and two individual green space measures to explore how urban green space affects the well-being of residents in Berlin.

Key results
The study calculated the implicit marginal rate of substitution between income and environmental variables of green space area and distance. Regarding green space area, the implicit marginal rate of substitution was €26.82 per person per hectare per month based on the average green space availability and average income.

Source: Bertram and Rehdanz, 2015.

Tiergarten Park, Berlin, Germany

© Tim Taylor

who wish to enhance biodiversity and those who seek to use them for recreation), and can be a defining characteristic of community (Stephenson, 2008). A green or blue space has no single fixed relational or cultural value; instead, the value is mutable and contextual, and it may not be possible to reach agreement on the value of such a space.

The term **social value** and associated methods such as social return on investment can be used to represent the full value to society (as far as this is understood or can be captured) of a resource such as a green or blue space, or of an action such as the creation of a green space. Therefore, such approaches to social value incorporate the other types of value discussed in this section, from economic to environmental. In addition, social value can be understood as a set of benefits related to community cohesion, contact and capital. Like community values, social values can be understood, expressed or applied at multiple scales (from individual level to community or societal level) and assessed using a range of methodologies.

Both quantitative and qualitative approaches can be used to assess the social and cultural values of green and blue spaces. Self-reported quantitative approaches can be used to assess factors such as community cohesion, social capital or crime. In-depth qualitative research methodologies can be used to explore these factors ,but also more intangible aspects such as or aesthetic valuation or spiritual experience. They can also be used to better understand lived experiences and the meanings attached to places.

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8. Valuation of the health benefits of urban green and blue spaces

8.1. Steps in the valuation

Valuation of the health benefits of urban green and blue spaces involves key steps, several of which apply to both quantitative and qualitative valuation approaches.

Step 1. Identify the green/blue space to be valued

It is first important to identify the green/blue space to be valued. Is it a specific green/blue space? Is it all green/blue spaces in a city? Or a specific change to a green/blue space? The answer to these questions will depend on the needs of the policy-maker.

Step 2. Identify health impact to be quantified

This is perhaps the most difficult step because it involves exploring the different pathways through which green space impacts health (shown in Fig. 1). These may include changes in:

- **physical activity** and its impacts in terms of QALYs or outcomes for specific diseases;
- **mental health and well-being** (which may involve the use of the green/blue space or living near or seeing the green/blue space);
- **mitigation of pollution and other environmental risks**, e.g. studies have shown that air pollution, noise pollution, flooding and water pollution may be mitigated by green/blue spaces; and
- **pollen impacts** on asthma and other respiratory diseases;

Step 3. Identify and quantify the affected population

The affected population will normally be people using, living near to or travelling past green/blue space. On-site surveys may be needed to evaluate users of or people travelling past the space, unless these data already exist. Census data may be available for people living in buildings near the green space.

For qualitative studies, purposive or theoretical sampling methods may be used to identify the appropriate populations. Sociodemographic characteristics of the population (such as ethnicity, age, vulnerable groups) may also be needed to allow the assessment of equity implications.

Step 4. Quantify the health impacts (positive and negative)

The quantification of health impacts involves either a new epidemiological study or the transfer (with appropriate adjustments) of knowledge from existing sources on the impact of green spaces on health. An epidemiological study may be based on (i) existing health data (e.g. prescriptions data, emergency room visits or mortality data) or (ii) new surveys to capture the impact of a green space or a change to the nature of a green space on health and well-being, using appropriate scales. The latter are costly and time consuming, but may be necessary if the existing knowledge base is less developed on some impacts than on others. Linkages between researchers and public administrations are important to ensure that data are collected and analysed appropriately.

New analyses may use existing calculations (such as exposure–response functions) to assess the impact of green/blue space on health and well-being. Care is needed when applying an exposure–response function from one city or country to another context (e.g. the relationships between heat and health impacts differ quite a lot between cities in different parts of Europe).

Step 5. Conduct the valuation

Having quantified the health impact, choose an appropriate valuation method (monetary or other; as discussed in section 7) for the particular health end-point. Monetary values can be transferred from existing studies using value transfer methods, but care is needed to adjust for changes in price levels (e.g. using the inflation indices) for studies conducted in different time periods and, depending on the monetary valuation method, for income levels between different locations.

Step 6. Use the value to support decision-making
The value of health can be applied to decision-making in many ways. First, different kinds of values from green space (e.g. recreational value, health value) can be compared with each other, or the same type of value can be compared between green space sites or different uses. Values can be used more formally to inform cost–benefit or cost–effectiveness analysis. A cost–benefit analysis can compare the costs and benefits of interventions over time (using discounting to compare between different years). The net present value of the different streams of costs and benefits can be estimated in order to determine the benefit–cost ratio. A cost–effectiveness analysis compares the costs of an intervention with the benefits, as expressed in physical terms (e.g. cost per QALY). In both cost–benefit and cost–effectiveness analyses, a sensitivity analysis should be conducted to assess changes in assumptions (e.g. the discount rate or the costs).

Decisions should be supported by qualitative evidence on the views and opinions of local residents and users of spaces on the proposed changes. Effective and ongoing consultation is an important part of the planning process and ensures that differing views are considered.

8.2 Challenges in the valuation

The decision on about which method is appropriate to value the health and environmental benefits (or costs) associated with urban green and blue spaces depends on several factors, as follows.

8.2.1 Time

Conducting a full assessment of the values, notably if a new primary study is needed (e.g. a choice experiment study or qualitative interviews), takes significant time (and money). To understand how people are using the parks, it is necessary to consider their use of these spaces in different seasons (unless strong assumptions are made). This involves fieldwork that includes repeated observations in representative days across different seasons, meaning that at least 12 months are needed for data collection – and potentially repeating this exercise in different years. For policy-making, advice is often gathered over a shorter time frame; therefore, assumptions may need to be made or values transferred from other sites. Cities may be able to draw on existing datasets on park or beach use, which could help to quantify the use and, therefore, reduce the cost and time needed for estimating benefits.

8.2.2 Financial resources

Getting representative population samples to respond to questionnaires or holding focus groups or interviews may require considerable financial resources, depending on the location and scale of the research. An online survey can be cheaper, but there are issues about whether the respondents represent all sectors of the population: they tend to be representative of certain characteristics (e.g. age, sex and income level), but not of others (e.g. those with poor digital literacy or the lowest socioeconomic status). Guidelines for online surveys in the context of economic valuation may address some of these issues (e.g. Menegaki et al., 2016).

Simple calculations can sometimes be useful. For example, using the WHO Health Economic Assessment Tool (WHO, 2017a) to estimate the health value of improving an urban walkway in a green space may be sufficient to show that the benefits are large enough to justify investment (and that a further, more-detailed cost-of-illness approach to valuation of the morbidity impact is not needed). In addition, analysis is needed of the sensitivity of the findings to changes in certain assumptions (e.g. discount rates or values of life).

8.2.3 Specific nature of the investment being considered

Stakeholders may only be interested in the direct costs for health care, for example, if a health service wants to invest in forests, it may prioritize assessing the direct cost savings to the health sector itself (i.e. using only health service costs). This approach may lead to increased investment in green and blue spaces but may not capture the breadth of benefits of green/blue spaces and, therefore, lead to suboptimal investment.

9. Equity issues – who pays and who benefits

9.1 Who pays?

When considering an urban green/blue space intervention, it is also important to consider who bears the costs of establishing and maintaining the space. Green and blue spaces may be funded through taxation, businesses, entrance fees and other mechanisms. Where taxes are used, there may be a wider impact (e.g. on how people spend their money, or on their working patterns); this may need to be considered in any calculation of value, alongside estimates of the regressive/progressive nature of the tax (European Commission, 2013).

Increasing attention is being given to the potential for businesses to finance the creation and improvement of green and blue spaces. Recent developments in corporate social responsibility and related practices show that private parties can be involved in co-financing public amenities such as urban green for reasons such as visibility, environmental impact and societal impact (possibly related to formal or informal environment, social and governance reporting (Tsang et al., 2023)). Entrance fees are one way to capture the value of recreation to fund green and blue spaces, but may exacerbate health inequities if lower-income groups are excluded from such spaces. Therefore, differential pricing may need to be considered (e.g. for local residents compared with tourists, or for unemployed people). Whatever the source of financing, a critical question for a city remains how to allocate an appropriate budget for green and blue spaces, considering the other priorities.

9.2 Who benefits?

Despite growing evidence for health and well-being benefits of urban green and blue spaces, it is increasingly clear that access to these benefits is not equitably distributed. In Europe, people living in northern and western cities generally have more access to urban green space, whereas cities in the south and east have less total green space (European Environment Agency, 2022).

Within cities, people from higher socioeconomic groups may be able to access to more green and blue spaces than those from lower socioeconomic groups (Schüle et al., 2017), while neighbourhoods with higher migrant and Black and minority ethnic populations have less available green and blue spaces (WHO, 2017b). Entrance fees may further restrict accessibility. Moreover, ethnic minorities may also have less access to private green spaces such as gardens (Office for National Statistics, 2020). However, when they do have access to green and blue spaces, people from lower socioeconomic groups may experience greater health and well-being benefits (Marselle et al., 2020; Mitchell et al., 2015; Olsen et al., 2019).

Other groups, such as elderly or disabled people, may make less use of spaces with inadequate facilities, such as seating or toilets (Onose et al., 2020). Perceived safety may influence willingness to use green and blue spaces, particularly for women (Lapham et al., 2016), members of LGBTQ+ communities, and elderly people.

10. Which tools are used for valuing?

A number of tools have been developed to assist in valuing green and blue spaces and their health benefits (Box 1 gives an overview of some). Further information on the approaches for valuation of nature can be found in a recent report by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2022).

Box 1.

Tools that can be used to value green and blue spaces

Health Economic Assessment Tool, WHO

The Health Economic Assessment Tool combines evidence on the mortality impacts of walking and cycling, including the direct impacts on health and the impacts of exposure to air pollution and fatal accident risk, with the VSL (based on transferring values from existing studies) (WHO, 2023). Users can either input the existing numbers of users and duration of use to estimate the value of current activity levels or define scenarios for the future.

Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST), Stanford University

InVEST offers a suite of tools that help o estimate the values of changes in ecosystems (Stanford University, 2023). It covers a range of benefits, including recreation, urban cooling, water purification and urban flood risk mitigation.

BlueHealth toolbox, BlueHealth project

The BlueHealth toolbox comprises six tools to help urban planners and designers when thinking about making changes to urban blue (and green) spaces (BlueHealth, 2020b). This includes a Decision Support Tool to identify the key health-related risks and benefits of an intervention, and a Behavioural Assessment Tool to quantify changes in activity using observational mapping before and after an intervention.

Tool Assessor, Ecosystems Knowledge Network

The Tool Assessor is an easy-to-use online repository of tools that may be useful for evaluating the different ecosystem service benefits of green and blue spaces (Ecosystems Knowledge Network, 2023). It includes specific tools to assess the carbon and biodiversity effects of change, assist in monetary valuation, help to map ecological connectivity, map ecosystem services and quantify the services provided by nature, as well as methodological guidance documents.

Artificial Intelligence for Environment & Sustainability, Integrated Modelling Partnership

Artificial Intelligence for Environment & Sustainability (ARIES) is an online platform that enables users to investigate the spatial mapping and quantification of ecosystem services in a location and the associated economic values (Basque Center for Climate Change, 2023). It can be used from the local to national levels for issues such as natural capital accounting, conservation planning, spatial policy planning and forecasting changes in ecosystem services.

Note: this list is not exhaustive and represents no endorsement.

11. How to appraise approaches to valuing nature

In order to have confidence in their findings, studies valuing urban green and blue spaces may need to be critically appraised. A number of existing tools aim to appraise the quality or reliability of research using different methods. These provide a series of questions against which the published research can be assessed and judged.

11.1 Critical appraisal of economic valuations

The Drummond checklist was designed to support the critique of economic evaluations of health care interventions, but contains many elements of relevance to any economic evaluation (Drummond, 2015). It assesses 10 items: (i) the research question; (ii) the description of the study/intervention; (iii) the study design; (iv) the identification, (v) measurement and (vi) valuation of costs and consequences; (vii) whether discounting was carried out; (viii) the incremental analysis; (ix) the presentation of results with uncertainty and sensitivity analyses; and (x) the discussion of results in the context of policy relevance and existing literature. A summary of the questions is available on the National Information Center on Health Services Research and Health Care Technology website (National Library of Medicine, 2023).

11.2 Critical appraisal of qualitative research

A number of frameworks exist to consider the quality, or trustworthiness, of qualitative research reports. Given that qualitative research can come from a wide range of academic disciplines and have different epistemological and ontological foundations, it may be challenging to identify approaches that are appropriate for all qualitative research (Garside, 2014). Nonetheless, it is desirable to distinguish between well and poorly conducted and reported qualitative research, particularly in the context of systematic reviews and qualitative evidence synthesis. An approach adapted from Wallace et al. (2004) covers the research question, theoretical perspective, study design, context, sampling, data collection, data analysis, reflexivity, generalizability and ethics.

12. Evidence gaps and research needs

Valuation of the health benefits of urban green and blue spaces is relatively new compared with, for example, valuation of the recreational benefits of urban green spaces. It is possible to estimate values based on the transfer of values for both health outcomes (e.g. dose–response functions) and monetary values for health (with adjustment for income). However, further city level studies on the epidemiology and valuation side are needed to further validate these estimates. In particular, the following suggestions are presented.

- **Collect and collate further evidence** in a consistent format on the use of green spaces in cities, including the number of people visiting the spaces and types of activity they undertake. The latter can be based on the use of existing tools such as the BlueHealth Behavioural Assessment Tool (Box 11) (BlueHealth, 2020).
- **Conduct further studies** on the dose–response function between exercise and health outcomes for different populations.
- **Morbidity valuation** is less well developed than mortality valuation, and the transfer of cost-of-illness estimates between different health contexts is difficult. Adopting consistent approaches to reporting and developing case studies in countries with different types of health systems would be useful.
- **Well-being valuation methods are in their infancy.** When implementing a change to a green or blue space, conduct a pre-/post-intervention evaluation of the well-being of residents using appropriate measures of well-being.
- **Most studies relate to northern and western Europe**. Further work is needed to investigate values in non-EU countries and contexts, where relationships with green and blue spaces may differ owing to cultural differences.
- **Use consistent reporting methods for valuation studies** to enable the better transfer of results between contexts. Studies should report factors such as the timing of data collection and price year for values, and list critical assumptions.
- **Studies on the benefits of green and blue spaces** should also consider negative impacts (e.g. exclusion, injuries, pollen exposure and other disbenefits).
- **Improve the transfer of knowledge between cities** on the valuation of the health benefits of green and blue spaces so that cities can learn from one another's experiences and develop new strategies. Conduct further studies on the relative costs and benefits of improving green and blue spaces that consider both the capital costs and operations and maintenance costs Evidence on these areas is limited.

13. Key messages and potential solutions

Green and blue spaces have a significant potential to deliver health benefits for urban populations. However, to avoid health inequities, the needs of different users need to be taken into account in both the design of facilities and the locations of green and blue spaces.

This report summarizes methods that can be used to place monetary values on the health benefits of green spaces. Such values can help policy-makers to appropriately allocate resources to green and blue spaces to ensure that these spaces are not undervalued and improve public and environmental health.

Suggestions to support decision-making about green and blue spaces by increasing the understanding of their benefits and value are to:

- **use the available tools** to quantitatively and qualitatively value the health benefits of green and blue spaces, and use this information to improve policy-making;
- **design green and blue spaces** that enable physical activity and improve mental health and well-being to give the greatest benefit for health;
- **critically appraise the quantitative and qualitative evidence** on nature benefits so that policy-makers can understand the quality of the evidence on the health value of green and blue spaces;
- **involve a range of stakeholders** who place different values on urban green and blue spaces in developing appropriate strategies;
- **ensure that all policies that impact green and blue spaces** (from climate adaptation to urban development policies) consider the health and well-being implications for urban populations, as well as the environmental and social impacts; and
- **promote knowledge-sharing and training** on valuation of the health and well-being benefits of green and blue spaces, including on economic valuation and qualitative methods.

Urban green and blue spaces are an important resource for health and well-being. As societies face the challenges of ageing populations, climatic and environmental change, and pressure on health systems, it is critical that to realize the multiple benefits of these spaces.

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WHO European Centre for Environment and Health
Platz der Vereinten Nationen 1
D-53113 Bonn, Germany

Tel.: +49 228 815 0400
Fax: +49 228 815 0440
E-mail: euroeceh@who.int
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