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Federal Agency for Nature Conservation

Green, natural, healthy:

The potential of multifunctional urban spaces

Final Report

Katrin Rittel, Laura Bredow, Eva Regina Wanka, Dorothea Hokema, Gesine Schuppe, Torsten Wilke, Dennis Nowak, Stefan Heiland

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Scientific support:

Federal Agency for Nature Conservation
Field Office Leipzig
Department II 4.1 – Landscape planning, spatial planning and urban spaces
Florian Mayer, Alice Schröder
Karl-Liebknecht-Str. 143, 04277 Leipzig
Internet: http://www.bfn.de/0102_231.html

Authors:

Technische Universität Berlin
Institute of Landscape Architecture and Environmental Planning
Department of Landscape Planning and Development
Prof. Dr. Stefan Heiland (Head of Department)
Dipl.-Ing. Katrin Rittel, Dr. Dorothea Hokema, B.Sc. Gesine Schuppe
Straße des 17. Juni 145, 10623 Berlin
Internet: http://www.landschaft.tu-berlin.de

Ludwig-Maximilians-Universität München
Institute and Outpatient Clinic for Occupational, Social and Environmental Medicine
Prof. Dr. Dennis Nowak, Dr. Eva Wanka, M.Sc. Laura Bredow
Ziemssenstr. 1, 80336 München
Internet: http://arbmed.klinikum.uni-muenchen.de

City of Leipzig
Department for Greenspaces and Waters
Dipl.-Ing. Torsten Wilke
Postal address: 04092 Leipzig
Main address: Prager Straße 118-136, 04317 Leipzig
Internet: http://www.leipzig.de

Translation

Environmental English
Mark Sixsmith, B. Sc.
http://envenglish.blogspot.com

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Abbreviations

BBR	Bundesamt für Bauwesen und Raumordnung (Federal Office for Building and Regional Planning)
BBSR	Bundesinstitut für Bau-, Stadt- und Raumforschung (Federal Institute for Research on Building, Urban Affairs and Spatial Development)
BfN	Bundesamt für Naturschutz (Federal Agency for Nature Conservation)
BMELV	Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (Federal Ministry for Food and Agriculture)
BMG	Bundesministerium für Health (Federal Ministry of Health)
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety)
BNatSchG	Bundesnaturschutzgesetz (Federal Nature Conservation Act)
Difu	Deutsches Institut für Urbanistik (German Institute for Urban Affairs)
e.V.	eingetragener Verein (registered association)
F+E	Forschung und Entwicklung (R&D research and development)
GVP	Gesundheitsverträglichkeitsprüfung (HIA Health Impact Assessment)
idw	Informationsdienst Wissenschaft (The Science Information Service)
o. J.	ohne Jahr (n.d. no date)
SUP	Strategische Umweltprüfung (SEA Strategic Environmental Assessment)
UN	United Nations
WHO	World Health Organization

Foreword

‘Green, natural and healthy’ – a succinct way of describing urban green areas and structures, and their positive effects on human well-being. The BMU and BfN Nature Awareness Studies in 2011 and 2013 show that health and recreation in nature are, for many people, among the most important reasons for nature conservation. In a natural, green environment you simply feel ‘well’. The high esteem in which such areas are held by the urban population is not surprising, given the health risks due to noise and emissions, among others, especially in urban areas. Therefore, open spaces gain importance that allow a balance both in a physiological and psychological perspective.

This was the reason why the Federal Agency for Nature Conservation wanted to prepare the scientific findings concerning the effects of urban green areas on individual health for practitioners. For daily administration action, for key urban planning decisions, as well as for those acting in nature conservation, detailed knowledge of the health-promoting effects of green structures is of importance. The health effects emanating from green spaces and structures are the corporate benefits of urban ecosystems for humans. Therefore, in many areas synergies arise between the protection of biodiversity and health promotion, which should be exploited on both sides. Nature conservation can in this case, for example via landscape planning, contribute to the creation of health-promoting environments, by dealing with the recreational function of urban green spaces, develop appropriate goals and actions and help to provide and to secure important spaces for nature experiences and well-being.

With this report, the Federal Agency for Nature Conservation wants to help to increase the attention paid by local planners to the green structures in our cities and settlements and to their importance for human health. Only when the consciousness and awareness of the importance of green spaces in urban areas for health promotion has been strengthened, will it be possible to create and design liveable and thus health-promoting environments. Because nature conservation is also ultimately the protection of people and their health. This thus corresponds well with the objectives of the National Biodiversity Strategy for urban landscapes, to maintain and improve the quality of life for people through natural spaces in urban areas.

Prof. Dr. Beate Jessel

President of the Federal Agency for Nature Conservation

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Summary

Health is increasingly seen as an important issue in urban development, not least because of climate change and a diverse set of societal changes. Urban nature and urban green spaces can substantially contribute to health in urban areas. Against this background, the German Federal Agency for Nature Conservation initiated a research project that investigated the following questions:

- What types of health promoting effects or potentials do urban green and natural spaces have?
- Are there particular features that these spaces need in order to promote health?
- Which synergies and conflicts exist between biodiversity protection, a key element of nature conservation, and health promotion in urban green spaces? How can these conflicts be minimized or solved?
- How can landscape planning (as a planning instrument of nature conservation) take health promotion into consideration?

The project conducted a comprehensive scientific analysis of the literature, but also considered perspectives, experiences and requirements of municipal planning practitioners, as the ultimate goal of this report is the application of research results in nature conservation, planning and administrative practices. For these reasons, the cities of Eckernförde, Leipzig, Munich and Norderstedt were chosen as ‘practice partners’ in this project.

According to the WHO, health is regarded not simply as the absence of disease, but more comprehensively as a state of complete physical, mental and social well-being. Hence, this project assumes that health theoretically can be divided into aesthetic-symbolic, social, mental, as well as physical components, and that these need to be considered equally. The project emphasizes the promotion of health, which includes: maintaining health, the strengthening of health resources and establishing healthy environments. Due to the spatial approach of nature conservation and urban planning, the project addresses strategies to improve the environmental factors influencing human health instead of aiming at modifying individual behaviour.

Nature conservation is understood in a broad sense as defined by paragraph 1 of the German Federal Nature Conservation Act (BNatSchG): Nature conservation does not only focus on biodiversity and the maintenance of the functional capacities of the natural environment but on the visual appearance and recreation suitability of landscape and urban green spaces. The importance of nature conservation is justified by the essential function of nature and landscape for human health and well-being. The part of nature conservation that focuses on nature protection in cities and urban areas is referred to as ‘urban nature conservation’. Green spaces are unbuilt urban areas that are both unsealed and characterized by vegetation.

Urban nature conservation as well as green and open-space planning provide extensive opportunities to take health issues, in particular health promotion, into account and integrate

them in urban planning and development. Green spaces in this regard have many positive health benefits, even though occasional negative effects such as allergies need to be considered as well. In certain instances, conflicts between urban nature conservation and health promotion can arise. To solve these conflicts, three strategies or any combination thereof can be used:

- Assignment of prioritized uses or functions to certain green spaces
- Consideration of the need for green spaces dedicated to specific uses or functions in the overall urban context
- Spatial and/or temporal separation of use or function within a green space

Ultimately, the effects of climate, demographic, and lifestyle changes in combination with environmental justice and participation requirements affect urban nature conservation as well as human health. Thus, urban nature conservation and health promotion share interests and challenges. For instance, a task of landscape and open-space planning that is becoming increasingly important is to mitigate health relevant consequences of urban heat stress and to meet the new demands placed on open spaces by an ageing society.

The core of this publication consists of work materials based on the suggestion of the practice partners. These materials aim at facilitating the inclusion of health promotion aspects in planning practice:

- Analysis of user groups: Knowing the needs of different user groups is essential for assessing and enhancing the effects of green spaces on health promotion
- Assessment criteria to determine health-promoting potentials of urban green spaces: The potential health benefits of green spaces and their actual properties depend on a variety of characteristics and factors. This makes it impossible to attribute specific health benefits to a particular type of green space. Instead, an analysis of each individual case is required that encompasses both the characteristics of the considered space, and also the entire urban green space system.
- ‘List of good arguments’ for planners: Scientific findings demonstrating positive effects of green spaces on human health are included here, not denying some negative effects and contradictory findings. Thus, municipal planning actors will not only be able to refer to positive benefits of ‘green spaces’ on health, but also to prove them.

What are the possibilities/options to promote human health by urban nature conservation and local planning? This question has been examined in the field of municipal landscape planning. There are three possibilities with varying methodological intensity and scope that can be applied in order to integrate health issues systematically into planning practice.

1. Integrating health as a subject of protection in Strategic Environmental Assessment: The positive and negative health impacts of the proposed objectives and measures need to be thoroughly addressed in cases where a Strategic Environmental Assessment (SEA) is required for landscape plans. As a result, adverse health effects will be avoided and positive effects of landscape planning can be identified. A planning approach designed for the purposes of enhancing the health potentials of green spaces can therefore not be pursued.

2. Health as an argument to further substantiate landscape planning goals: Very often goals and measures suggested by landscape plans have positive side-effects on health issues. As these positive side-effects are usually omitted, this strategy seeks to draw more attention to them by explicitly identifying and presenting them. Not subject to this option are goals and measures which are predominantly health related (e.g. the reduction of health impairments in green spaces).
3. Health as an independent subject of protection of landscape planning: Here, health related aspects are not just used in order to come up with further arguments for nature conservation and landscape planning goals. Instead, specific goals and measures are developed for the purpose of health promotion. From a health promotion perspective, this is the preferred option. This means, however, that landscape planning is entering previously unchartered territory.

Some criteria are given to assess which of the three options is most applicable in each single case. This does not deny that the final decision on whether they choose an approach beyond SEA obligations lies with the municipalities and planners.

The realization of the proposed health-related approaches as part of urban nature conservation implies further action and research that could not be addressed in this project. Surveys in health and planning sciences as well as studies of practical implementation are necessary.

To conclude, it can be stated that harnessing the existing synergies and solving potential conflicts between urban nature conservation and health promotion offers significant opportunities for both disciplines. Realizing these advantages will be challenging. Nevertheless, the following applies: ‘‘The ‘healthy city’ … can only be understood as an interdisciplinary task and as the product of a concerted effort of many actors’’ (Klages 2012, p.323).

1 Introduction

Health is increasingly perceived as an important topic of urban development, not least against the backdrop of climate change, as well as demographic and other social changes. 'Urban nature' and urban green spaces can make an important contribution to promoting health in urban areas, especially as 'nature' is closely linked with health by a large part of the German population. This report aims to raise awareness and highlight the many links between nature conservation and health in urban areas. In particular, it addresses people in planning and nature conservation practice, who can take into consideration health concerns in their respective areas of work.

'Green' and 'nature' in the city – these can be very different. From the viewpoint of nature conservation, it is the habitat of animal and plant species, the conservation of urban biodiversity, which is often higher than that of the intensive agrarian surroundings, the regulation of the water balance or the climate balance. Spatial planners and landscape architects like to focus more on the importance of green spaces for the cityscape and usability by the population, on their recreational function. And the city residents themselves? According to the 'Nature Awareness Study 2011' (BMU & BfN 2012), 93% of the population put nature equal with recreation and health – even if one cannot directly equalise 'nature' with 'urban nature' or 'town green'.

This somewhat pointed representation of different perspectives on green spaces in the city clarifies one thing: For nature conservation it might be worthwhile to also look at these other ways of considering 'urban green' and, together with other stakeholders, to achieve a quantitative and qualitative preservation or improvement of urban green spaces. As the above mentioned figure shows, the theme of health offers this in a particular way. All the more so in the context of an ageing society, increasing heat stress due to climate change, as well as requirements for the socially equitable distribution of environmental resources and burdens (Chapter 3.3.4 Environmental Justice) which means that health will be of increasing importance for the planning and design of cities.

But can green spaces and natural areas in the city actually associated with nature conservation goals simultaneously and equally meet the different usage requirements associated with health concerns? Are there synergies between nature conservation and health? Or even conflicts? Because, as Claßen et al. note (2005; c.f. Claßen 2008; Kistemann at al.2008), official nature conservation representatives only see small potential for nature conservation in the topic of health.

This confirms the view in practice: The health effects of natural areas and other green spaces in the city have not been worked systematically through nature conservation, landscape planning, but also the neighbouring discipline of open space planning.

The subject of health is again only implicit, and thus hidden, perhaps in the form of recreational issues. So, the health importance of (semi-natural) green spaces in planning and political decision on future land uses is largely irrelevant. This is also because in nature conservation, urban landscape and green space planning, the differentiated knowledge about the health effects of urban green spaces is still largely absent, whereas the authorities responsi-

ble for health promotion are seldom widely involved in decisions of nature conservation or urban and landscape planning.

However, in § 1 Federal Nature Conservation Act (BNatSchG) a wider social order of nature conservation is formulated, which justifies the protection of nature and landscape in terms of its importance as a basis for the life and health of people. Likewise, the National Strategy for Biodiversity calls on greater use of the synergies of nature conservation and health. Thus ‘‘the health sector to raise awareness that nature conservation can make a contribution to the protection of health and many positive effects of nature on human health are based on permanent free services of nature’’ (BMU 2007, p 115). This demand on the health sector conversely requires that those involved in nature conservation are aware of these contributions; they communicate and take into account the issue of health in their decisions and argumentation.

Against this background, the German Federal Agency for Nature Conservation initiated a research project that investigated the following questions:

1. What types of health promoting effects or potentials do urban green and natural spaces have?
2. Are there particular features that these spaces need in order to promote health?
3. Which synergies and conflicts exist between biodiversity protection, a key element of nature conservation, and health promotion in urban green spaces? How can these conflicts be minimized or solved?
4. How can landscape planning (as a planning instrument of nature conservation) take health promotion into consideration?

The project saw itself from the outset not only as academic, but at the same time as practice-oriented. It was very important, therefore, to consider the perspectives, experiences and requirements of municipal planning practitioners. This was ensured by the involvement of the cities of Eckernförde, Leipzig, Munich and Norderstedt in the project. In addition to interviews, in each city a one-day workshop took place with the participation of different administrations and other relevant actors.

Municipalities were deliberately selected which differ from one another in terms of inhabitants, size, administrative structure, demographic development and other factors, such as the anticipated impacts of climate change. In addition, there was a one-day workshop with representatives of different (environmental) medical subjects.

A goal of the project is to give local actors in nature conservation, landscape and open space planning, as well as other relevant authorities, associations or individuals, assistance in taking account of the issue of health in their planning and decisions. For this reason, the report is divided into a main part and an annex. The main body is condensed as short as possible and firstly explains the central definitions of the project (Chapter 2), discusses the opportunities and demands for the consideration of health aspects in urban nature conservation (Chapter 3) as well as synergies and conflicts between the two areas of action (Chapter 4) and finally, in the central section 5, ‘work materials’ information regarding user requirements for urban green spaces (5.1), criteria for identifying their health-promoting potential in planning (5.2) as well as scientific findings on these potentials together. Various possibilities for

the integration of health aspects into municipal landscape planning are presented in Chapter 6. In Chapter 7, a brief conclusion is drawn and an outlook cast on further research and action.

2 Definitions

To avoid misunderstandings, the key terms in this report will first be defined. **Green spaces** refers to all undeveloped urban areas that are characterized as unsealed and with vegetation. **Nature conservation** is very broadly defined within the meaning in § 1 Federal Nature Conservation Act (BNatSchG). In addition to the protection of biodiversity, as well as the utilization and performance of the natural balance, it applies equally to the visual appearance and the recreational suitability of the landscape, and thus also of urban green spaces. It is, among other things, justified by the importance of nature and landscape as a basis for life and human health. That part of nature conservation that deals with cities or urban areas is called **urban nature conservation**.

Health is not only the ‘‘absence of disease’’, but more comprehensively a ‘‘state of complete physical, mental and social well-being’’ (WHO). Health can be divided into aesthetic-symbolic, social, mental, as well as physical components. At the forefront of **health protection** is the prevention of potential health risks and diseases. The concept of **health promotion** focuses on maintaining health, the strengthening of health resources and establishing health-promoting environments. **Prevention** is understood to include protection against disease as well as promoting health. Preventive measures can be divided into **behavioural prevention** (changing the behaviour of a person) and **situational prevention** (changing the environment surrounding a person). In the context of this report, situational prevention is paramount.

In this chapter a clear understanding is made of the terms ‘green spaces’, ‘(urban) nature conservation’ and ‘health’ as well as related terms that are of central importance to the project.

2.1 Green spaces

Green spaces refers to all undeveloped urban areas that are characterized as unsealed and with vegetation. These include a variety of areas such as parks, urban forests, floodplains, allotments, wasteland, cemeteries, playgrounds and sports grounds. Their great heterogeneity leads to various green spaces being especially suitable or important for different uses: heaths or flood plains designated as nature reserves for species and habitat conservation, neighbourhood parks for intensive recreational use, allotments for the needs of urban gardeners[1]. Green spaces, however, should not be regarded only as individual locations; both in the context of health promotion as well as the open space planning and nature conservation, they play an important role with their networking (as green corridors) and their quantitative and spatial distribution throughout the city.

Specific green elements, such as street trees, roadside vegetation and vegetation closely linked to development (roof and facade greening), may also be of importance for nature conservation and health in certain contexts. In this report the term green spaces is used for them; if a specific green element is referred to, this is explicitly mentioned.

[1] ‘Urban gardening’ refers to various places and forms of organization of decentralized urban horticulture, which takes place not only in allotments and domestic gardens, but also in community gardens and cultivated areas on the roofs of buildings, urban wastelands and offset areas, where tubs, raised beds and boxes are used as alternatives on sealed or polluted land. Urban gardening can also meet the self-sufficiency needs of the user.

2.2 Nature conservation and urban nature conservation

Nature conservation is broadly defined by §1 Federal Nature Conservation Act (BNatSchG): It has a comprehensive requirement for settled and non-settled areas and refers to the conservation and development of biodiversity, the sustainable performance and functioning of the natural balance, as well as the diversity, characteristic features and beauty of nature and landscape, and its recreational value. Since 2009, the protection of nature and landscape is also legally justified by their importance as a basic necessity of human life and health. This refers to both the tangible and intangible needs of people, so that physical, psychological and social well-being are to be considered equally (Lütkes & Ewer 2011; Frenz & Müggenborg 2011).

From the BNatSchG, different fields of action and tasks of nature conservation can therefore be derived:

- Protection and development of biodiversity in terms of the protection of ecosystems, habitats and species[2]
- Protection and development of the abiotic natural resources of soil, water, air and climate
- Protection and development of the landscape appearance
- Creation of conditions for landscape and open space-related recreation.

Thus the BNatSchG requires, at least indirectly and implicitly, that nature conservation also makes a contribution to the preservation of human health.

In this respect the following also applies to the aforementioned statements: nature conservation and urban nature conservation can be widely understood as synonymous, whereas nature conservation is broader and urban conservation a more specific term. The latter is often used to emphasize the characteristics, which must be taken into account with nature conservation in cities as a habitat of people (BfN 2007, Breuste 1994, Schulte et al. 1997).

This implies the fact that species and habitat protection as one of the ‘classic’ tasks of nature conservation even plays an important role in cities, but in addition human recreation and the possibility of experiencing nature must also be given special attention. Breuste (1994, p 120) states that: ‘‘rarity and exclusivity of urban fauna, flora and habitats should step back in the assessment of species and habitat conservation in the city behind the potential opportunities for nature experience, recreation and the landscape.’’ You do not have to follow this argument of Breuste that urban nature conservation contrasts with ‘nature conservation in rural areas’, especially since in rural areas, or even in national parks, nature experience and adventure play an important role for people and can come into conflict with other conservation goals. But it is evident that ‘man’ is a significant factor in urban nature conservation and, therefore, nature conservation – also because of its requirements to cover all areas – should not be limited to semi-natural and valuable protected areas (nature reserves, Natura 2000

[2] Biodiversity includes the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (UN 1992). In the context of this project, only the levels of the habitats and species are of importance, not those of genetic diversity.

sites, natural monuments) for species and habitats. ‘Nature’ in the city is, in any case, a significant factor in the quality of life, and therefore health; so nature conservation also has a corresponding contribution to make.

This therefore means that landscape or outdoor recreation, nature appreciation and experience, human health, and all urban green areas are potentially the subject of nature conservation. This results in overlapping or blurred boundaries regarding the neighbouring disciplines of open space planning and landscape architecture; but, as shown in the discussions in the model communities, a clear separation is not possible. Therefore, when urban nature conservation is mentioned in the following, this can also include – despite all the differences – the objectives and responsibilities of open space planning and landscape architecture. Those disciplines have always been much stronger than ‘classical nature conservation’ in pursuing an approach that emphasizes the human usability of green spaces as well as their importance for welfare and health.

This broad understanding of urban nature conservation in no way reflects the existing administrative responsibilities, which differ from municipality to municipality. Usually there are conservation agencies or authorities (at least in autonomous towns and cities) which deal mainly with species and habitat protection as well as area protection, plus park and recreation offices whose task is the planning and maintenance of open spaces as places of urban design as well as recreation for the urban population. Landscape planning as a specialist planning of nature conservation can, in turn, be located either at the said offices, but also together with land-use planning in a Planning Department. All the above-mentioned authorities have one thing in common – they are ultimately concerned with green spaces that may have both health-promoting potential and importance for the conservation of biodiversity depending to their characteristics (naturalness, size, maintenance, facilities, location, etc.).

In this report, the above-mentioned areas are summarized under urban nature conservation; differentiation is stated when required, for example species and habitat protection, open space planning, recreation provision.

2.3 Health

Health is not only the ‘‘absence of disease’’, but more comprehensively a ‘‘state of complete physical, mental and social well-being’’ (WHO 1946). This also describes the essential characteristics of the quality of life; thus, the definitions of health, quality of life and well-being are closely linked. According to this WHO definition, the following components of health can be identified, for which urban green spaces can also be of significance (see Abraham et al. 2007):

- **Aesthetic-symbolic component of health**

  An understanding of the aesthetic effect as well as the symbolic power an area or an element can have on an individual, leading to the well-being of people. This can be, for example, ‘beautiful landscapes’ or individual old trees which symbolize ‘healthy nature’ or a past ‘happy childhood’ and thereby also contribute to the identification of a site.

- **Social Health**

This includes aspects such as belonging, integration, communication, etc., which promote social interaction as well as individual development and identification processes.

- **Mental health**

  This includes, among others, psychological well-being, relaxation, self-efficacy (ability to effect, to make one's own life) and finding meaning. In addition, this component also includes aspects such as mental stress, concentration and ability to work. The expression mental health is a synonym for psychological health.

- **Physical Health**

  Here we understand aspects and functions, which contribute to physical well-being, such as the condition of the cardiovascular system, muscular system, nervous system, physical performance, endurance, etc.

The above-mentioned components of health must not be regarded in isolation, but interact with each other so that this division is more scientific-analytical, simply illustrating a sensible systematization for structured consideration in this report. An understanding and perception of health is always dependant on person/individual, culture and time. For this reason, self-assessed (health-related) quality of life is often used as a measurement and evaluation measure of health, as it is all about subjective sensation and perception (WHO 1998).

2.4 Health promotion

In addition to health protection, it is also necessary to have health prevention and health promotion in order to achieve health and therefore quality of life, as well as to maintain it. At the forefront of **health protection** is the prevention of potential health risks and diseases. This traditional focus of medicine is increasingly supplemented by **health promotion**. This concept was comprehensively described in the Ottawa Charter (WHO 1986) from the first international WHO conference; it is getting more and more attention in the medical and health science field, where it is also increasingly being implemented. The concept focuses on maintaining health, the strengthening of health resources and establishing health-promoting environments. It is essential to adopt a 'setting approach', thus integrating interventions or activities into daily life and in places where people live, work, play and learn. As a result, the respective target groups are visited in their environment and are given the chance to actively participate in health-enhancing opportunities. **Prevention** in the original sense dealt with averting disease, but now also includes health promotion. It is divided into **primary prevention** (promoting and maintaining health, preventing the development of disease), **secondary prevention** (preventing progression of a disease at an early stage through early diagnosis and timely treatment), and **tertiary prevention** (avoiding the aggravation of diseases already made manifest). Preventive measures can be divided into **behavioural prevention** (changing the behaviour of a person) and **situational prevention** (changing the environment surrounding a person).

When considering the health potential of urban green spaces, situational prevention is paramount, as is the creation of health-promoting living environments. These often only initially provide a potential source, as the actual results or health effects usually depend on the use of the spaces by the people and their attitude and motivation. This should always be taken

into account, but could not be considered in this project.[3] Table 1 compares the different areas for promoting health.

Table 1: Maintaining health - differentiation of various terms

	Health protection	Health promotion	Situational prevention	Behavioural prevention		
				Primary prevention	Secondary prevention	Tertiary prevention
Aim	Avoiding hazards (health stressors) for human health (e.g. by noise barriers)	Strengthening of health resources (e.g. using a park to reduce stress)	Adaptation of home, living and working environments (e.g. plant a green schoolyard)	Prevention of disease and strengthening health (e.g. vaccination)	Detection / precaution (e.g. perceive screening tests)	Prevention of deterioration (e.g. therapies)
Target group	Total population	Individual person and the total population	Total population	Risk groups (e.g. children)	Already ill person still without symptoms	Ill person in treatment
Time	Before development of the disease	Before development of the disease	At all times	Before development of the disease	Early stage of the disease	Advanced stage of the disease

Since environmental conditions (in terms of situational prevention) and individual behaviour (in terms of behavioural prevention) are equally needed for health promotion, a distinction is made hereinafter between the health-related potentials, functions and effects of green spaces. **Health-related potentials** describe the theoretical effects on health that green spaces can provide based on their characteristics. Whether they take effect, however, depends on the individual usage and behaviour of people. That is, **health-related effects** of green spaces only unfold by being in a green space or in its vicinity, and are dependent on human behaviour: although a large park offers the possibility for walking or jogging, a person has to actively use the opportunity to experience a positive health effect. Accordingly, often no statement can be made in the conservation and planning context, unless appropriate empirical, individual case investigations are made. **Health-related functions** are understood to be the effects and services which are provided by a green space and (can) have a direct impact on human health, without people being active themselves (e.g. fresh air production).

Within medicine and health sciences the terms resources and stressors are often used in connection with health-promoting or disease-causing factors. **Resources** here refers to a range of health-promoting environmental factors (e.g. a park or a forest, a playground, etc.) and personal characteristics (such as self-confidence, skills, information, education, participation, and support from social networks). A walk in the park can reduce stress, making the park a health resource. **Stressors**, however, are adverse health factors such as noise, chemical and biological pollution, physical and emotional stress, poor diet, lack of exercise,

[3] Cf. the work of the 'Cityscape & Health' Junior Research Group at Bielefeld University: http://www.uni-bielefeld.de/gesundhw/ag7/projekt/leburbraum.html (accessed on 24.05.2013)

social isolation, negative stress, or discrimination. Resources and stressors can both be within the person as well as in the environment, but because this report focuses on situational prevention, it concentrates on components of the surrounding environment.

2.5 Salutogenesis

As part of the understanding of health represented here, **salutogenesis**[4] ultimately plays an important role. Health is understood here as a dynamic process which is subject to constant change and can be influenced by its actions (behaviour) as well as health-promoting resources (in the environment) (Antonovsky 1997). The focus is in contrast to medical pathogenesis, which primarily deals with illness – 'get healthy and stay healthy'. One of the core elements of salutogenesis is the sense of coherence: people feel healthy when they understand the world (comprehensibility), can deal with it (manageability) and can see a sense in their existence (meaningfulness):

- **Comprehensibility**

  ''People with a strong sense of coherence experience the world as structured, predictable and explainable'' (Bengel 2001). A green space may be in this context a clearer world than, for example, a busy street or the bustle of a big city. In addition, the conscious experience of the seasons provides structure and makes the cycle of growth and decay explainable and visible.

- **Manageability**

  ''Behind the feeling of coping with the world are general resistance resources at hand which give the belief of being able to deal with problems and challenges'' (Bengel 2001). A walk in the woods can reduce stress and thus becomes a manageable resource.

- **Meaningfulness**

  ''People with a strong sense of coherence feel that their lives, their biography and their actions make sense'' (Bengel 2001). This may mean, for example, that people prefer to grow their own vegetables, instead of buying them at a supermarket, because from their perspective it is 'more ecological' and pesticide-free.

[4] Literally 'health creation', from the Latin 'salus' meaning health, well-being and 'genesis' from the Greek γένεσις meaning birth, origin, formation

3 Consideration of health promotion in urban nature conservation – opportunities, possibilities, influences

Green spaces can have a positive impact on human health in many ways – either by filtering air pollutants and dust or contributing to the cooling of heat-stressed neighbourhoods, by providing space for taking a walk, for exercise and social contacts, by having a relaxing and calming effect on their users, or even contributing to a quicker recovery after illness. So they not only have the potential to promote physical health, but also to promote the psychological, social and aesthetic-symbolic health components. Compared to these positive aspects of green spaces there are only a few negative effects, but they should not be ignored.

These connections suggest that nature conservation should more than ever address the subject of health and seek closer cooperation with relevant stakeholders. This presupposes a willingness to cooperate across their own discipline boundaries to consider different points of view and approaches: while nature conservation, urban and landscape planning thinking is highly spatially-based, the approach of health promotion is oriented to the individual. Nevertheless, there are already points of contact between the two sides, such as the issue of recreation, which could, however, be more strongly emphasized and utilized.

Finally, climate change, demographic change, changes in lifestyle as well as requirements for environmental justice and participation have effects on urban nature conservation as well as on human health, so more common interests and challenges arise which demand interdisciplinary cooperation. For example, it is more and more the task of landscape and open space planning as well to prevent the health-related increase in urban heat effects or to deal with changing demands on open spaces in a 'ageing society'. Finally, as in almost all areas of society, the participation of affected and interested people in nature conservation and health promotion is becoming increasingly important.

Assuming that urban green spaces are important for quality of life and the well-being of people, and thus on their health, several questions arise: Which 'added value' could arise from a strengthened inclusion of health considerations in nature conservation, both for the quality of urban green space as well as for quality of life and health of people? What possibilities exist for this purpose, what obstacles could impede this, what are the reasons for it to do so, and last but not least, what to consider in order to exploit synergies, avoiding or at least minimizing any conflicts? This chapter provides initial answers to these questions. Firstly it is necessary to briefly describe what potential health effects green spaces have (see detail in Chapter 5.3).

3.1 Health potentials and effects of green spaces – an initial overview

Various studies show a variety of health-promoting potentials and effects of green spaces, although the results of the individual studies are not always consistent with each other (see Chapter 5.3 for detailed explanations and references). Nevertheless, the statement can be made that green spaces tend to have a positive impact on people's health, especially in the residential environment. Whether and to what extent this is actually the case, however, cannot be judged without consideration of each individual case, since the respective effect is always that of the spatial position, the number of green spaces, the connections between them, the quality of the individual green space, and depends especially on the actual usage. The potential and effects of green spaces can be divided, according to the health component

introduced in Chapter 2.3, into aesthetic-symbolic, social, mental and physical potential as well as potential effects. In addition, there are health-related ecosystem functions.

Health-related ecosystem functions primarily have a positive effect on physical health, but also partly on mental health. Examples include the filtering of air pollutants and dust by trees and shrubs, the cooling of urban temperatures by the formation and transport of cold air, improving air quality through production and transport of fresh air, or the infiltration and pollution filtering of soils which may be important for drinking water production. People benefit from this regardless of whether they visit the respective green area or not (situational prevention). Nature conservation, in particular in the context of environmental assessment and landscape planning, has been dealing with these functions for a long time, without requiring an explicit health-relevant mention as a rule. The first connecting factor is to put greater emphasis on the subject of health in nature conservation, and to emphasize the contribution of nature conservation to health (see Chapter 5.3).

Green spaces have **aesthetic and symbolic potentials**; humans have an inherent preference for biodiversity and they regard this as especially ‘beautiful’. In addition, green spaces and structures symbolise a ‘successful human-nature relationship’, evoke pleasant memories, contribute to an identification with a place and thus to well-being.

Social effects of green spaces arise from the fact that being in green spaces encourages both the social development of children as well as social interaction and communication between all users. Isolation and feelings of loneliness are reduced; sharing green spaces can also promote social integration of different groups.

Green spaces develop **psychological effects**, because being in them or simply seeing them can improve mental well-being as well as reduce stress, have a relaxing and calming effect, and also encourage a spiritual experience. This can have a positive effect on cognitive and emotional development and improve attention, concentration and work performance.

The findings on the **physical effects** of green spaces are sometimes very contradictory: there is controversy about whether being in the countryside reduces mortality, or whether green spaces near one’s home encourage stronger physical activity. Not controversial, however, are research findings which show that people recover from illness faster if they look at green spaces or structures (e.g. single trees), or can be with them or in their environment.

Seeing ‘green’ also reduces heart rate and blood pressure, and being in the forest increases the immune defence. Even sports in green spaces seem to favour the physical recovery better than sports in a closed room or ‘grey environment’. However, some physical effects of green spaces or being in them can also have a negative impact on health. This particularly applies to allergenic plant species as well as the transmission of infectious diseases by animals (especially rodents, insects, ticks) (see Chapter 5.3.5).

3.2 Opportunities and possibilities for consideration of health promotion in urban nature conservation

Health is an issue that affects every human being directly. It is therefore not surprising that it generates socially and politically significant interest. Due to the ageing population, health-related climate change impacts, changes in eating and exercise habits, and the increasingly

discussed requirements for environmental justice (Chapter 3.3.4) this will possibly increase in the future. In addition, the aforementioned developments for health promotion on the one hand, and nature conservation and open space planning on the other hand, are for various reasons equally relevant (Chapter 3.3).

All this suggests emphasizing the topic of 'health' in urban nature conservation more than previously and seeking cooperation with the stakeholders responsible for health. Planning and design of healthy green spaces will succeed better if they are carried out in a more co-operative and interdisciplinary way. This requires the cooperation of different disciplines such as health sciences, nature protection including its planning disciplines, as well as urban planning (see similar in Abraham at al.2007; Job Hoben & Erdmann 2008). Thus, objectives and measures of urban nature conservation in regard to potential positive health effects could be optimized. This would also correct the impression of people who are opposed to nature conservation because they think it mainly takes care of special species and individual habitats while people are considered only as a disruptive factor. Thus, a contribution to increasing the acceptance of nature conservation as a whole is possible. Last but not least, the assertiveness of both nature conservation and landscape and open space planning, as well as health-related arguments, could be strengthened in planning decision-making processes.

Medicine and health sciences as well as stakeholders of health-related management can also profit from cooperation with stakeholders in urban nature conservation, since they have so far hardly had any influence on the design of urban spaces. Through collaboration it would be possible to incorporate health concerns into spatial planning. Spatial planning would no longer only fight off harmful influences on health, which are necessary due to legal requirements and limits, but they could use the knowledge of the health sector to take a more active role in greater health promotion.

What possibilities exist now for the above-mentioned increased attention to health issues in urban nature conservation and increased cooperation between the disciplines?

First, it is necessary to envisage and to accept the different central approaches and reference points of the two disciplines: nature conservation has a very strong spatial reference, medicine and health sciences in contrast refer to individuals or certain (vulnerable) populations, to their needs and their specific life situations. This means that there is not a health goal for the whole population, but that health needs are always individual. If the goal is to design a healthy space, it must be geared to the desires, needs and interests of those people who (shall) use the space. This need is reinforced by the fact that the health benefits of a green space in many cases only arise if it is actually used by a human. An analysis of general health as well as socio-demographic data (such as health monitoring, poverty report) is necessary to initiate appropriate measures, complemented by statements regarding the specific needs and interests of local people. Even then there is still a risk that certain population groups (mostly disadvantaged) are not adequately taken into account. A sweeping statement for a single person is not possible, because at this point personal motivation plays a crucial role: one person seeks privacy and seclusion, another seeks social interaction. The aims of health promotion are therefore always individual: they are determined by each individual person.

These different priorities – 'space versus human individual' – can complicate the cooperation and understanding between the disciplines, but they also offer opportunities: each has its

own perspective and can be complemented by those of the other side, resulting in substantive and methodological improvements. Moreover, health sciences are not completely 'spatially blind', nor does urban nature conservation ignore people entirely.

The reference to green spaces – as part of the environment – is reflected in a paradigm shift in health sciences: man and his behaviour will no longer be considered in isolation, but rather the impact of the social and physical environment on human behaviour and health has been identified.

This interaction is seen in the '**socio-ecological model**'. Figure 1 shows the personal and environmental factors linked to the example of 'walking' (Pikora et al. 2003).

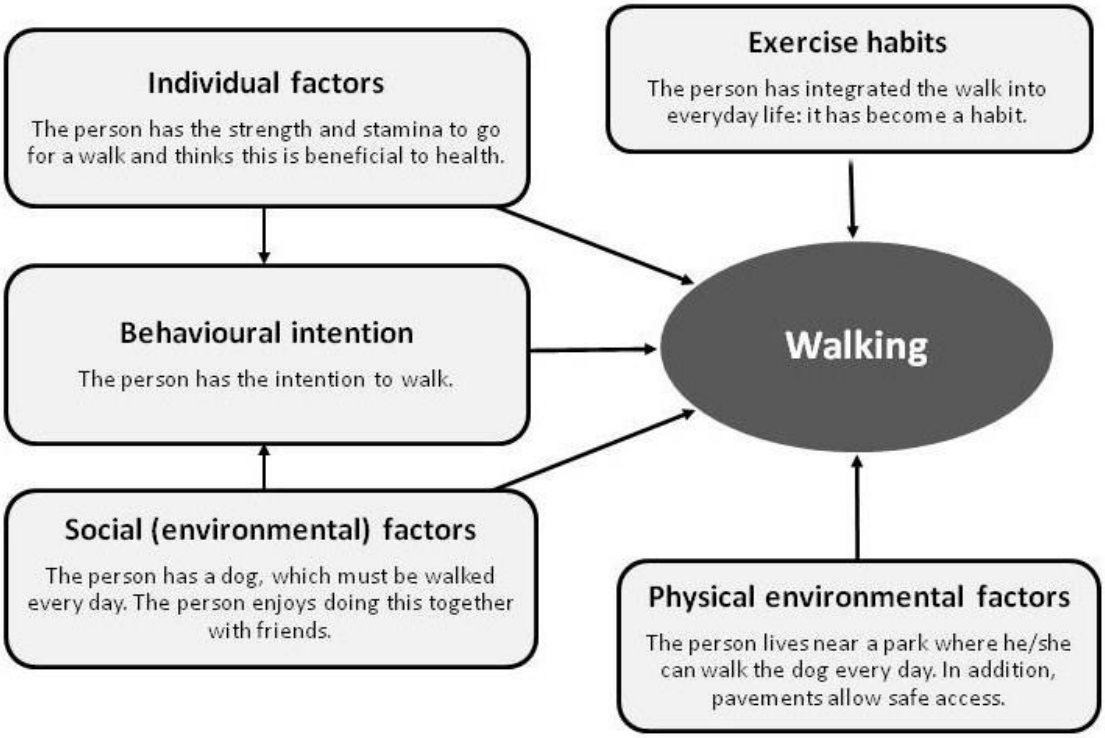

Figure 1: The socio-ecological model – different influences on physical activity using the example of 'walking' (after Corti 1998, in Pikora et al. 2003, adapted and translated)

This stronger consideration of environmental factors has led in recent years to a whole series of studies and projects which have described the health benefits of 'nature' and landscape in general and green spaces specifically (among others, Abraham et al. 2007; Bell et al. 2008; Bowler et al. 2010; BMU 2009b; Frumkin 2003; Lee & Maheswaran 2010; Maas et al. 2009; Nagel & Bellin-Harder 2008; Pretty et al. 2010) and came to the results briefly described in section 3.1 (in detail see Chapter 5).

Conversely, the consideration of human needs and interests, as well as public participation in nature conservation, plays an increasingly important role and has always been a central component of urban space and green space planning. With regard to nature conservation in general, this concerns landscape design as well as the management of biosphere reserves and national parks, cooperation with agriculture or integrated projects of local and regional development. A variety of research projects and publications confirms this development (see Brendle 1999; Heiland 1999, 2008; Schuster 2008; SenStadtUm 2011, Haaren et al. 2005).

Another point of contact between the two disciplines is **recreation**. According to the BNatSchG it is the task of nature conservation to safeguard the recreational value of nature and landscape in the long term. According to § 7 section 1 No. 3 BNatSchG, recreation includes nature and landscape-friendly activities in the open countryside, but also and especially in the middle of settlements and populated areas, provided this does not affect other goals of nature conservation (Lütkes & Ewer 2011, p 86). This understanding of recreation refers both to urban green spaces as well as physical activity and exercise as important prerequisites of physical health, thus being directly relevant for health promotion in cities. It should therefore be possible without much additional effort to connect and to emphasize the health aspects of the handling of the 'subject of protection' recreation into landscape planning. Medicine and health sciences also deal with recreation, but do not understand it in the sense of the BNatSchG, but refer to the regeneration of the individual, which is understood as ''restoring normal performance after fatigue or injury'' (DOSB 2012, online; Pschyrembel 2002). Both notions are neither congruent, nor contradict each other, so this should not hinder cooperation between the disciplines, especially if one is aware of the different uses of the term.

The question of the nature, extent and intensity of the inclusion of health considerations in urban nature conservation in a particular context cannot be answered universally. This is dependent on the particular issue and the resources available from the relevant stakeholders – time, finance, human and knowledge-related. Various far reaching possibilities for this are proposed in Chapter 5.4 using the example of municipal landscape planning. However, the experience in the four pilot communities shows that smaller district towns do not have their own health administration and thus the 'in house' contact person is missing and must be sought at the county level. However, there may be little capacity and interest to deal with local issues. Even in larger cities with their own health administrations, the issue of health promotion is represented only by individuals. Even if there is a mutual interest in information exchange or co-operation in concrete projects, this is not often possible without special effort. The added value – and the pilot communities show this as well – could also justify these efforts.

3.3 Other social and environmental influences on health promotion and nature conservation

In addition to the arguments presented, there are further developments that suggest the need for an improvement in connection between health (promotion) and nature conservation, since they bring consequences for both areas and they will also be discussed. These are:

- Effects of climate change
- Demographic change
- Changes in lifestyles
- Requirements for environmental justice and participation

3.3.1 Effects of climate change

The existing and potentially expected effects of climate change on land use, nature and landscape, as well as cities, have been described many times (among others, see Wilke et al. 2011), so that here only those will be mentioned which are equally relevant to urban green spaces and to human health. It is important to note that clearly causal relationships between green spaces and health on the one hand and climate change on the other hand are often difficult to determine, since both green spaces as well as the health condition of people are determined by several factors. From a health perspective, positive effects from climate change are also at least partly to be expected, such as increased time and exercise outdoors due to higher temperatures. Nevertheless, climate change poses significant challenges to both urban nature conservation and health care and promotion.

- **Increased temperatures extreme**

  The increase in hot days (maximum temperature above 30°C), tropical nights (temperature at night does not fall below 20°C) and long-lasting heat waves (no uniform definition exists), as well as the reinforcing of the urban heat island effect associated therewith, can increase biometeorological or bioclimatic burdens on city residents. The people most affected are those with cardiovascular and pulmonary diseases, as well as other groups of people who are physically weaker, or in time and space may find it more difficult to adapt to heat waves due to job requirements or their social and physical situation, such as children (Gouveia et al. 2003, Fouillet et al. 2006) or the elderly (Fouillet et al. 2006, Ishigami et al. 2008, Rey et al. 2007).

  These consequences of climate change in regard to health are already being addressed by spatial planning. Due to their cooling effect, green spaces and structures are regarded as an important component of health-related adaptation strategies to climate change, whilst taking into account that, through appropriate plant selection, they themselves adapt to climate change. Examples include the city development plan on climate Berlin (SenStadt 2011; Heiland et al. 2010), as well as pilot projects of experimental urban development (funding programme ExWoSt) in Bad Liebenwerda and Regensburg (BBSR 2013a, b, online) or at a regional level, pilot projects of spatial planning (funding programme MORO) in the West Saxony planning region (BBSR 2013c, online).

- **Floods, extreme weather**

  Floods or other factors triggered by floods (e.g. overloaded sewer systems) may possibly lead to health problems such as physical trauma with fatal consequences, or to directly fatal events. But psychological trauma can also be a consequence of these and other extreme weather events (extreme weather, storms), such as potential loss of one's home and the experience of crises in itself (Bernstein et al. 2007; Page & Howard 2010; WHO 2002; WHO 2005).

  Although landscape planning, urban and regional planning already deal with these issues intensely (BBSR 2009a, b), health issues are only marginally discussed.

- **Changes in water balance**

  Changes in the groundwater level and the water flow in flowing and standing water are particularly relevant to human health when they drop temporarily or long-term due to prolonged droughts. Decreased groundwater resources and a low water level in surface waters can lead to problems of drinking water supplies in certain cases. Higher water temperatures and a relative increase in the concentration of pollutants (due to the reduced amount of water) in surface waters can impair their water quality considerably. This may also contribute to restriction of drinking water supply, but may equally affect the aesthetic appeal of the waters due to odour exposure and to reduced bathing water quality. In addition, the occurrence of cyanobacteria[5] can increase (Hense et al. 2013), which are also harmful to health in certain concentrations.

- **Changes in biodiversity**

  Climate changes lead to a change in and extension of pollen periods and to a changing spectrum of allergy triggers from invasive species (Augustin et al. 2008; Bergmann at al.2012; Eis et al. 2010; Richter-Kuhlmann 2010; WHO 2005; Zebisch et al. 2005). Popular examples of this are ragweed or oak processionary moth. In addition, the increase in animal intermediate hosts and carriers (so-called vectors, e.g. rodents) of pathogens (pathogenic viruses, bacteria, parasites) by favourable living and propagation conditions due to warmer and more humid winter is discussed (Meerburg et al. 2009). This means more sufferers of Lyme disease and tick-borne encephalitis or hantavirus infections are expected, although this is not yet clearly established (Augustin et al. 2008; Eis et al. 2010; Zebisch et al. 2005).

- **Increase in air pollutant concentration**

An indirect consequence of climate change is an increased exposure of the population to air pollutants, on the one hand by an increased concentration of ozone and particulate matter on hot days (Eis et al. 2010; Fiala et al. 2003), and on the other hand by people possibly staying longer outdoors (due to longer and hotter summer days and tropical nights). In this way, the cardiovascular system and respiratory organs in particular will be affected in sensitive groups of people, such as elderly and children, and with regard to ozone primarily children (Eis et al. 2010).

3.3.2 Demographic change

Demographic change in Germany is characterized by the following general traits (Demuth et al., 2010):

- Population decline due to higher mortality rate compared to birth rate
- Changes in the population structure by:
  a) aging of society
  b) ethnic and cultural heterogeneity

[5] Cyanobacteria are also known as blue-green algae, but taxonomically they are bacteria and not algae

However these features are regional and on a small scale; for example, they can be found in individual cities and their surrounding countryside, and they vary greatly. In addition to so-called shrinking regions there are also rapidly growing areas and even in overall shrinking regions the population of individual municipalities can rise (Demuth et al. 2010; Schlömer & Pütz 2011). Therefore, demographic change and its impact should be considered as spatially very varied.

Due to population decline and economic restructuring since the 1990s, residential and commercial wasteland has appeared in many cities in eastern Germany, but also in old industrial regions of western Germany, such as the Saarland and Ruhr area. In principle these areas are available for subsequent reuse, but they are also available as green and recreational spaces (Demuth et al. 2010). This opportunity for urban nature conservation and health promotion is, however, frequently limited by the often missing (planning) availability of wasteland for different reasons, or they can be used only under certain conditions (Rößler 2010). However, there are many good examples where urban brownfields are in some way reused or temporarily used, either through municipal plans and their implementation by civic involvement, in a way that benefits both urban nature conservation and health promotion (BBR 2008, 2009).

From the health sciences point of view, aging is especially important. A result is that an increase in chronic diseases and multimorbidity (simultaneously affected by several diseases) can be expected, since these increase with age. In the future, more frequently occurring medical conditions are likely to be osteoarthritis, hypertonia, osteoporosis, chronic obstructive bronchitis and emphysema, diabetes mellitus, and dementia (Peters et al. 2010).

Beside children, elderly people (especially multimorbid) particularly suffer from the climate change related increase of urban heat; in extreme cases, this can also lead to death (Eis et al. 2010). This demonstrates that different trends – demographic change and climate change – can be mutually reinforcing, and therefore their interaction has to be taken into account.

Both from the aging of society as well as cultural heterogeneity and internationalization – which is taking place mainly in west German cities – ‘‘qualitative adaptation needs’’ (Bucher & Schlömer 2008, p 6) arise in cities.

This includes the layout, location and accessibility of green spaces: ‘‘Older people, as the only expanding group of people, have specific needs and increasing age (mobility) restrictions, which give rise to special needs and thus the need for action’’ (Difu 2013, online). Impressive evidence of this is documented in an empirical study by Eberlein & Klein-Hitpaß from 2012 on behalf of the German Institute of Urban Affairs (idw 2013, online): ‘‘All local authorities confirmed a great need for action due to demographic change. In 2030 one-third of the population will be over 65 years of age. In some regions by 2025 the proportion ‘over-sixty’ will be even higher than 40 percent. This applies particularly to rural regions in eastern Germany, southern Lower Saxony, the Ruhr area, Saarland and regions surrounding metropolitan areas. According to the survey, only 63 percent of public transport, 50 percent of streets and residential areas and 20 percent of buildings have disability access’’. In the same way the of-

ten very different, partly diverging needs of different ethnic groups are also taken into account (Gobster 2002).[6]

3.3.3 Changes in lifestyle

Lifestyle changes are currently being observed at all ages, characterized in addition to an unbalanced diet, obesity, stress (Nagel & Bellin-Harder 2008) and increased sedentary activities. Health sciences uses the term 'sedentary lifestyle': more and more activities take place in front of the computer or television; there is a lack of attractive play areas close to the place of residence; the car and public transport promote a passive movement style; more and more office and other sedentary work activities affect everyday life (BMELV & BMG 2011; Wabitsch 2004). Not only the consequent lack of exercise, but too much sitting itself is harmful to health (Owen et al. 2010, 2011; Thorp et al. 2011). Because of these lifestyle changes, in the future there is expected to be a substantial increase in neuropsychiatric, psychological and so-called lifestyle diseases (e.g. cardiovascular diseases, obesity, diabetes mellitus) (NGFP 2010, online; Owen et al. 2011; Rütten et al. 2009; Teychenne et al. 2010; WHO 2012).

For nature conservation these lifestyle changes can also be important because it is likely to lead to an increasing loss of 'contact with nature'. Individuals who reside less in green spaces have less direct experience with natural or semi-natural elements and may not develop a sense of responsibility for nature conservation (Brämer 2004; Demuth et al. 2010; Wippermann et al. 2008). However, this lacks reliable evidence – especially as many of the people who like spending time 'outdoors', are active there and do sports, are by no means committed to nature conservation or always behave compatibly with nature.[7]

3.3.4 Environmental justice and participation

In recent years there has been increased discussion about **environmental justice** in urban areas, both in science and in the practice of urban, landscape and environmental planning (BfS et al. 2008; Deutsche Umwelthilfe 2009; Köckler 2006). The aim is a socially fair distri-

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[6] For more information about the health consequences of demographic change: Robert Koch-Institut (n.d.): Demografischer Wandel. Online at http://www.rki.de/DE/Content/Gesundheitsmonitoring/Themen/Demografischer_Wandel/Demografischer_Wandel_node.html (access on 21.03.2013). Peters, E., Pritzkuleit, R., Beske, F., Katalinic, A. (2010): Demografischer Wandel und Krankheitshäufigkeiten. Eine Projektion bis 2050. In: Bundesgesundheitsblatt 53: 417-426. Online at http://www.mpm.med.uni-erlangen.de/e3102/e3197/inhalt3372/Krankheitshufigkeiten-bis-2050_Katalinic_2010.pdf (accessed on 21.03.2013).
Nowossadeck, E. (2012): Demografische Alterung und Folgen für das Gesundheitswesen. Hrsg. Robert Koch-Institut Berlin, GBE kompakt 3 (2). Online at http://www.rki.de/DE/Content/Gesundheitsmonitoring/Gesundheitsberichterstattung/GBEDownloadsK/2012_2_Demografischer_Wandel_Alterung.pdf?__blob=publicationFile (accessed on 21.03.2013).

[7] Further information can be found in the Platform Ernährung und Bewegung e.V.: Sitzen bleiben? Lange Sitzzeiten begünstigen Übergewicht besonders. Online at http://www.regionen-mit-peb.de/191.html (accessed on 21.03.2013).

bution of environmental burden and environmental resources, essentially concerning the relationship between social status, environment and health (Bolte et al. 2012; Hornberg & Pauli 2009). Environment thereby includes the natural, built and socio-cultural environment in a broader sense (Hornberg et al. 2011). The starting point of the debate is the observation that the availability and usability of green spaces in the city are generally not equally distributed: ‘‘The provision of adequate green spaces, like most living environment quality factors, are not equally distributed and disadvantage mostly the neighbourhoods in which poorer population groups live. In addition, the use of existing areas – especially for children, but also women and seniors – is influenced by the perception of safety and cleanliness, which also results in a deprivation of the socially poor neighbourhoods.’’ (Braubach 2009, p 95; Wehrspaun 2009). This is all the more serious as green spaces in the residential neighbourhood of socially disadvantaged people are needed, either for social communication or as a substitute of an own garden (Claßen 2008). Urban nature conservation, urban and open space planning are therefore also a question of social justice. For this reason, the preservation and, if necessary, creation of high quality green spaces is also required, especially in deprived urban areas.

In order to make the population actually use the green space, taking their specific interests and needs into account is absolutely necessary and so they should participate in the design process of new green areas as actively as possible. Nagel & Bellin-Harder (2008, p 79) emphasize this using the example of people with an immigrant background: ‘‘Ignoring different claims and usage habits may firstly lead to a growing population group that does not use the existing open spaces from a lack of identification with the green space, and thus remains excluded from the health benefits. On the other hand, it is possible that the design of the green area does not comply with the use requirements and there is damage or destruction of, for example, park elements’’.

This quote shows the importance of active **civic participation** for the design and use of green spaces as well as for health promotion. In nature conservation as well as landscape and urban planning, this need is hardly disputed or has long been actively promoted (Brendle 1999, Heiland 1999, Oppermann et al. 1997, Sauer 2006, SenStadtUm 2012, Stoll-Kleemann 2002, and many others). High-profile examples such as the major projects of Stuttgart 21, Berlin-Brandenburg and Frankfurt airports, smaller projects such as the East-Side-Gallery in Berlin, but also much less noticed (nature conservation) projects show that planning procedures are very expensive or projects may fail if the affected population is not early and comprehensively informed and involved in decision-making processes.

Nevertheless, it must first be pointed out that participation in general is an important prerequisite for the acceptance of planning measures, but it is not a guarantee per se. Secondly, it is not very productive to always have participation without taking into account the specific circumstances of each case in equal intensity and in the same manner. The first limiting factor is capacity limits in public administration. The tendency for participation will be most important when it comes to creating new or transforming existing public green spaces. The preservation of existing areas or the creation of smaller connecting areas for creating a green space network should, however, generally require less public participation. But here is where each respective individual case should be looked at. Finally, participation can refer not only to the design, but equally to management and maintenance of land, which could even reduce the workload of local government in the optimum case. Against the background of the ever-

needed examination of the individual cases, as well as the administrations human resources, some of the benefits of and requirements for participation from the health-scientific point of view are mentioned in the following paragraphs. Detailed information about methods and procedures is omitted, as extensive literature exists on this.[8]

The Ottawa Charter (WHO 1986) emphasized self-determination of citizens and control over their own life and living conditions as the main concern of health promotion: people should therefore be given the opportunity to contribute their needs and interests in relevant planning processes, which can strengthen their social position. This means that the population is not merely presented with particular designs and projects which have in principle already been concluded and agreeing to these terms ('tokenism'), but that it takes an active part in the planning process from the very beginning and the respective content and procedure must be transparent. As a minimum, the (health-related) needs, ideas and wishes of potential green spaces users must be obtained and taken into account. This increases the probability that green spaces are accepted and used and thus their health-promoting potential can act accordingly.

Participation and **empowerment** (strengthening of autonomy and power) have a healthy effect not only because the relevant needs of the future users of green spaces are identified and taken into account, but because the process itself can also have a positive effect on health. Empowerment processes enable people to gain control over their own lives and their environment and thereby cause (structural) changes (Tengland 2008). This increases the feeling of self-efficacy – the belief that one can shape one's own life (Bollinger-Salzmann undated). Overall, self-confidence, self-esteem and mental well-being can be strengthened (Laverack 2006). Moreover, solidarity can develop feelings of connectedness with other people and stimulate addressing their needs, which enhances communication skills and social interaction. Fears, alienation and social exclusion tendencies can thus be reduced, social connectedness and social capital (e.g. resources arising from social relations) can be strengthened (Andress 2011; Laverack 2006). Empowerment and participatory processes also cause power changes, as decisions are negotiated with the citizens (Laverack 2006; Loss 2008; Tengland 2008). This is very beneficial for people from disadvantaged neighbourhoods to force ahead structural changes and to stand up for their own needs.

For many people, participation represents a new experience for which they cannot have recourse to the appropriate knowledge and skills. It is therefore necessary to consult the people in their environment (both locally and verbally) and assist them in the participatory process (Böhme & Reimann 2012; Freytag-Leyer et al. undated). ''Health-promoting measures and projects only have a chance of sustainable success if the people, for whom the offers will

[8] Among others, see: Bischoff, A.; Selle, K.; Sinning, H. (2005): Informieren, Beteiligen, Kooperieren. Kommunikation in Planungsprozessen. Eine Übersicht zu Formen, Verfahren und Methoden, 4. überarbeitete und erweiterte Neuauflage, Dortmund
Ley, A.; Weitz L. (Hrsg.) (2003): Praxis Bürgerbeteiligung. Ein Methodenhandbuch. Bonn.
Meunier, C. (2006): Öffentlichkeitsbeteiligung in der Bauleitplanung. UVPspezial 20. Dortmund.
Österreichische Gesellschaft für Umwelt und Technik (ÖGUT) (2005): Handbuch Öffentlichkeitsbeteiligung.
SenStadtUm Berlin (2011): Handbuch zur Partizipation. Berlin.
http://www.urge-project.ufz.de/ (accessed on 13.03.2013)

be developed and implemented, can actively participate. Therefore, target group-oriented conditions for participation need to be established.'' (Böhme & Reimann 2012 p 205).

4 Urban nature conservation and health promotion – synergies and conflicts

The objectives defined in § 1 of the BNatSchG often affect human health positively. For example, the conservation of biodiversity and species-rich habitats and structures often safeguards aesthetically pleasing recreational areas for people; clean lakes and rivers are an important habitat for animals and plants, but also serve as bathing water or the supply of clean, safe drinking water; and, last but not least, functional soil conservation contributes to food security, as well as to groundwater recharge and rainwater retention during heavy rain and thus reduces the risk of flooding and inundation, including any associated negative health impacts. From the perspective of health sciences, synergies with nature conservation arise in terms of providing healthy play and living environments, relaxing recreation areas, as well as providing social spaces that promote personal development and social interaction.

However, in individual cases it can also lead to conflicts between urban nature conservation and health promotion. Here you can distinguish several types of conflicts: health promotion activities are not always compatible with the conservation of biodiversity. For example, trampling, noise or light can affect the flora and fauna. Moreover, an intense and health-promoting recreational use can contribute to compacted soils, eutrophication or pollution of soil and water. Conversely, allergic reactions are caused or exacerbated by the presence of certain plant species; however, these species may be desirable from the perspective of nature conservation. Problems of being in green spaces can also arise from disease-carrying animals (ticks and rodents). Finally, areas which have 'gone wild' and which may be of importance for nature conservation often lack the acceptance of the city residents for aesthetic reasons. A solution to such conflicts is possible with the help of three different, but combinable, strategies:

1. Assigning priority for a specific use or a function in a green space (fundamental priority)
2. Consideration of the need for green spaces with a specific use or function in the overall urban context (contextual priority)
3. Spatial and/or temporal separation of use or function within a green space (part territorial and/or temporal priority).

A systematic and comprehensive consideration of the synergies and conflicts between nature conservation and health promotion is not possible in the scope of the project included in this report; however, what can be estimated reliably is whether, and to what extent, closer integration of health concerns in the city and nature conservation is useful. It is, as far as can be anticipated, the case that potential synergies outweigh potential conflicts by far, and many conflicts can be minimized or even avoided altogether.

To determine potential synergies and conflicts, the objective rules of § 1 BNatSchG are used for nature conservation. These are very general and have to be substantiated for each individual case, from which additional synergies or conflicts may arise not mentioned here. However, to understand the principal points, reference to § 1 BNatSchG 'Objectives of nature conservation and landscape management' seems both reasonable and sufficient.

4.1 Synergies between nature conservation and health promotion

a) Protection of biodiversity

High biodiversity may have an equally positive effect on the mental, aesthetic-symbolic and physical health components. This is particularly evident, for example, when a richness of particular plant or bird species causes an increase in mental well-being and sense of beauty.

Where certain individuals (such as distinctive old trees), species or habitats support cultural and spiritual values, they can thus significantly contribute to human well-being (see Chapter 5.3). Less obvious and well-known, but nevertheless important for physical health, is the fact that an increasing diversity of vertebrate species decreases the transmission of Lyme disease by ticks to humans.

One object of nature conservation could be the fight against invasive species that lead to massive changes or damage to local flora and fauna. Against the background of changes in species ranges due to climate change, and the (often small) chance of success of such measures, a decision on this controversial nature conservation issue must always be made on an individual basis. Synergies with health concerns arise if the invasive species in question are also disease-inducing or allergenic. This especially concerns the common ragweed and giant hogweed (Claßen 2008; Eis et al. 2010)[9].

b) Protection of the performance and functioning of the natural balance

The performance and functioning of the natural balance (§ 1 Sect. 3 BNatSchG) depends on the biological diversity of the natural resources of water, soil, climate and air.

Natural resource water: Preserving or restoring the natural self-cleaning capability and dynamics of surface waters, including their banks and floodplains, as well as the contributions of conservation to flood control and groundwater protection, has the following positive health-related potentials:

- Contribution to ensuring a sufficient supply of clean (drinking) water
- Reduction of organic pollution of water and thus the occurrence of pathogens
- Conservation of the recreational suitability of water bodies (aesthetic experience, bathing use)
- Mitigation of floods and related physical and psychological damage (injuries, trauma, etc.).

Natural resource soil: soils shall in principle be used sparingly and carefully as a non-renewable natural resource, so that they can fulfil their functions in the ecosystem. Sealed surfaces that are not used any longer should be restored. This contributes to:

- Increasing the infiltration of rain water and flood water into soils, and thus to groundwater recharge (drinking water), to the reduction of discharges of polluted water into surface waters (in particular by overflows of sewage during heavy rain), and the reduction of floods and related health hazards
- Conservation of soils for food production, which is gaining importance in cities (‘urban gardens’, ‘urban agriculture’).

[9] Further information:
http://www.floraweb.de/neoflora/handbuch/ambrosiaartemisiifolia.html; http://www.ambrosiainfo.de/ (accessed on 24.05.2013);
http://www.bafu.admin.ch/dokumentation/fokus/00140/01275/01336/index.html?lang=de (accessed on 24.05.2013);
http://www.floraweb.de/neoflora/handbuch/heracleummantegazzianum.html (accessed on 24.05.2013)

Finally, productive soils are essential for plant growth, and thus for the preservation and creation of new green spaces with all their health potential.

Natural resource climate/air: Here, especially focussing on the protection of areas with favourable air-cleansing or climate effects, such as areas in which fresh or cold air develop, or pathways for air exchange (§ 1 Sect. 3 sentence 4 BNatSchG). Contributions to climate protection (e.g. natural carbon reservoirs and sinks) and for adapting to climate change are increasingly important (Wilke et al. 2011). Through the achievement of these goals, urban green spaces already make contributions to health protection and promotion, the importance of which will be of even greater importance due to the expected impacts of climate change:

- Reducing the urban heat island effect
- Creating opportunities for the urban population to escape to cooler areas, such as in parks, forests, landscaped backyards
- Contribution to improving the air quality situation and the resulting health stresses.

c) Diversity, uniqueness and beauty of nature and landscape

Diversity, uniqueness and beauty of nature and landscape are important for the physical, psychological and aesthetic-symbolic component of human health. Protecting and ensuring the accessibility of green spaces in settlements and nearby areas for **recreational purposes** (§ 1, Sect. 4 No. 2, and Sect. 6 BNatSchG) provides a significant contribution to health promotion, because these recreation areas with all their potential positive health properties can be used by people and thus achieve positive health effects.

Health promotion

What are the current goals of health promotion? Have positive effects for conservation been derived from this? Health promotion is aimed indeed at all people in all life situations, but no general objectives for the whole population can be determined. For this reason, health sciences and medicine specify targets for certain risks or categories of people, certain diseases, or particular areas of action in health promotion. Thus, in 2000 the Federal Ministry of Health together with the federal states took the initiative to set national health goals and set their implementation into motion. Currently seven goals have been named, including recommendations to achieve objectives such as ‘Growing up healthily: life skills, exercise, diet’, ‘Depressive disorders: prevent, detect early, treat sustainably’ or ‘Type 2 diabetes mellitus: lowering disease risk, identify and treat sufferers earlier’[10]. However, these objectives are not comprehensive; clear synergies with nature conservation can only be deduced cautiously, indirectly and in a general manner. They arise from the demand for the provision of healthy play and living environments, for securing a healthy environment, and for support of the personal and social development of individuals and groups – since the provision of green space fulfils all these demands, they are essential or at least offer a high potential for this purpose.

[10] http://www.bmg.bund.de/gesundheitssystem/gesundheitsziele.html (accessed on 24.05.2013)

4.2 Conflicts and possible solutions

Before reference is made to individual potential conflicts between nature conservation and health promotion (Chapter 4.2.2), three basic strategies are first introduced which can separately or jointly help to solve such conflicts (Chapter 4.2.1). Where possible they are supplemented by conflict specific references in Chapter 4.2.2. In this chapter the focus is on conflicts between nature conservation on the one hand, and health promotion on the other. Of course, conflicts arise between different conservation objectives and various uses with different health effects. Such conflicts of use are, however, the 'daily bread' of conservationists and planners and will therefore not be dealt with further.

4.2.1 General solutions

Three basic strategies are suitable as approaches to prevent, or at least reduce, conflicts that must be specified for the particular case and combined with each other:

4. Assigning priority for a specific use or a function for a green space
5. Consideration of the need for a use or function for a green space in the overall urban context
6. Spatial and/or temporal separation of use or function within a green space.

Strategy 1: Assigning priority for a specific use or function for a green space (fundamental priority)

Green spaces have different potentials for health promotion and functions for nature conservation due to their size, facilities and location. If a green space has a special suitability for a specific health-promoting potential or a specific function for nature conservation, this can be given priority and, in case of conflict, competing uses or needs can be permanently excluded.

Strategy 2: Consideration of the need for a use or function for a green space in the overall urban context (contextual priority)

The above strategy should be complemented because it only comes from the actual situation of the green space features. It takes into account neither the needs of the urban population in certain health-promoting uses, nor any surface requirements for nature conservation (e.g. habitat connectivity, cold air corridors, etc.), nor the partial or total urban context. The importance of an area for a use or function (e.g. habitat of an endangered species, particular possibilities for aesthetic experience, sports and exercise facilities) increases when this function is less covered by other green spaces in the immediate and wider environment. In addition, the health-related needs and requirements of potential users of green areas should be considered.

The need to use green spaces (of whatever kind) by city residents in several municipalities was determined with the aid of so-called supply analysis (for more details, see Chapter 5.2.2). These are different guideline values for the maximum distance between home and public green areas, the minimum area size of green spaces, and the minimum average area of green space per inhabitant based on the municipality. These guidelines provide a way to determine the overall requirement of green spaces in a municipality or a subspace and anal-

yses for different green space types (such as playgrounds, allotments, parks), as well as how to approach selected user groups (such as children, the elderly, disadvantaged groups). The shortcomings of these approaches are that they typically consider only partial or very generally requirements of different user groups, that they only consider straight-line distance and thus do not capture the actual path length between home and green space, that they do not take into account obstacles and access problems (e.g. busy streets), and finally, that they cannot indicate the actual use when there are several available green areas (Garske 2011, 2013).

Strategy 3: Spatial and/or temporal separation of use or function within a green space (part territorial and/or temporal priority)

If conflicts cannot be solved differently, particularly for larger green spaces, a spatial separation of health-promoting and nature conservation-oriented uses and functions within the green spaces is possible. These can be limited in time, such as closing a meadow in spring if it is a breeding ground for species sensitive to disturbance. The complete exclusion of health-promoting uses is to be avoided if possible. ‘‘Nature that can only exist through the exclusion of humans should be the exception in cities’’ (Breuste 1994, p 121). A use restriction in the sense of ‘Nature conservation’ makes more sense than ‘Relic preservation’ (Breuste 1994, p 122): usages that impair or threaten the specific nature conservation, as well as health-related functions, are excluded, while other unproblematic usages remain possible. This applies, among others, to green spaces that cannot be entered, but can at least be appreciated from the outside, so that they can still achieve positive health effects that are based on the observation of nature (see Chapter 5.3).

Conclusion

On the basis of analysis as part of the contextual priority (Strategy 2), it is the part of the territorial-related priority of Strategy 3 therefore, to define within individual green spaces, but also for the entire green space system of a city, priority uses or functions and make appropriate zonings. This has long been a standard in spatial planning. It should also be noted that with the temporal aspect (time priority), conservation and health-related potentials, effects and functions can change over time – be it by newly planted young trees getting older and bigger, new forms of use occur, or changes in the intensity of care. Thus, a well-kept grass area can develop into a meadow due to longer mowing frequency and, for example, is no longer suitable for football matches, but allows better observation of nature and a higher ‘aesthetic experience’.

4.2.2 Conflicts and conflict-specific solutions

‘Conflict types’ are discussed below in a generalized form, i.e. potential conflicts between nature conservation and health promotion, as well as within health promotion. They are partly taken from the literature, but were expressed mainly from the model municipalities. Severity and intensity of the conflict will be very different in a specific case, and must always be determined on an individual basis since it depends on the type and size of the green space, the importance and sensitivity of the respective protective object to certain uses, as well as the nature and intensity of these uses.

Conflict type 1: Biodiversity conservation (species and habitat protection) versus health promotion activities (habitat interfering activities)

Conflict description: Human activities can contribute to the disruption and disturbance of wildlife, as well as damage or destruction of plants, habitats and migration corridors (Claßen 2008; Winkler 2008). This could be triggered by trampling (trails), eutrophication, noise, light (by night lighting) as well as the resulting reduction or dissection of habitats (e.g. by newly created paths and trails). Quieter forms of recreation (walking) are generally less conflictual than intense exercise and those in larger groups (e.g. football on a meadow, barbecue, mountain biking through a forest). Nevertheless, even minor disturbances can negatively affect species, so the respective density of use is always taken into account.

Solutions: The designation of priority uses and the zoning of a green space can contribute to conflict resolution, based on a citywide investigation of importance and needs of the conflicting claims within the meaning of the strategies outlined in Chapter 4.2.1. In addition, examining the extent of the protection of individual species can be assured by supportive measures (nest boxes, food supply), so that usage restrictions can be largely dispensed with. Nevertheless, there are species that are very sensitive to disturbance and their protection (complete, partial or temporary) requires use exclusion – or has to stand behind specific use requirements. For this purpose, the European and national species protection laws are considered.

Conflict type 2: Securing the performance and functioning of the ecosystem and health promotion activities (the ecosystem affecting activities)

Conflict description: Certain usages lead to soil compaction (e.g. intensive use of meadows to play football, footpaths) and eutrophication of soil, surface and ground water (e.g. through urine, faeces, littering.). Apart from exceptions (increased levels of uric acid and nutrients in bathing water) these conflicts tend to be less relevant in urban areas compared to conflicts with the protection of biodiversity However, some of the above mentioned stresses can lead to health and hygiene problems.

Solutions: In addition to the above mentioned strategies, it should be examined whether in larger, heavily used green spaces in particular an adequate supply of public toilets and rubbish bins can be created to reduce eutrophication. Thus, both nature conservation and health and hygiene requirements are taken into account.

Conflict type 3: Biodiversity protection versus protection of people with allergies (allergenic plants)

Conflict description: The allergenic potential of certain plants is becoming increasingly relevant as the number of allergy sufferers is increasing. Well-known examples are birch, hazel, alder, ash; rarely also sycamore, sessile oak and common oak or white willow may cause allergic reactions (Bergmann et al. 2012). At the same time, some of these plants are an integral part of native vegetation, so they are very important for the conservation of biodiversity, but also for cultural identity (Claßen 2008). To date, the resulting conflict has been insufficiently taken into account in nature conservation and planning, also in the international context (Cariñanos & Casares-Porcel 2011).

Solutions: A solution on the part of health sciences is to forego the planting of allergy-inducing plants where possible. However, given the importance that the above-mentioned plants have for conservation as well as for forestry, this is not possible on a wide-scale and will possibly be intensified due to climate change (Roloff et al. 2008). However, there is no need to use potentially allergenic plants in the case of (usually) smaller green spaces in the urban area because design and use aspects are more relevant compared to the protection of biodiversity. In any case, open space planning and nature conservation should be aware of the allergenic effects of certain plants when making decisions and implement them where appropriate.

Conflict type 4: Green spaces as a habitat of undesirable and disease-transmitting animals (disease-carrying species)

Conflict description: Depending on design and maintenance intensity, green spaces can be a habitat for undesirable and disease-carrying animals, such as ticks and rodents (especially rats and mice), oak processionary moth or mosquitoes.

Solutions: A universal approach to conflict resolution is not known. In the case of Lyme disease, which is transmitted by ticks and rodents, the stocking of pastures with farm animals such as cattle, sheep or goats may be helpful in the spring. These reduce the risk of transmission of Lyme disease because they deactivate the source of infection (Borrelia) (Baden-Württemberg Foundation 2012). However, this is only likely to come into question for a few urban areas.

Conflict type 5: 'Wild' green spaces versus aesthetics and a sense of security (acceptance-reducing low intensity of care)

Conflict description: Green spaces which are unstructured or (partly) unmanaged can be viewed as 'unkempt', 'neglected' and disruptive (Claßen 2008) or even perceived as fear-causing, especially when an area is overgrown, has unused paths and gives the impression that no one takes care of it.

As a result, people avoid such green spaces, so that much of their health-promoting potential for the broader population does not come into effect here.

Such green spaces also contribute little to the aesthetic-symbolic component of health. This applies in particular to brownfield land in declining cities which are not always perceived as an enrichment and desired 'urban nature', but often as an expression of social and economic decline and decay (see Demuth et al. 2010). At the same time, (especially) such areas can be very important from nature conservation perspective and play an important role for the nature experience of children and adolescents. If both arguments are true at the same time, there is an internal nature conservation conflict of objectives between species and habitat protection on the one hand, and nature experience of young people on the other hand. A conflict between wider health-promoting use by the population and nature conservation probably does not apply here, since the various needs are precluded in such cases due to the appearance of the respective green space.

Solutions: The experience of nature by children and young people is very important, especially in cities, but as only a few areas are usually available, emerging conflicts with species

and habitat conservation in general should be resolved in favour of children and young people. Many of the reservations against ‘wild’ green spaces can be eliminated with low maintenance measures, in particular by measures at the edges of the green space. This can be done by edging with hedges, mowing a strip less than a metre-wide along the edge of roads, or grass areas along the border of the green spaces. ‘‘Once the population gets the impression that the space is not completely ‘neglected’, conflicts usually decrease’’ (Demuth et al. 2010, p 50), since a measure of perceived safety and cleanliness is conveyed. At least in residential areas, this should be ensured. Green areas perceived as unsafe should not directly adjoin buildings. At the same time, it is possible to avoid risks that could result from actual inadequately protected banks or paths, as well as through insufficient knowledge of risk (Claßen 2008).

5 Working materials

A number of working materials should make it easier for those involved in planning practice to consider aspects of health promotion to varying degrees, in the framework of different projects and at different planning stages. This ranges from the collection and evaluation of current health-related potential of green spaces and their consideration in weighing decisions, to the health-promoting redesign or even new development of urban green spaces.

The materials provide information on the following topics:

- Analysis of user groups: Knowing the needs of different user groups is essential for the health assessment and planning of green spaces. This is because only if people use green spaces can the health potential of these green spaces have a real impact. Therefore, green spaces must be adapted to meet the demands of the people in the neighbourhood. Such specific requirements are presented for different user groups. This must be examined in each particular case and modified if necessary.
- Criteria for identifying health-promoting potential of urban green spaces: The health-promoting potential of green spaces and their actual effects depend on a variety of characteristics and factors that make it impossible to attribute a certain green space type (e.g. park, wasteland, urban forest) with an individual health potential. Rather, the consideration of each case is required. Based on the four health components (aesthetic-symbolic, social, psychological, physical), the features and elements of green spaces are listed that influence their health-promoting effect and thus can be used as criteria for determining the health-promoting potential of urban green spaces. However, the health-related potential of green spaces should not be judged solely on the basis of each individual area. The urban green and open space system as a whole is equally important. How many areas of what size and quality are available for people and how close are they to home? Is there a spatial concentration of green spaces or are they relatively evenly distributed across the city?
- Putting arguments into practice: In Chapter 5.3 there are scientific findings that demonstrate the effects of green spaces on human health, but also evidence of conflicting research results and negative effects. This rather brief list will serve as an argumentation aid to municipal planning practice, especially when it comes to not only identifying correlations between ‘green in the city’ and health, but also proving them.

This chapter is intended to give employees in urban nature conservation, landscape design and open space and green planning the instruments, information and arguments at hand, with whose help they can take into account aspects of health promotion when considering and planning better than previously. Such consideration may take place at very different intensities – depending on the task, planning scale, quantity and quality of green spaces and the respective available resources (money, time, staff). In the best case this can mean a quantitative and/or qualitative improvement of the total urban green network or single green spaces in consideration of the requirements of the potential users/user groups.

In other cases, it is only possible to go to the determination of the health-promoting potential of a green space in order to assess its (potential) importance for the health of urban citizens and contribute as an argument for consideration in planning decisions – for example when it comes to decisions about conservation or development of an area.

With the inclusion of health aspects in planning and nature conservation, differently extensive intentions or goals can be connected, which are not mutually exclusive since they are not clear-cut, but fluently merge into each other:

- Use of health arguments in support of nature conservation and open space planning objectives (e.g. for preventing land from being developed)
- Considering health aspects as a concern in planning urban nature conservation
- Redesign of green spaces to explicitly increase their health-promoting effects.

In terms of nature conservation and landscape or open space planning, the consideration of health concerns can include the following tasks and work steps:

- **Survey and assessment** of the health-promoting potential of green spaces (or their actual effects, provided that user behaviour can be detected)
- **Identifying and resolving conflicts of interest** between nature conservation and health-related requirements or uses (see Chapter 4.2)
- **Identification of potential negative and positive impacts** of urban development plans and projects on issues of health promotion and human health in the context of environmental impact assessments as well as the environmental assessment in land use planning
- **Development of health-promoting measures** in the framework of municipal landscape planning and green space planning as well as a result of land use and development planning
- **Redesign** of a green space to improve its health-promoting potential and effects
- **Design and redesign** of (particular) green spaces in compliance with health-enhancing criteria.

In every step of the process it is useful to consider the needs and interests of potential users of the green spaces and integrate them into planning and implementation. The more a planning-based and implementation and design oriented approach is followed, the more necessary it is to avoid bad planning and lack of usability and acceptance of a green space.

The following chapters provide information on the health-related needs of different user groups in urban green spaces (Chapter 5.1), the possible criteria for helping to identify and assess the health-promoting potential of green spaces (Chapter 5.2), as well as a compilation of research findings on the health effects of green spaces (Chapter 5.3).

5.1 Requirements of different user groups in urban green spaces

Apart from the ‘health-related ecosystem functions’ (fresh and cold air generation, pollutant filtering of water in soils, etc.) the health-promoting effects of green spaces do not result automatically from their existence or their respective features, but always only due to its use by people. For successful health promotion, the importance of claims of different users /user groups of green spaces therefore should not be underestimated. This is also reflected in a publication of the Federal Ministry of Health (BMG 2010), in which two points are emphasized:

1. Implementation of ‘setting related’ approaches by health-promoting green spaces are especially required, ‘‘where [...] [people] spend a large part of their everyday life’’, e.g. near nurseries, schools, places of work or recreational facilities (BMG 2010, 17).

2. Target group oriented design, ‘‘to also [...] reach those who have currently the largest deficits in the [...] [health behaviour]. In addition to the social situation this also relates to age and gender specific differences, for example the high proportion of adolescence girls who do not exercise must be considered’’ (BMG 2010, 17; also see Bucksch et al. 2012).

In particular, in the planning and redesign of areas the consideration of user needs is significant (Stiles 2011), although it is also helpful to estimate and evaluate the health benefits of an existing space. However, needs are difficult to generalise because they are always subjective and depend on the particular stage of life (Maderthaner 1995). You can also not clearly categorize and attribute exclusively to certain groups of people (Sen 2007), because some meet the needs of many user groups (e.g. gardeners) while others do not, or not for all members of a group. For many users, green spaces are important opportunities to find peace, retreat and private ‘naturalness’ experience, or, on the other hand, opportunities to be able to establish and cultivate social contacts (Buchecker 2008; Grahn & Stigsdotter 2010; KGSt IKO-Netz 2010; Stigsdotter & Grahn 2011). Physical activities are, however, not named as primary needs.

The possibility to fulfil all conceivable user requirements within a green space is limited because of their size and priority purposes. This unavoidable deficit should, however, be compensated for by a variety of green spaces and use-opportunities on a local and city-wide level. Finally, it must be remembered that public green spaces usually survive over decades and therefore not only current but also future needs have to be taken into account.

All this does not question in principle the usefulness and necessity of consideration of user interests and identifying their needs, because a green space is then most likely to develop health effects when people like to be in it and use it (according to their individual needs). In this sense, green spaces should not be understood as ‘health intervention’, but the health effects are more or less ‘incidental’

Needs of potential users can be determined by analysis of user groups, in conjunction with public participation procedures. A corresponding assessment related approach on health issues and the quality of green spaces was developed by Greenspace Scotland (2008). The focus is mainly on participatory procedures, both in planning and beyond (e.g. responsibility for maintenance measures). On top of that, the identification of particularly vulnerable and affected user groups plays an important role, as well as their health-related needs or demands for green spaces. Furthermore, the question should be answered of whether, to what extent and at what expense green spaces can be adapted to changing user needs. The procedure over the entire planning and implementation process of time should be based on Plan-Do-Check-Act cycle or similar approaches. Accordingly, the design of a green space should be planned with the residents (plan), promptly carried out (do), evaluated in terms of actual usage and acceptance of the area by the residents (check) and adjusted if necessary (act).

The following statements from technical literature are put together for different user groups. These are neither exhaustive nor inclusive – they represent a first approximation whose validity should be checked in a specific case as far as possible. Also, mention of any specific points in a group of users does not mean that these are not or could not be relevant for other groups as well, but only that they are of particular importance for the respective group. Finally, the statements on the individual groups are not entirely analogous, since the underlying studies differ in their questioning. Initially the needs are shown that the respective user group

(or a majority of it) have on green spaces, and can be initially independent of health issues. Resulting health aspects and interrelationships are briefly described below, before the consequent demands on green spaces are mentioned in note form. If known, easily accessible and practical further reading is provided.

Allergy sufferers (allergic rhinitis, allergic bronchial asthma)

Patients with respiratory allergies are dependent on environments being as low-allergen as possible and are advised accordingly to avoid allergenic spaces. From the perspective of this group, green spaces should be as free of allergenic plants as possible, and planting of corresponding types (e.g. birch, alder, ash, hazel) should be avoided (Bergmann et al. 2012; also see discussion in Chapter 4.2).

User group	Allergy sufferers
Needs	• Low-allergen environment
Health aspects	• Triggering allergic symptoms (e.g. rhinitis) / risk of allergic asthma or risk triggering complaint previously sensitized by occurrence of allergenic plants
Requirements for green spaces	• Lack of (high) allergenic plants (avoid replanting) • Fighting (high) allergenic alien species and invasive species

Elderly people

Elderly people use green spaces regularly (daily to weekly), and thereby more likely in the morning and afternoon. If they are not very mobile due to declining physical condition or illness, they need green spaces which have places to sit and are accessible by public transport or within walking distance (Bucher & Schlömer 2008; CSIR 2000; Kliemke 2012; Stiles 2011). The search for communication and relaxation are primary aims when visiting green spaces.

User group	Elderly people (distinction between mobile and immobile)
Needs	• Communication • Quiet • Aesthetically pleasing places
Health aspects	• Being in green areas generally leads to improvement or maintenance of physical fitness and health and for the prevention of age-related impairments (osteoarthritis, hypertension, back pain, osteoporosis, chronic obstructive bronchitis and emphysema, diabetes, dementia) • Prevention of isolation by promoting social interaction and community • Preservation of cognitive abilities by stimulating the senses and spiritual experience
Requirements for green spaces	• Orientation opportunities • Seating: especially in entrance areas (for people who are waiting), wind and sun protection • With limited mobility: easily passable and navigable ways; railings; large print on notice boards; good public transportation • Paths for walking, running and Nordic walking; best barrier-free – without steep gradient slope and obstacles • Refreshments

	• (Intergenerational) play opportunities (e.g. chess tables, bowling), also to promote strength, balance, agility; • Lawns for gymnastic exercise
Further reading	• Check list 'Altersgerechte Quartiersentwicklung' – Ein Handlungsleifaden für Wohnungswirtschaft, Stadtentwicklung und Seniorenvertretungen. http://www.fh-erfurt.de/fhe/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/Material/ Institut/ISP/PDFs/ISP_Erfurt_2012_Checklisten_Altersgerechte_Quartiersentwicklung_LANGFASSUNG.pdf&t=1364491609&hash=3c8d77aca336cd646a55c5618f0d348d (accessed on 24.05.2013) • Report 'Senior Health in San Mateo County - Current Status and Future Trends' http://www.sustainablesanmateo.org/home/sustainability-resources/senior-health/ (accessed on 24.05.2013)

Working people

Depending on the nature of their job, working people need different green spaces, also in close proximity to work. On the one hand this should give rest and relaxation, on the other hand possibilities of exercise to offer compensation for often too sedentary or rigid activities (Brander et al. 2004; CSIR 2000; Stiles 2011).

User group	**Working people**
Needs	• Regeneration spaces (exercise, rest, relaxation) near the place of work • Social interaction
Health aspects	• Relaxation and tranquillity promote the regeneration of cognitive and physical performance • Social interaction increases overall well-being
Requirements for green spaces	• Green spaces in the immediate proximity of the place of work • 'Working areas in green': ability to do individual work in green spaces (e.g. working on the laptop at seats with tables)

Parents of young children/carers

Parents of young children need safe play areas for their children with enough seating opportunities for themselves in their direct residential environment (Bezirksamt Lichtenberg 2011; Stadt Wien 2012).

User group	**Parents of young children/carers**
Needs	• Play and seating options
Health aspects	• Increase well-being through social interactions with other parents
Requirements for green spaces	• Clearly defined play areas for small children • Combinations of tables and benches in visual contact with the play area • Shaded area • Access to water (for washing hands, etc.) • Baby changing station • Rest areas: lawns, swimming areas
Further reading	• Handbook 'Gender Mainstreaming in der Stadtplanung und Stadtentwicklung'. Online at http://www.wien.gv.at/stadtentwicklung/grundlagen/gender/index.html (accessed on 24.05.2013) • Spielplätze in Lichtenberg. Genderspezifische Analyse der Nutzung kommunaler Anlagen. Online at :

	http://www.berlin.de/imperia/md/content/balichtenberghohenschoenhausen/gleichstel-lung/spielplatzbroschuere_1_.pdf?start&ts=1314698766&file=spielplatzbroschuere_1_.pdf (accessed on 24.05.2013)

Women

Women generally have a higher need for security than men, which should be considered in planning. In addition, they are interested in or frequently do sports that are rarely integrated into urban planning, e.g. volleyball, badminton (CSIR 2000; Stadt Wien 2012).

User group	Women
Needs	• High security and cleanliness needs • Different sports interests than men
Health aspects	• Increase well-being through social contacts and recreation • Physical activity and sport contribute to the improvement of physical and mental health
Requirements for green spaces	• Opportunities for types of games/exercise such as volleyball, badminton • Retreat (partial confined spaces) on the one hand, clarity/visibility on the other hand: clear paths concepts, visual contact with the street or residential buildings, fast 'escape routes' and many exits • Illumination of paths • Cleanliness of surfaces • Toilets
Further reading	• Handbook 'Gender Mainstreaming in der Stadtentwicklung' online at at http://www.stadtentwicklung.berlin.de/soziale_stadt/gender_mainstreaming/download/gender_deutsch.pdf (accessed on 24.05.2013) • http://www.wien.gv.at/stadtentwicklung/alltagundfrauen/sicherheit.html

Teenagers

Teenagers are mainly looking for social contacts and sports facilities in public places. A balance should be provided of both well-attended and protected areas (from other social groups) which are located near the residential and school environment. The equipment tends to play a secondary role. Large spaces for sports and activities are important (CSIR 2000; Stiles 2011) and they must have a quality corresponding to the needs of young people (Beckmann et al. undated; Bezirksamt Lichtenberg 2011).

User group	Teenagers (13-19 years old)
Needs	• Social contact • Trials of strength and 'showing off' (also in relation to the opposite sex) • Sport
Health aspects	• Opportunities for sports and games promote motoric, emotional, cognitive, social and creative development • Communication, interaction and feelings of belonging promote well-being
Requirements for green spaces	• Enclosed, secluded spaces • Facilities near (± 500 m) schools or home (specialized spaces such as sports venues can be further away) • Opportunities/areas for free, close to nature games and experiences • Facilities with football areas, football pitches, climbing walls, facilities for volleyball,

	basketball, hockey, table tennis, skate parks

Children

Infants (2-5 years) must play near their parents. This mainly involves the development of the senses and motoric skills, as well as role playing. Small spaces are therefore often sufficient. Older children (6-12 years), in contrast, require large spaces in which they can 'discover the world' independently (Bezirksamt Lichtenberg 2011, BMVBS 2010, CSIR 2000, Stiles 2011). Basically, play areas should be located close to school and home.

User group	Children
Needs	**2-5 years old / pre-school children:** • Need for security • Development of the senses **6-12 years old / school children:** • Need for exploration
Health aspects	• Promote motoric, emotional, cognitive, social and creative development as well as communication and interaction through sports and games
Requirements for green spaces	**2-5 years old / pre-school children:** • Small play areas in visual contact with parents or home • Protection/demarcation road • Distance between home and play area approximately ± 400 m • Minimal risk of injury, e.g. soft ground • Age-appropriate play opportunities which stimulate the senses, especially the sense of space: land for free, close to nature game, sandpit and toddler equipment, play houses, slide, sand table, climbing frames, water games, etc. • Planting non-poisonous plants **6-12 years old / schoolchildren:** • Spaces that allow natural experience (e.g. so-called nature experience space) • Large play/sports grounds, spaces to discover and create, retreat etc. • Close to home and school (± 500 m), secure accessibility without parents • Design will meet the various interests and uses of girls and boys • Facilities with larger climbing combinations, ballgame possibilities, sandy areas, mounds, areas for free close to nature games, football pitches
Further reading	• Guidelines 'AUF AUGENHÖHE 1,20 m. Verwaltungsinterner Leitfaden zur Förderung einer kinderfreundlichen Stadtentwicklung' online at http://www.entwicklung.bs.ch/checkliste_011117.pdf (Accessed on 24.05.2013)

People with high stress levels

According to Grahn & Stigsdotter (2010), people with stress prefer environments that appear 'natural' or are diverse and species-rich, as well as provide opportunities for retreat and calm. Activities are, for example, walking or those involving contact with animals (Stigsdotter & Grahn 2011). Places with a lot of people are less visited.

User group	People with high stress levels
Needs	• Rest and relaxation • Solitude

Health aspects	• Promote opportunities for retreat and quiet, facilitate relaxation and recuperation to contribute to well-being
Requirements for green spaces	• Screened shelters since highly frequented locations are avoided • 'Close to nature' and biodiversity • Possibilities for 'activities with animals' (e.g. horse riding) and 'quiet activities'

People on low incomes

People on low incomes often live in cramped spaces without usable surrounding 'green', e.g. in the form of leafy courtyards or gardens. Because they often have poorer health than the average population due to low resources, access to green spaces especially is important for them (Stiles 2011). Therefore, as compensation they should be provided with usable green spaces as diverse as possible (barbecue, picnicking, active games, etc.) close to home that promote social interaction and integration. The possibility to do gardening and growing vegetables is particularly relevant to this group, as gardening on the one hand has multiple health effects, and on the other hand the cultivation of vegetables allows a healthy diet for those with limited financial means.

User group	**People on low incomes**
Needs	• Residence near access to green space
Health aspects	• Social contacts and integration increase overall well-being • Studies show that health, especially among people on low incomes, will be improved by having green spaces close to home (see Chapter 5.3).
Requirements for green spaces	• Location of green spaces close to home • Opportunities for social interaction through picnics, barbecues etc. • Opportunities for exercise • Opportunities for gardening; vegetable growing

People with an immigrant background

Generally valid statements about people with an immigrant background are difficult to make because in this group, depending on the origin, strong intercultural as well as intergenerational differences (first, second and third generation immigrants) must be respected. People with an immigrant background suffering from post-traumatic stress disorder often have more difficult access to health care, presumably an increased vulnerability, and thus tend to have poorer health than other populations (Razum et al. 2008). Therefore, they particularly benefit from green spaces (de Vries et al. 2003; Groenewegen et al. 2012; Mitchell & Popham 2008), in which case their use often has social interaction at the forefront (Gobster 2002).

Being in the sun is important for all population groups in order to ensure adequate vitamin D intake. However, this applies particularly for women with head and body coverings and people with dark skin. Nevertheless, basic sun protection measures should be considered, otherwise there is an increased risk of skin cancer (Berg et al. 2010; Zeeb & Greinert 2011).

User group	**People with an immigrant background**

Needs	• Social interaction and integration
Health aspects	• People with an immigrant background are more likely to suffer from post-traumatic stress disorder and therefore particularly benefit from being in green spaces • Being in green spaces can boost integration, communication and a sense of belonging and thus positively affect mental and social health
Requirements for green spaces	• Opportunities for social contacts (e.g. barbecues, picnics, music, celebrations), more sedentary forms of use

The 'immobile'

'The immobile' do have the possibility of adequate exercise, but doing so fails for some reason, e.g. due to a lack of motivation or an unattractive environment. Rütten et al. (2009) have questioned those people according to their sporting needs and interests. It turned out that they (depending on age and gender) especially prefer endurance sports and ball games, where the corresponding opportunities are provided in close proximity to home and work.

User group	**The immobile**
Needs	• Group activities • Close to home or work
Health aspects	• Physical activity improves physical and mental health
Requirements for green spaces	• Group opportunities • Ball games and endurance sports (walking, jogging) • Quick accessibility to green spaces via proximity to work or home • Age- and gender-related possibilities: women prefer everyday activities, men prefer ball games

People with mobility impairments

People with mobility impairments especially need barrier-free access to green spaces, which must be easily walkable and driveable to (CSIR 2000; Kliemke 2012). For these people, the accessibility of green spaces by public transport must be guaranteed (which presupposes these are barrier-free).

User group	**People with physical disabilities**
Needs	• Accessible entrance and barrier-free usability
Health aspects	• Using green spaces encourages social integration and interaction, and therefore reinforces the perception of being able to participate in society and thus well-being
Requirements for green spaces	• Good public transport connection • Good walkable or drivable paths (solid flooring, width at least 90 cm) • Shallow gradient • Parking spaces for wheelchairs or walking frames near seating
Further reading	• Handbook 'Design for all – Öffentlicher Freiraum Berlin'. http://www.stadtentwicklung.berlin.de/bauen/barrierefreies_bauen/download/designforall/Handbuch-Design_for_all_2011.pdf (accessed on 24.05.2013)

People with mental impairments

People with mental impairments, such as anxiety disorders (e.g. social anxiety, panic disorder) or depression, often avoid highly frequented places and crowds. Thus retreat areas are important to allow physical activities and sports because exercise influence mental health most positively (RCPsych & AMRC 2010).

User group	People with mental impairments
Needs	• Safety • Retreat
Health aspects	• Retreat promotes well-being • Physical activities help to improve mental health
Requirements for green spaces	• Retreats within green spaces • Security/clarity • Opportunities for exercise

5.2 Criteria for identifying health-promoting potential of urban green spaces

Almost every urban green space should have health-promoting potential within itself, and in many cases also have corresponding effects. But what are those potentials and effects, can we see the specific potentials a particular 'green space type' (e.g. a park, a wood or a brownfield site) does or doesn't have, and thus make a differentiation between green spaces per se? This is not possible. In the first place, different types of green spaces in themselves are very heterogeneous; firstly, parks can differ considerably in size, proportion of trees, age, intensity of maintenance, restrictions, places of retreat, facilities with play areas, and of course with regard to the requirements of species and habitat protection, etc. Secondly, the health-related potential of the location of green space within the city depends on the accessibility of the area, the noise and pollutant effects from adjacent streets, as well as the connection to other green spaces. Which user groups can be found in the environment, is the green space at all useful for their needs? All these questions can only be answered in each individual case; general statements on this are not effective.

Therefore, a kind of checklist or 'set of criteria' would be meaningful here to provide a guide that will help to show the relevant health-related characteristics of green spaces, and so the corresponding potential can be estimated or evaluated. The starting point is again the four components of health (aesthetic-symbolic, social, psychological, physical), which are associated with criteria to shape and equip a green space (Chapter 5.2.1). To actually ever achieve health benefits, a green space must be used as well. For this purpose, in addition to aesthetic and identification-promoting characteristics, 'general quality criteria' are decisive (e.g. safety, cleanliness, accessibility) which are prerequisite for all health components and are therefore presented separately at the end of Chapter 5.2.1.

Depending on the objectives, these criteria can be used as part of the working stages that have been preliminarily named in Chapter 5, and thereby strengthen nature conservation arguments or bring health concerns into planning decisions (stocktaking and assessment, conflict analysis, determination of health-related effects of plans, development of health-promoting measures, remodelling or new installation and design of green spaces). This is possible both for individual green spaces (Chapter 5.2.1) as well as the 'green space network' on a city-wide level (additional notes in Chapter 5.2.2) – although of course with different levels of effort.

In applying the set of criteria, the following points should be noted:

- The criteria and the associated health-promoting features and elements of green space provide an exemplary but by no means exhaustive overview;
- Neither can nor must a green space have all the mentioned features, as this is unlikely to be possible in a limited space and individual elements as well as related uses can also be in conflict with each other;
- The individual elements cannot be evaluated in their health-promoting significance per se, since this depends on other characteristics of the green space and the needs of (potential) users; in some specific cases some of the items listed will have no importance so

an appropriate assessment must therefore be adapted to the specifics and requirements of the case carried out;

- The criteria are based exclusively on health aspects, not on (other) nature conservation requirements. It remains undisputed that these have to be considered and sound decisions made in favour of one or another interest in the case of a conflict. However, since this is common practice in nature conservation and landscape planning, this will not be illustrated in this report.

5.2.1 Assessment of individual green spaces

Aesthetic-symbolic components of health

Criteria	Relevant features and elements of the metropolitan area (by way of example, not mandatory, not exhaustive)	Needs of relevant user groups (completed case-specific)
Perception, identification In order for people to use green spaces, they need to identify and build a positive emotional connection with them. This is closely related to the aesthetic appearance and characteristics of a site.	**Beauty** • Striking visual axis within the green space and surrounding areas • Light and shadow plays, reflections • Water in various forms (standing, running, rushing, fountains, water feature / waterfall) • Rolling terrain, landscaping • Combination of different 'outdoor characteristics', e.g. woody structures and open (meadow) areas • Variation of natural vegetation and intensively cultivated planting • Vegetation (trees, shrubs, perennials, early bloomers, etc.) with a varied shape, texture and structure, flower size • Berries for birds, bee pastures, species-rich meadows	
	Features promoting identity • Characteristic, recognizable places that promote an attachment to the place ('sense of place') • Typical local characteristics • Note: Different user groups have different requirements for premises in order to identify with them (e.g. young people – seniors, people with an immigrant background)	

Social Health

Criteria	Relevant features and elements of the metropolitan area (by way of example, not mandatory, not exhaustive)	Needs of relevant user groups (completed case-specific)
Interaction and integration Social contacts in green spaces strengthen communication and interaction skills as well as create a sense of social belonging and thereby contribute positively to the 'social capital' and the identification with the neighbourhood. To facilitate interaction and integration, green spaces need to ensure access and stay for as many people or potential user groups as possible.	**Social interaction** • Places that are suitable as a meeting place (succinct place, sculpture, fountain, sports and playing fields and equipment) • Separate areas for different (conflictual) benefits (e.g. quiet and noisy recreation; sunbathing area – football pitch) • Seating with tables made of warm materials (e.g. wood or plastic) for working, eating, playing • Opportunities for picnicking, playing music; barbecue pits, fire sites (possibly with rain protection)	
	'Design for all' (cultures, ages, etc.) / Accessibility • 'Intercultural design' • Seating and entertainment in low / user-specific adapted distance • Enough space for walking frames, wheelchairs next to seating (min. 120 cm deep and 100 cm wide) • Barrier-free design, including: broad paths:> 150 cm (min. 90 cm); ramps in addition to or instead of stairs (gradient max 6% without cross slope); path gradient less than 6%; good walkable and passable flooring (solid, barrier-free); information texts also at wheelchair eye level (approximately 1.25 m), reasonable reading distance	

Mental health

Criteria	Relevant features and elements of the metropolitan area (by way of example, not mandatory, not exhaustive)	Needs of relevant user groups (completed case-specific)
Experience and Creativity The experience of nature favours the development of the senses, which in turn promotes attention to themselves and their own environment. Spaces for creative design, music and gardening can use the personal and creative development positively influence and facilitate a sense of self-efficacy.	**Nature experience** • Semi-natural, extensively cultivated areas • Berries for birds, bee pastures, species-rich meadows • Variety of plant species with different shape, texture and structure; different flowering times • Opportunities for animal contacts (e.g. children's zoo) • Barefoot walking, barefoot paths	
	Creativity (expression, art and music) • Opportunity and space to be (temporarily) creative and to design[11]	
	Opportunity for gardening and self-harvest • Allotments, intercultural gardens, neighbourhood gardens • Orchards, fruit-bearing trees and shrubs (fruit, nuts, etc.)	
Quiet relaxation and regeneration With appropriate equipment green spaces can have a stress-reducing and relaxing effect, offer retreats and enable rapid recovery after physical exertion.	**Retreats** • Screened, small hidden areas • Places with natural elements and views of them	

[11] Examples at http://www.kunst-werkstatt-natur.de/

Physical Health

Criteria	Relevant features and elements of the metropolitan area (by way of example, not mandatory, not exhaustive)	Needs of relevant user groups (completed case-specific)
Exercise Green spaces provide an opportunity for sports. Exercise prevents cardiovascular diseases, diabetes, depression, etc. In addition, strengthening of bone structure and immune system and well-being by UV radiation. However, it is not conclusively established whether green spaces actually promote physical activity outdoors. It is important that different elements can be found that allow children and adults to play.	**Range of play options** • Play area for stimulation of various exercise patterns (swings, trampoline, climbing wall, merry-go-rounds, etc.) using a variety of materials (wood, metal, foam, etc.) • Play areas and seating, also in the shade • Access to water in the immediate proximity (note potential danger for children) • Secure area for 2-5 year olds, such as fencing and for children not to open gates	
	Using natural features • Trees for climbing, balancing, etc. • Bathing facilities • Grass for football, badminton, frisbee, kite flying, frolicking	
	Range of sports facilities • Paved areas for football, basketball, badminton, bowling, etc. • Sand area for beach volleyball • Facilities: table tennis, mini golf, giant chess, fitness trail, Kneipp basins	
Freedom from health-impairing features and elements	**Features and elements that reduce adverse health effects or risks** • Low-allergen plants • Thornless and non-toxic plant species (especially near playgrounds and other areas preferred by children) • Frequent mowing of intensively-used meadows to keep them short (reducing the risk of tick infestation) • Separation of active and quiet areas (reducing noise pollution) • Balance of sunny and shady spots (to protect against intense sunlight)	

General quality criteria

In order to be attractive for different groups of users, and thus be able to achieve positive health effects, green spaces must fulfil the below-mentioned basic quality requirements.

Criteria	Relevant features and elements of the metropolitan area (by way of example, not mandatory, not exhaustive)	Needs of relevant user groups (completed case-specific)
Safety	• Lighting (main path) to avoid dark areas and 'anxiety spots' • Paths with visual contact to roads or residential buildings • Manageable size: walls, fences, shrubs, hedges less than 1.5 m; starting tree tops from about 2 m height • Coexistence of different uses in order to ensure certain minimum frequenting with different user groups and thereby increase the sense of security • Emergency phones • Dog free areas / dogs on leads (and designated special areas for dogs elsewhere)	
Cleanliness	• No signs of destruction (e.g. broken windows), disfigurement (e.g. graffiti) or contamination (e.g. urine, dog faeces, broken glass) • Waste bins along the paths	
Equipment	• Maintained condition of the equipment (cleanliness, functionality, no risk of injury) • Sun and shade (by awning or trees/shrubs); • Seating on routes, water bodies etc. • Sanitary facilities / toilets, changing facilities; • Bicycle stands • Catering (café, restaurant, kiosk, snack stand, bistro, ice cream stand)	
Information / Orientation	• Information panels; signage; possibly multilingual or with self-explanatory pictograms • Distinctive places for orientation (e.g. solitary, large tree; building; especially in larger parks)	
Paths	• Various surfaces for different uses: bike paths, routes for inline skating, promenades, footpaths, trails, mountain bike paths, bridleways • Branched path network with circular trails • Variety of roadside barriers (trees, walls, etc.) and openings into other areas (meadows, water bodies, visual axis, etc.)	
Accessibility and approachability	• No or few obstacles on the outer sides of the green space (e.g. busy roads, railway tracks) • Accessibility according to the spatial reference plane (near housing, settlement, etc.) in every way possible (traffic lights / crossings, cycling and walking, public transport connection, parking facilities, also for disabled people) • Sufficient number of entrances • Spatial proximity to facilities with potential user groups (e.g. schools, kindergartens, public buildings, nursing / retirement homes)	

5.2.2 Assessment of partial and total urban 'green space system'

''Open spaces are not distributed in specific patterns in cities, but every city has its own open space system based more or less on the natural conditions, original uses and plans carried out in the course of urban development.'' (DRL 2006, p 7). However, the nature of this open or green space system (i.e. the spatial distribution of individual green spaces with their respective characteristics, sizes and usage suitability) determines the actual use and, therefore, the health effects of the partial or total urban green space system, not least with regard to questions of sufficient availability and quality of green spaces in all districts and for different user groups and hence for environmental justice. Because of these differences between cities on the level of the 'green space system', no generally valid statements regarding the quantity and quality of green spaces and their context can be made. However, some requirements can be formulated which can provide appropriate guidance and can be modified on an individual basis. These relate to a) the catchment area of green spaces with different functions, b) guide values for the supply of certain green areas in the immediate proximity of housing, and c) the spatial-functional network of green spaces. Basically, the aim is a spatial distribution of green spaces throughout the city which ensures an adequate quantitative and qualitative supply of public green spaces within all population groups.

a) Catchment areas of green spaces with different functions

Urban green spaces can be distinguished according to their catchment area and thus ultimately on the number of users. Among others this depends on their size, their characteristics and thus the functions which can be met by them as well as the distance to the residential areas. Therefore, to some extent supply values (square metres of green space per inhabitant) are linked. Corresponding values are summarized in the following table. These are in no way universal, but are taken from the literature or applied guidelines in individual municipalities that can provide indications of a supply analysis.

Table 2: Catchment areas of green spaces with different functions based on different standard values for surface area, supply value (square metres per inhabitant), distance between green space and housing (compiled from: DRL 2006;, Freie und Hansestadt Hamburg 1997; Natural England 2010; Pelizaro 2005; Richter 1981; Schröter 2010; SenStadt 2009; Stadt Freiburg im Breisgau 2005; Stadt Gütersloh undated; Steidle-Schwahn & Hoffmann 2005; van Herzele & Wiedemann 2003)

Green spaces of different catchment areas	**Relevant characteristics of a green space (by way of example, not exhaustive)**
Housing related green spaces (Residential Green)	• Area size 0.2-1.5 ha or 0.1 ha in the town centre • Supply values: 4 m² / inhabitant • Distance between green space and housing: 150 m / 4-5 minute walk • Examples: green spaces, roadside greenery, play streets, potentially usable public traffic areas with a corresponding design
Near-residential green spaces (neighbourhood or residential area-based green	• Area size: 0.5-10 ha • Supply values: 6 m² / inhabitant • Distance between green space and housing: 500 m / 5-10 minute walk • Stay usually on an hourly basis for short-term and after-work recreation • Equipment requirements: high utility value, variety of uses

spaces, Neighbourhood Green)	• Intensively usable facilities for children • Opportunities for quiet and sociable behaviour (rest areas, meeting places for different social groups) • Vegetation areas (with semi-natural character) • Uses: observing, communicating, playing, reading • Special significance for less mobile population groups such as children, the elderly and the disabled, but also for the employed (breaks)
Neighbourhood-based green spaces (Quarter Green)	• Area size: 5-40 ha • Supply values: 7 m² / inhabitant • Distance between green space and housing: 1,000 m / 15-20 minute walk • Stay usually from one hour to half a day • Equipment requirements: high adventure and utility value • Intensive usable areas for children • Play and leisure sport range for youths and adults (e.g. grass areas) • Areas for resting and socializing • Extensively cultivated areas showing natural character and landscaped vegetation areas • Uses: walking, enjoying nature, play, sport, communication
Settlement near green spaces (landscape recreational areas, District Green)	• Area size: 10-40 ha • Supply values: 7-8 m² / inhabitant • Distance between green space and housing: 2,000 m / 20-40 minute walk • Length of stay is usually between a half to a full day • Equipment requirements: contiguous landscaped characteristic green spaces • Play areas and leisure sports facilities • Larger, natural, nature conservation valuable land and landscaped areas with fields and meadows and forest units (diverse landscape) • Areas for resting and socializing • Water elements (also usable for swimming) • Uses: enjoying nature, exercise, walking, playing, preoccupying children outdoors, communication
Green spaces for the entire metropolitan area (City Green)	• Area size: > 20 ha • Supply values: 8 m² / inhabitant • Distance between green space and housing: 5,000 m / 15-30 minute by public transport • Stay generally between a half a day and a day, especially at weekends • Equipment requirements: citywide popular green spaces with high attraction for distant residents and tourists • Landscape diversity • Various recreational facilities (e.g. walking, riding and cycling trails, playgrounds and lawns, animal enclosures, swimming, picnic areas, restaurants), special uses and cultural events • Uses: contrast to the urban environment, fresh air and tranquillity, nature watching, walking, cycling, resting/playing, socializing with family and friends

b) Reference values for green space management

Approximate size, value of supply and distance between green space and housing exists for specific categories of green spaces, independent of the catchment area in the sense just described. In practice, these specific reference values are often integrated into supply analysis. These play a role in so far as, for example, larger green spaces are used more frequently

and by more people even at a greater distance from home, but regular visits to park decreases with increasing distance from home (Stigsdotter, in print).

Table 3 compiles guidelines for various types of green space used in various municipalities. Since nationwide uniform, legally prescribed or generally accepted guideline values do not exist, the individual figures differ in part quite strongly from each other. Therefore, they can only be recommendations. Some municipalities commissioned their own studies to determine the appropriate values (e.g. Munich, see Nohl 1995), for play areas in some municipalities (e.g. Cottbus 2005, Soest 1974), or even federal states (e.g. North Rhine-Westphalia, see MIK NRW 1974) these values are fixed by statute or decree.

Table 3: Typical values for surface area, supply unit (square metres per inhabitant) and distance between green space and homes of different green space types (compiled from: DRL 2006; Freie und Hansestadt Hamburg 1997; MIK NRW 1974; Natural England 2010; Nohl 1995; Pelizaro 2005; Richter 1981; Schröter 2010; SenStadt 2009; Stadt Freiburg im Breisgau 2005; Stadt Cottbus 2005; Stadt Gütersloh undated., Stadt Soest 1974; Steidle-Schwahn & Hoffmann 2005; van Herzele & Wiedemann 2003)

Criteria	Quantitative information
Area size	• Allotments: 300-400 m² • Football pitches: 500 m²
Supply values: Area of urban green space (m^2) per inhabitant	• General public green spaces: 6-25 m² / inhabitant • Sports facilities: 2.5-6.0 m² / inhabitant • Football pitches: 0.75 m² / inhabitant • Playgrounds: 0.75-1.0 m² / inhabitant • Allotments: 10-18 m² / inhabitant • Cemeteries: 3.5-5.0 m² / inhabitant
Distance between green space and housing	• General public green spaces: 50-300 m • Sports facilities: up to 500 m • Football pitches: up to 750 m • Play areas for small children (up to 6 years old): up to 100 m • Play areas for children (6-12 years old): up to 400 m • Play areas for teenagers (12-18 years old): up to 800 m

c) Spatial-functional networking of urban green spaces

The spatial network of green spaces facilitates access and thus their use by the population, enabling them to further develop their health-promoting effects. A longer stay in green spaces is also made possible due to the different design of individual spaces – usually – by switching between different uses and thus not having to travel longer distances between green spaces in a built-up area. In addition to walking or 'hiking' within a city (e.g. '20 green main routes' in Berlin[12]) daily physical activity in particular is encouraged. According to environmental health assessment, this is one of the most important aspects of health promotion

[12] www.stadtentwicklung.berlin.de/umwelt/berlin_move/de/hauptwege/ www.gruene-hauptwege-berlin.de (accessed on 24.05.2013)

in the city[13]: exercise must not only be encouraged in leisure time, it must be an integral part of everyday life: journey to work, to school, going shopping, etc. should be covered as much as possible not by car, but on foot or by bike. Attractive, reliable, largely noise-free path connections in street green spaces can promote this, or they are even an important prerequisite (Greenspace Scotland 2008; Pikora et al. 2003; WHO 2007).

Accordingly, in town and landscape planning, appropriate green connections should in particular be in close spatial relationship on the one hand to residential areas and, on the other hand, too highly frequented places such as community centres, schools, kindergartens, sports fields or shopping centres. It is important to make sure that different forms of exercise are equally possible (walking, cycling) and possible continuations of road networks exist (e.g. on foot and cycle paths). All this can thereby ultimately contribute to the reduction of car traffic, thereby reducing noise, accidents and air pollution, and in this way also improve health-related environmental conditions.

Existing plans, or already existing interconnections as habitats or foot and cycle path concepts, can be used for such a total urban network of green spaces into one ‘recreation and form of exercise composite’. Whether a complete spatial overlap of such systems is reasonable and possible without conflict has to be considered on site.

[13] Result of the activities carried out under the project workshops with representatives of Health Sciences and Environmental Medicine on 18.03.2012 in Munich.

5.3 The importance of urban green spaces for health promotion - supporting arguments for municipal practice

The model communities showed the desire for scientific evidence of the health benefits of urban green spaces to be able to argue on a secure basis. This chapter presents relevant findings together as 'talking points', providing justifications for the preservation and (re)designing of green spaces from a health science perspective. However, the following points should be noted:

- Accurate, quantitative statements about relationships between green spaces and health, in the sense of ''green spaces reduce the temperature to x degrees and contribute in this way to a reduction in disease y to z%'' are not possible.
- Although statements are often made about correlation and causality between green space and health-related aspects, the effective causality is not always clear due to a lack of long-term studies and the complexity of the subject. Also, other factors may be added which are not taken into account. For example, some studies have shown that overall mortality decreases the 'greener' the residential area is, but this cannot be explained only as an effect of green spaces, but also with the fact that wealthier people with good health and easier access to the health system settle intentionally in 'green' districts.
- The cited studies have partially contradictory results. Among others, this can be caused by different study populations, the spatial location in urban or in rural areas, as well as different methods. In addition, certain matters have not yet been adequately investigated. So it is assumed, for example, that physical activity is not necessarily related to the supply of green spaces, but to the people's own motivation to move and play sports.
- To compile the arguments, with the exception of Chapter 5.3.1, reviews and literature studies were mainly evaluated, as well as individual case studies of recent years on the subject of ''green and health''. Most studies are still carried out in the English-speaking world (especially in the USA and Australia); therefore, caution is advised in their immediate transfer to German conditions. Nevertheless, they provide important information that can be supported by further studies, especially from the Netherlands and Scandinavia.
- The analyzed documents show only a part of the 'green and health' research field, which is becoming increasingly relevant. A complete description is not possible due to the constant abundance of new publications.

Some general health-promoting effects by green spaces are represented below (5.3.1) before then dealing with the effects on the different components of health (5.3.2 – 5.3.5).

Potentially negative health impacts of green spaces are mentioned in 5.3.6, and finally (in 5.3.7) factors, conditions or obstacles are addressed which decide whether green spaces are used at all and thus can have some health effect.

The italicized headings are each supported by the studies referred to in the individual bullets, and contradictory findings are mentioned.

5.3.1 Health-related ecosystem functions of green spaces

Health-related ecosystem functions have a positive impact mainly on physical health, and partly also on mental health. In contrast to the effects mentioned in 5.3.3 to 5.3.6, they are regardless of whether people see a green space or not. Nature conservation has been dealing with those functions for a long time in particular in the context of environmental assessment and landscape without explicitly mentioning health relevance.

Green spaces improve the city climate

- In contrast to undeveloped areas, the climate in cities is characterized by modified wind conditions and increased temperatures, especially during the night. This 'urban heat island effect' phenomenon can lead to health problems for heat-sensitive population groups. The vegetation of urban green spaces reduces this effect, since compared to the built environment it heats up less strongly or cools down more significantly at night. Green spaces from approximately one hectare thereby produce cold air flows in thermally stressed areas – to different extents, depending on wind conditions, topography and nature of the surrounding buildings – can lead to a reduction of the heat island effect (Bolund & Hunhammar 1999; Gómez-Baggethun & Barton 2013; Katzschner 2012; Kuttler 2004a, b; Nagel & Bellin-Harder 2008). In particular, this is relevant with regard to the expected climate change due to increasingly longer heat waves (Wilke et al. 2011).

Green spaces improve the air quality in cities

- Green spaces contribute to the improvement of air quality situation in cities[14], as vegetation filters out air pollutants and reduces the resuspension of particulates (Bolund & Hunhammar 1999; Claßen & Hornberg 2008; Gómez-Baggethun & Barton 2013; Nagel & Bellin-Harder 2008;) (Forum Die Grüne Stadt 2008).
- Green facades reduce the concentration of toxic nitrogen dioxide (NO_2) by 40% and the concentration of particulate matter (PM_{10}) by up to 60% (Pugh et al. 2012, p 7697).
- Trees filter oxides of nitrogen and other gaseous substances (Matzarakis and Streiling 2004). Airborne particles are particularly attached to conifers and deciduous trees with hairy and sticky leaves, before they are rinsed by rainwater (Flohr 2010).
- Not all vegetation leads to air hygienic effects: the closed canopy of densely planted street trees can lead to an accumulation of emitted air pollutants at ground level because the canopy complicates the exchange of air. In residential areas and other quarters with less traffic the effect of street trees is, however, assessed as fully positive (Merbitz & Schneider 2012; Pugh et al. 2012).

Green spaces can contribute qualitatively and quantitatively to regulate the water balance, groundwater recharge and to ensure the supply of drinking water

- Rainwater can be retained, stored and seep away in green spaces, which, especially during heavy rain events, relieves the sewerage and drainage system and thereby contrib-

[14] Numerous cities, emitters (transport, industrial, commercial, domestic fuel) are concentrated in a small space, so that cities are often characterized by a high exposure to air pollution, which can also lead to legal limits being exceeded (Katzschner 2012, Kuttler 2004)

utes to reduction of inundation and flood risk with their harmful consequences (Bolund & Hunhammar 1999; Gómez-Baggethun & Barton 2013).

- The storage of rainwater in green spaces and its purification by seepage into the soil also helps groundwater recharge and therefore also ensures a quantitatively and qualitatively sufficient drinking water supply (Bolund & Hunhammar 1999; Gómez-Baggethun & Barton 2013).

Green spaces can contribute to decreased noise perception

- Noise is one of the most important health risks in cities and can lead, inter alia, to psychological strain, stress, cardiovascular diseases, sleep disorders and cognitive impairments (WHO 2011). In fact, the noise-reducing effect of vegetation is low. A really measurable decrease in the noise level is possible only through thick and very wide wooded areas (Stich et al. 1992). Thus we get from ‘‘a 100 m wide strip of forest with dense undergrowth a level reduction of 5 to 10 dB’’ (Ministry of Urban Development, Housing and Transport of the State of Brandenburg 2001, p 124).
- Therefore, narrow shrub or tree planting does not really lead to measurable noise protection, but has a positive effect on the subjective noise perception – the noise source is not seen, the noise is less strong and disturbance less perceived (Ministry of Urban Development, Housing and Transport of the State is Brandenburg 2001).

Green spaces contribute to climate protection and thus have an indirect positive effect on health

- Vegetation and soil store carbon to varying degrees (carbon storage) and it is further bound (carbon sink), so that no climate-damaging CO_2 is released or removed from the atmosphere (Gómez-Baggethun & Barton 2013; MEA 2005, Wilke et al. 2011).

  Forests, marshes, wetlands and grasslands are particularly important here. Through a contribution to climate protection, a contribution to the reduction of the health burden effects of climate change will also be made.

5.3.2 General health benefits of green spaces

Green spaces in the living environment promote health

- In the Netherlands, about 250,000 residents were interviewed about their health (Maas et al. 2006). It turned out that green spaces in a radius of 1-3 km around the residence affect the general health positively. This is especially true for older people, children and people from low income groups. Stigsdotter et al. (2010) were able to confirm this with a study in Denmark (approximately 11,200 people). This involves examining both the quantity and quality characteristics of the role green spaces role in the assessment of personal health (in general, both physically and mentally), as van Dillen et al. (2011) shows in a study of 1,640 people in the Netherlands. Green elements on streets can also have significant positive effects.

The effects of green spaces varies with income and urbanity of residence

- The positive health effect of green spaces is stronger among people from lower income groups than those with higher incomes (Mitchell & Popham 2007, 2008). However, this is

influenced by the place of residence and with its urbanity. In England, Mitchell & Popham (2007) analyzed 32,000 records and came to the conclusion that the beneficial effects of green spaces in cities and urban areas exist in all income groups. In suburban and rural areas, however, people with higher incomes in 'green' living areas are not healthier than those who live in areas with less green. For people from low-income groups in suburban areas a higher number of green spaces was even negatively associated with health. The authors suggest that this may be related to the quality, aesthetics and accessibility of green spaces and the generally poorer health of residents of suburban low-income neighbourhoods.

5.3.3 Effects of green spaces on the aesthetic and symbolic component of health

People have an inherent preference for a variety of plant species

- A study by Lindemann-Matthies et al. (2010) refers to manipulative experiments, field studies and photo studies in Switzerland, showing that the aesthetic appreciation of an area increases with an increasing number of species.
- A 6-year-old already feels that a species-rich meadow is more beautiful than a species-poor one (Lindemann-Matthies 2009).
- Fuller et al. (2007) show in a study that high species richness (especially in plants, but also in birds) leads to increased mental well-being.
- In a study in England, Dallimer et al. (2012) carried out a questionnaire survey with a total of 1,108 park visitors. They found, in contrast to the findings just mentioned, that there is no uniform relationship between biodiversity and human well-being. Well-being decreases accordingly, even with an increasing number of plant species. The promotional affects on well-being contrast with the respondents' subjective feeling or perceived greenness of the environment, which often does not match reality.

Green spaces allow identification with a place

- Nagel & Bellin-Harder (2008) report in a study (Seeland & Ballesteros 2004) to what extent city dwellers use public green spaces for identification processes, in addition to the experience of nature and relaxation. At the same time, identification with close-to-home green is necessary in order to have a health effect.

5.3.4 Effects of green spaces on social health

Being in green spaces encourages social interaction and communication

- Frumkin et al. (2007) in a review of studies suggest that the sense of community increases in neighbourhoods when accessible and well-maintained public green spaces are located near the place of residence.
- Abraham et al. (2007) show that social interaction is promoted in attractive, accessible parks and community gardens that are rich in vegetation and sufficiently secure and therefore the users' ability to communicate is enhanced (Lee & Maheswaran 2011). Be-

dimo-Rung et al. (2005) report on studies showing that parks provide a space where social interaction can occur.

Social interaction in green spaces reduces feelings of isolation and loneliness

- Maas et al. (2009) examined social contacts and health of approximately 10,000 residents in the Netherlands in a study of the relationship between distance from home and the nearest green space. The results showed that a higher distance to green spaces is connected with feelings of loneliness and perceived lack of social support.
- Van den Berg et al. (2010) show in a study that older horticulturally active people feel less lonely and have more social contacts than 'non-gardeners'.

Being in green spaces promotes the integration of local residents

- According to the literature studies of Nagel & Bellin-Harder (2008) and Abraham et al. (2007), parks, green areas and community gardens near residences are significant for social integration because people from different social groups can come together there. This develops personal contacts and social networks, which in turn promotes the social competence of the residents and identification with the district.
- Seeland et al. (2009) show in a study of 437 students from Zurich that urban green spaces make a significant contribution to developing intercultural contact and friendships.
- Lee & Maheswaran (2011) show that access to green spaces goes hand in hand with better social integration of older people, and this positively affects their 'social capital'.
- Bedimo-Rung et al. (2005) describe places with trees as attracting more people than places without 'nature'[15].
- Kuo & Sullivan (2001) show in a study that in 'greened' areas of Chicago there is less crime than in other districts[16].

5.3.5 Effects of green spaces on mental health

Living in proximity to green positively affects psychological well-being and quality of life

- Based on 900 records from Australia, Francis et al. (2012) show that the residents of neighbourhoods with high-quality public space (e.g. safe, attractive and well-maintained) have less psychosocial stress than residents of neighbourhoods with poor quality public space. The quantity of public open space, however, was not associated with reduced psycho-social stress. In addition, the result was irrespective of whether the space is used or not.
- Lee & Maheswaran (2011) refer to a review of a study in urban areas in the Netherlands. This compared homes near green spaces with the occurrence of mental illness by evalu-

[15] Many studies talk about 'nature' without indicating precisely what exactly is meant by that. Often it seems to be a generic term for any form of 'green' (house plants, trees, lawns, parks, forests, etc.).

[16] Again, the question arises whether this is merely a correlation or causality. One explanation would be that members of the middle and upper classes prefer to live in 'green' neighbourhoods and the lower crime rate is not affected by the existence of green spaces.

ating medical records of 345,000 individuals. The number of cases decreased with a higher proportion of green areas at a distance of up to 1 km from the place of residence. The effect was particularly pronounced in children and people with low socio-economic status.

- Another Dutch study with 4,500 participants showed that people close to green spaces are less affected by life events that they perceive as stressful (Lee & Maheswaran 2011).
- Bedimo-Rung et al. (2005) describe that the proximity of parks to a college contributes to mental well-being of American students, as they provide space ‘‘to escape the campus’’. This aspect was more important than the social and recreational functions of the parks.
- Bedimo-Rung et al. (2005) report on studies that show that residents of smaller parks regard them as ‘‘the greatest source of joy’’.

Being in green spaces encourages the cognitive and emotional development of children

- Frumkin (2003) pointed out in a review that staying out of doors stimulates the ‘‘emotional, cognitive and value-based development’’ of children.
- Wells (2000) accompanied 17 children who moved to ‘green’ areas, and was able to show that their cognitive level and thereby their attention substantially improved.
- In a literature study, Nagel & Bellin-Harder (2008) suggests that children who live in the countryside are confronted with diverse emotions. They feel both positive emotions, such as joy and courage, and negative impressions, such as risk and uncertainty, so emotional development and self-reliance are promoted.
- Creativity, imagination, self-reliance and development of children and young people are particularly strongly stimulated in so-called nature experience spaces, that is, in only slightly modified, larger areas, which allow games and experiences close to nature (Brack et al. 2010, Reidl et al. 2005).

Being in green spaces encourages spiritual experiences

- In reviews, Frumkin (2003) and Newton (2003) note that green spaces can have a spiritually inspiring effect.
- An article by Richard (2011) describes the importance of urban gardens for spiritual experience. Thus, gardening strengthens attentiveness,

Sports in the open air enhance psychological well-being, self-esteem and mood (sometimes more than sports in built-up areas)

- A book contribution by Pretty et al. (2011) refers to studies that suggest sport in the countryside improves self-esteem and mood. While all types of exercise are useful, those with light intensity are most effective. Water plays a very important role since it promotes a particularly strong mental well-being. The strongest effects are found in people with mental illness, the least effects in the elderly (Pretty et al. 2011).
- In a review, Bowler et al. (2010) show that walks and sport activities in natural environments have more positive effects on the mood than in built environments.

- Mitchell (2012) shows in a study with around 2,000 people in Scotland that sporting activities in natural environments (especially forests, as well as parks and open spaces) reduce the likelihood of poor mental health. People who regularly go to the forest had their risk of bad mental state reduced by half.

  In contrast, mental well-being could not be significantly improved through sporting activities in natural environments. It is noteworthy that contrarily, in non-natural environments (sports grounds and sports and fitness centres) an improvement of mental well-being could be detected. This may be due to the fact that activities in non-natural environments encourage greater social interaction, which in turn positively influences the results of the mental health and well-being.

- Martens & Bauer (2011) were able to show with 138 people in a Swiss study that both extensive and intensive exercise in agricultural areas increases mental well-being more clearly than exercise indoors. Different effects of different agricultural land could not be found.

The viewing of 'green' and being in green spaces has stress-reducing, relaxing, balancing and calming effects

- Thompson et al. (2012) in a study using the biomarker cortisol (indicated stress level) showed that green spaces in the residential environment can reduce stress.
- In a study carried out in Denmark with approximately 11,200 people, Stigsdotter et al. (2010) show that people who travel frequently within green spaces feel subjectively less stressed than those who do not.
- Lee & Maheswaran (2011) describe a review of a survey of about 4,530 people, which was carried out in the Netherlands in various residential areas (urban, rural, urban-rural mixed). People who live in 'greener' areas indicated being less affected by stress-inducing events and being mentally healthier.
- Abraham et al. (2007) describe in a literature study that landscapes inter alia promote emotional relaxation and stability. Walkers in a forest have lower emotional stress levels than people who go for a walk in the city.
- Bedimo-Rung et al. (2005) report on studies with park users who were less anxious, less sad and in a better mood after the park visit, and felt the less stress the longer they stayed in the park.

Contact with 'nature' improves work performance and cognitive attention

- Contact with nature is related to reduced stress and improved work performance (by improving attention) (Frumkin 2003).
- Abraham et al. (2007) refer to the 'Attention Restoration Theory' of Kaplan and Kaplan (1989), which explains the possible influence of 'nature' on the restoration of cognitive attention. According to this, a relaxing environment has four characteristics: first, it enables people to take distance from everyday life; second, it draws attention to itself, without being exhaustive; third, new things can be discovered; and finally, it gives users the opportunity to satisfy their needs.

These features allow a reflection of personal goals and questions of life as close to nature perceived areas and thus contribute to maintaining or restoring mental attention.

- Hartig et al. (2003) describe a study with 112 students in which objectively measured attention rose slightly after a walk in a nature reserve, while it decreased after a walk in the city.
- Herzog et al. (1997) showed in a survey of 187 students in the USA that being in the open air promotes stronger recovery and self-reflection than being in urban built-up areas; this is because the latter generate too many stimuli.
- The review of Lee & Maheswaran (2011) shows through a study with 96 parents of children with attention deficit-(/hyperactivity) disorder (AD(H)D) that activities in the open air result in improved attention of these children.
- Thompson & Aspinall (2011) show in a literature study that residents seek green spaces, as they expect an improvement in their mental well-being. Physical activity is usually not so important, but comes with it.

Urban gardening has a positive impact on mental, physical and social health

- Van den Berg et al. (2010) show in a study with 120 allotment holders and 60 not horticulturally active people in the Netherlands that the allotment gardeners are more physically active. A large proportion of them (84%) met the national recommendations for physical activity, whereas this is the case for only 62% of the control group.
- According to a study by van den Berg et al. (2010), older active gardeners are healthier and feel more comfortable than older 'non-gardeners'.
- Gardens offer the possibility to grow one's own food, which is beneficial to diet and therefore to health (Pretty et al. 2011).
- Müller (2011) as well as Nagel & Bellin-Harder (2008) describe community gardening as promoting identity processes, the appropriation of public space and encounters in the city.
- Armstrong (2000) shows that community gardening promotes health, empowerment processes, as well as social interaction and integration of young and old as well as different cultures.
- Brack et al. (2010) describe in a review article that the experience of a garden and its design has a healthy effect.
- Working in the garden, for example dealing growth processes, promotes attention, mindfulness and patience. Contact with nature has a calming effect, reduces stress and stimulates the senses and spiritual experiences (Pretty 2004, Richard 2011).
- For the elderly, gardening provides temporal and spatial orientation through the experience of the change of the seasons or focusing on specific places and their spatial structures. Detweiler et al. (2012) show that it improves attention and perception, reduces stress and relieves pain.
- With children, gardening encourages the eating of fruit and vegetables (Castro et al. 2013).

- Moderately tiring physical outdoor work helps in the prevention of cardiovascular and mental illnesses. For these reasons, gardening is also practiced as an element of therapeutic measures (Hartig & Marcus 2006).

5.3.6 Effects of green spaces on physical health

Being in the countryside reduces the mortality rate (contradictory statements)

- Mitchell and Popham (2008) investigated over 366,000 death certificates in England and found that the presence of green spaces in residential areas is associated with a significant reduction in overall mortality. In particular, low-income groups have a significantly reduced mortality rate with increasing number of green spaces.
- Lee & Maheswaran (2011) refer to a study that was carried out in Japan over a period of five years, with approximately 3,100 people. It showed a positive association between residential areas with accessible urban green spaces and a decreased mortality rate for older city dwellers.
- Richardson et al. (2012) analyzed 49 American cities (with a total of 43 million inhabitants) in a cross-sectional study and demonstrated that there is no connection between the existence of green spaces and mortality from heart disease, diabetes, lung cancer or car accidents. The overall mortality rate was even higher in 'greener' cities. It should be noted that American cities are often urban sprawl with a high amount of green and the traffic is immense, with negative effects on the health of residents.
- Richardson et al. (2010) in New Zealand identified the same in a study of 1.5 million city dwellers. They could not find any association between mortality and green spaces (after accounting for interfering factors such as gender, age, socio-economic status, etc.).

Seeing 'nature' and 'green' leads to faster recovery after disease and reduces stress

- Miller et al. (2005) refer to a review of a study with hospital patients. Those who could see 'nature' from their room recovered faster, had a shorter hospital stay, needed less pain medication and had fewer post-operative complications than those overlooking buildings.
- Also, Maller et al. (2005) reported a study of prison inmates, some of which had a 'room with a (green) view' from their cell. They had fewer symptoms of stress and were less sick than inmates who did not have such a view from the window.

Seeing 'nature' reduces heart rate and blood pressure

- Pretty et al. (2011) in their book contribution quote various studies that show that viewing or being in 'nature' reduces heartbeat and blood pressure as well as stimulates the parasympathetic nervous system (provides peace and relaxation) and calms the sympathetic nervous system (provides motivation). These effects are however not sufficiently substantiated.

Being outdoors and in green spaces promotes vitamin D production by UV radiation

- Literature analysis in the report of Eis et al. (2010) and the book contribution by Pretty et al. (2011) show that 90% of vitamin D intake is produced by UV radiation, which is pri-

marily absorbed by being outdoors. Vitamin D increases the general well-being and immune defence (Eis et al. 2010) and is important for bone formation and cell proliferation (reduced risk of osteoporosis) (Asmuß & Baldermann 2012; Eis et al. 2010).

- Other relationships between UV radiation and health (e.g. cancer and cardiovascular diseases) are strongly presumed, but have not yet been sufficiently clarified and documented (Asmuß & Baldermann 2012; Eis et al. 2010; Pretty et al. 2011).
- Too intensive exposure to the sun can have negative effects caused by UV radiation, such as sunburn or increased skin cancer risk (Eis et al. 2010; Gießelmann 2012; Pretty et al. 2011).

Being in a forest increases immune defence

- Pretty et al. (2011) reported in a book contribution of a study that that being in a forest increases the activity of natural killer T cells (responsible for the immune system) and of intracellular anti-cancer proteins.

Biodiversity reduces the risk of developing allergies

- Hanski et al. (2012) show in a Finnish study that children being in areas of high biodiversity (rare native flower plants) significantly lowers their risk of developing allergies. This is explained by the presence of certain bacteria.

Sport in green spaces encourages the physical development of children

- McCurdy et al. (2010) describe in an article that the physical development and coordination of children is stimulated by free play and sports in green spaces.

Sports in the open air increases physical well-being

- Lee & Maheswaran (2011) point out in a review that sport in natural environments positively influences individual well-being.
- Abraham et al. (2007) show in a review that physical activities such as walking, hiking and fishing in well-equipped open spaces enhance physical well-being. Some studies show that forests in particular play an important role for this purpose.

Relationship of community-based green spaces and physical activity (contradictory statements)

- Groenewegen et al. (2012) describe in a review article that in different studies different results can be found on the relationship between residence near green space supply and exercise – depending on the study, this is described as positive, neutral or even negative. Thus, in the Netherlands there appears to be no relationship between the quantitative supply of green spaces and the time that is used for physical activity. The only exception: cycling for commuting purposes.
- In a Belgian study (van Dyck 2010) the social behaviour of 1,200 adults was investigated. Contrary to expectations, people spent more time sitting in walkable neighbourhoods (this can also include green areas) than people walking in poor neighbourhoods. This is especially true for men, younger, unemployed, highly educated people and people with clerical duties. In the same study, however, it was also shown that good walkable neighbourhoods are positively correlated with moderate to strenuous physical activity.

- In a study by Giles-Corti & Donovan (2002), approximately 1,800 individuals between 18 and 59 were interviewed in Perth, Western Australia. It turned out that individual and social environmental factors influence the motivation to be physically active more than the built or 'green' environment. This is necessary, but on its own not sufficient, to achieve the recommended level of physical activity.

Good accessibility, design and functionality influence physical activities in green spaces

- Lee & Maheswaran (2011) cite a study involving 2,650 adults in Australia, which shows that young adults (up to 35 years old) are physically active when they have access to public open spaces. The same was found in the USA in two studies with 1,550 girls and 1,320 adults (based on distance between home and green spaces) as well as in England, in a study with 6,820 adults.
- However, two studies from England with approximately 13,900 and 4,950 participants found no relationship between access to green space and physical activity (Lee & Maheswaran 2011).
- Kaczynski et al. (2008) show in a study of 380 adults conducted in Canada, that equipment features, especially paths, are crucial for physical exercise in parks, as well as their size and proximity to the place of residence.
- According to studies in the literature reviews by Abraham et al. (2007) and Nagel & Bellin-Harder (2008), good accessibility to green and open spaces, networked cycling and walking, mixed land uses, activity-promoting facilities such as playgrounds and sports facilities, as well as an aesthetically pleasing landscape, are all important for the stimulation of physical activity.
- A study by Giles-Corti & Donovan (2002) in Australia shows that access to attractive, public open spaces, noticeable paths, increased traffic and busy streets encourages walking and errands on foot.

Positive relationship between 'green' and health cannot be explained by physical activity

- Groenewegen et al. (2012) refer in an published article to several studies that have been carried out at national, municipal and local levels in the Netherlands. These show that less than 10% of the direct relationship between green space equipment and health indicators through activities such as walking and cycling can be explained.

5.3.7 Negative health effects of green spaces

Certain tree species and plants can trigger allergic reactions

- Bergmann et al. (2012) reported in a review that climate change may favour changes in pollen and the spread of invasive allergenic plants. Therefore, planting highly allergenic species should be avoided and allergenic invasive species (such as ragweed) specifically combated.

Animals can transmit infectious diseases (especially mammals and insects)

- Due to climate changes and strongly degraded ecosystems, the spread of infectious diseases by rodents and insects can increase, such as encephalitis and Lyme disease (Chivian & Bernstein 2004; Eis et al. 2010).

5.3.8 Requirements and obstacles of health-promoting effects of urban green spaces

The use of green spaces increases with the number of organized activities and events

- According to a study conducted in the USA by Cohen et al. (2009), the number of visitors to a park increases with the number of organized activities there, such as sports competitions.
- One of the studies cited by Bedimo-Rung et al. (2005) about obstacles of using parks showed that parks being closer to home and having a higher number of events could increase their use.

Safety and a sense of security are important factors that determine the use of green spaces

- Several studies by Nagel & Bellin-Harder (2008) show a positive relationship between the state and location of a park – aesthetics, amenities, accessibility, condition and safety – and its health benefits. These are detected, for example, on the basis of physical activity, obesity or depression (Diez Roux et al. 2010).
- A review article by Brack et al. (2010) refers to studies of women and children, showing that the sense of security and safe access decide how often green spaces are used. Open-plan green areas are perceived as safer than those with dense vegetation.
- Experts from different countries interviewed by Pikora et al. (2003) consider general security and safety in addition to aesthetics and functionality as important factors that positively influence walking and cycling in a neighbourhood.
- Abraham et al. (2007) suggest in a literature study that structural and design factors influence crime rates and the sense of security in cities (e.g. perceived extent of open space and the presence of grass and high tree density).
- Bedimo-Rung et al. (2005) show that places with a high proportion of trees and other vegetation inhibit crime, aggression and violence. Giles-Corti & Donovan (2002) found the same in a study in Australia.
- A study conducted in the USA by Cohen et al. (2009) found no association between the use of a park and the feeling of security among users.

Segregation by different user groups

- Brack et al. (2010) describe in a review article that certain user groups are displaced by different users and so claims of segregation can arise.

Crime and perceived dangers in green spaces prevent social interaction

- The Greenspace Scotland Guide (2008) warns that fear of crime can prevent visits to green spaces.

- Bedimo-Rung et al. (2005) noted that overcrowded, dangerous and noisy spaces can inhibit the formation of social neighbourhood relationships.

6 Integration of health aspects into the local landscape plan

Communal landscape planning is a suitable instrument to address health concerns in the context of nature conservation and urban development, although this is not one of their legally stipulated tasks. However, the protection of nature and landscape in § 1 BNatSchG is also justified in that they are the basis for life and human health. In this respect, there are three basic possibilities for different content and methodology intensity and coverage to systematically integrate the issue of health into landscape planning.

1. **Health as a subject of protection of the Strategic Environmental Assessment of landscape planning:** If a Strategic Environmental Assessment (SEA) is carried out for landscape planning under state law, the positive and negative impacts on health of the proposed objectives and measures of a landscape plan should be described. This avoids possible negative health effects, while positive effects of landscape planning for health can be identified. A separate planning approach, aimed explicitly at improving the health potential of green spaces, thus cannot be pursued.
2. **Health as a justification related to landscape planning objectives:** This option is similar to the first, but without the requirement to obtain an SEA. The aim is to set out the existing, but so far not explicitly named positive effects of objectives and measures of landscape planning on human health. Original health objectives and measures, such as to reduce health-related deficits of green spaces, are not addressed.
3. **Health as an independent subject of protection of landscape planning:** Here health aspects are not only tested or used as a further argument in favour of nature conservation and landscape planning objectives, but there are also continuously developed original goals and health promotion activities. From a health perspective, this is the preferred option, although landscape design thus enters largely uncharted territory. Nevertheless, individual existing plans show what can be carried out in terms of content and methodology, at least in a rudimentary form.

There are significant criteria that can be used to assess to what intensity it makes sense to address health in the local landscape plan. Ultimately, it remains the decision of the respective local authorities and planners to decide whether they want to an approach that goes beyond the obligations of the SEA.

Municipal landscape planning is suited to address health concerns for several reasons:

- It is precautionary and interdisciplinary;
- As a spatially comprehensive planning instrument it also has to explicitly deal with the settlement area [17];
- Its contents have to be considered by land use planning and other spatially relevant plans and projects that may have an impact on nature and landscape, whereby health concerns can also be incorporated into these;
- It can make propositions both on stress factors and on health resources, allowing it to treat health protection and health promotion alike[18];
- Many health issues can be relatively easy to ‘dock’ to existing contents of landscape planning, as they are already included in this, at least implicitly in a rudimentary form;

[17] An exception is North Rhine-Westphalia, where the scope of the landscape plan only refers to the the area outside of building zones for the purposes of planning law.

[18] The subject of health is understood holistically here: in the following, we no longer distinguish health protection and promotion aspects and consider them equally.

- It allows health-related surveys, assessments, objectives and concepts to be dealt with in the context of an existing instrument, so that no new instrument needs to be created (which are usually rejected by practitioners);
- Last but not least, according to § 1 BNatSchG it is the task of nature conservation, and thus landscape planning, to protect nature and landscape as a basis for life and human health.

In planning practice, apart from very few exceptions (e.g. landscape plan of the municipality Hohen Neuendorf), the issue of health has so far not been explicitly treated. If this is the case, it is done mostly in the context of the Strategic Environmental Assessment of the landscape plans which are a legal obligation in many German Federal states. However, most of the negative, potentially harmful effects of planning on people and their health, or its elimination or reduction, are mostly addressed in the landscape plan. Implicitly there has always been a reference to health issues in a landscape planning content (Chapter 4.1). This is especially true for the landscape-oriented recreation, but for example also for the protection of soil (healthy, pollution-free foods) and ground water (drinking water quality), or for the assessment of the landscape, where aesthetic effects of spaces are addressed. These extremely important human health aspects are rarely explicitly and systematically considered in connection with the issue of human health.

For a systematic integration of health-promoting aspects in landscape planning, there are three basic possibilities of varying intensity, scope and legal justifiability:

1. **Health as a subject of protection of the Strategic Environmental Assessment of landscape planning** – as a legally binding task, in the framework of the meaning of human health protection, primarily the impact of other landscape planning objectives on human health are addressed, but planning does not have primary health objectives and underlying corresponding justification relationships for the purposes of health care and promotion, therefore there is no active promotion of these interests.
2. **Health as a justification related to landscape planning objectives** – thus far only implicitly existing relationships between the objectives and measures of nature conservation and human health are openly and explicitly addressed. This is the landscape design that fulfils the mission to protect nature and the landscape as a basis for life and human health; this may require a health-related survey and evaluation for some propositions. A development of the original health-related objectives and measures is not possible.
3. **Health as an independent subject of protection of landscape planning** – as the most thorough and most complex way in which landscape planning explicitly formulates goals and measures for health protection and above all health promotion.

Within the framework of the Strategic Environmental Assessment, only the treatment of the subject of protection ‘human health’ is mandatory. Whether health should further be a topic of landscape planning should be left to the needs and opportunities locally, and thus left to the local decision makers. Certainly, the restriction on the treatment of the issue of health within the framework of the SEA is the least elaborate and cost-effective option. However, the effort it requires to refer to health as (further) reason for landscape planning goals should be manageable as long as no separate inventory and data collection is required. A recommendation

can be made that health aspects in landscape planning should be treated more intensively, the more the following statements apply (the list is not exhaustive):

- Health burdens frequently occur that are based on factors that can at least partially be influenced by landscape and urban planning, such as physical inactivity in children, heat or noise pollution in city centres. Also, under the aspect of environmental justice, there can exist an increased need for action in socially and medically disadvantaged districts or neighbourhoods, especially when these districts or neighbourhoods have a shortage of green spaces.
- Demographic change (ageing) and climate change are expected to strengthen certain disease patterns and health burdens in the future; their prevention and mitigation can be helped by landscape planning measures and concepts.
- Health issues are discussed in depth and supported by the population, and there is a high openness to the topic.
- If a municipality is a spa or a resort, or dependent on tourism in a particular manner, so the health aspects have a significant importance for its economic development.
- The positive effects of landscape planning measures for health promotion are so obvious that they should be considered in terms of an overall consideration of all relevant issues for urban development.

The different options are explained in detail below.

6.1 Health as a subject of protection of the Strategic Environmental Assessment of landscape planning

The processing of the subject of protection ‘human beings and human health’ is a minimum requirement to be met by all landscape plans, where they are a subject of a Strategic Environmental Assessment (SEA), as is the case in the majority of German Federal states.

However, this only includes an examination of positive and negative health-related effects of the plan on its own, so active health plan statements are therefore not targeted. Rather, the SEA, as well as landscape planning, especially treats (reducing) stressors such as noise, air pollution, bioclimatic stresses, water pollution, among other things. In this respect, overlaps exist here with the second variant (health as a rationale). In addition, adverse effects on townscapes and landscapes are discussed. Health aspects beyond the aforementioned impact factors are usually taken into account at most indirectly through other protected assets (see Crecelius 2010).

Nevertheless, examples can be found (such as in the SEA to the landscape plan of the city Bad Liebenwerda) where, in addition to the health, aspects of health promotion can be addressed and brought very easily into the context of landscape planning objectives and measures (see similarly applicable for landscape planning, the environmental assessment for the zoning of the city of Dresden, Schmidt 2013). The following table shows a selection of these examples (literal reproduction, highlighting by the authors of this report).

Table 4: Strategic Environmental Assessment for the landscape plan of the city Bad Liebenwerda: impact of selected measures on the subject of protection 'human beings and human health' (Stadt Bad Liebenwerda, Hemminger Ingenieurgesellschaft 2009)

Measure: Protection of existing hedges and rows of trees Impact on the subject of protection 'human beings and human health', 'landscape', 'cultural and other material goods': Drifts and soil erosion are reduced by binding of the vegetation, which can locally reduce the **particulate matter** (fine sands, dusts). Linear woodland structures enrich the landscape and increase the **recreational quality** of the corresponding natural areas. Old hedge structures including their path systems belong to historical cultural landscape elements. The population will find identification with them and a certain '**sense of place/home**'.
Measure: Preservation and creation of new reed beds and wet meadows Impact on the subject of protection 'humans and human health', 'countryside', 'culture and other material goods': Depending on area size and vegetation composition, riparian strips act as **nitrate sinks** and can thus contribute to minimizing their entry into **groundwater**. Thus, they make a **positive contribution to the subject of protection 'health'**. Depending on the growing season, the potential richness of native plants generates a variety of flowering displays that enhance the landscape and increase the **recreational quality** for the local population.
Measure: **Conservation and development of undeveloped town edges, preservation of woody plants** Impact on the subject of protection 'humans and human health', 'landscape', 'cultural and other material goods': The preservation of wooded areas and undeveloped town edges ensures a structured, lively townscape and landscape. In particular, fruit trees play an important role in the **visual and aesthetic appreciation** of municipal structures with their **flower display** in spring. This has a positive effect on the **quality of experience** of the settlements and the **identification** of the population with their settlements.

The working group 'Human Health' of the Environmental Impact Assessment (EIA) Association is currently working on a 'Guideline of protection of human health – for an effective health impact assessment in planning processes and authorization procedures' (EIA Association 2013, online; Hartlik 2013). In Crecelius (2010), there are indications of how deficits in the treatment of subject of protection health can be reduced in environmental tests (Table 5).

Table 5: Shortcomings and requirements regarding the processing of the subject of protection human beings and human health (according to Claßen & Hornberg 2008; Crecelius 2010, modified)

Deficits in the processing of subject of protection human beings / human health	Requirements for the processing of the subject of protection human beings / human health
• Database for public health in many cases inadequate	• Improve inventory data on the health of the population
• Legal limits are often not sufficiently precautionary • No legal pollution limits exist for several pollutants (e.g. dioxins)	• Orientation of legal limits to precautionary criteria • More research on cause-effect relationships between environmental factors and human health
• Cumulation effects of individual pollutants	• Synergies / cumulative effects and estimate chron-

usually not taken into account	ic / long-term effects of lower doses of pollutants considered in impact assessments
• Lack of an authority which comprehensively represents subject of protection 'human beings' in procedures • Health authorities not involved regularly, frequently and early enough in health-related plans • Cooperation between planning, environmental and health authorities often inadequate	• Early interdisciplinary integration of environmental and health ministries in planning procedures; improve cooperation • Building a network of experts together with the establishment of an internet platform on the topic 'human and the environment' and 'health impact assessment' (HIA)
• Health concerns often not sufficiently verifiable for time, financial, qualification and personal reasons	• Better human and financial resources as well as appropriate training of environmental and health authorities

6.2 Health as a reason for landscape planning goals

It has already been pointed out on numerous occasions that many objectives and measures of nature conservation and landscape planning have a positive impact on human health at the same time, or at least may have. However, this is hardly ever explicitly formulated in landscape plans; health effects remain mostly an unmentioned 'side effect' of landscape planning objectives and measures. In this approach, to take into account health aspects in landscape planning, the task is to explicitly mention implicit relationships between conventional nature conservation objectives and measures and human health; thus, ultimately the protection, care and development of green spaces, or by 'nature in the city', can also be justified by health arguments. Thus, landscape design proves that it actually meets the legal mandate to protect nature and landscape as a basis for life and health of the people. In this manner, firstly, health aspects can be emphasized and strengthened in their importance, secondly, it can be shown that conservation serves not only animals and plants, but above all people.

Methodologically, this variant requires a survey and evaluation of health-related characteristics of specific green spaces (Chapter 5.2) as well as the health 'side effects' of landscape planning objectives and measures – with the latter can at least qualitatively often be derived from general contexts (see Table 6). In individual cases, the identification of conflicts and measures for their solution may be useful (Chapter 4.2). Original health objectives and measures to reduce health-related deficits of green spaces are not involved. Table 6 illustrates positive health-related side effects of targets for the development of individual natural of protection which can acquire different meanings in each planning case.

Table 6: Examples of health-related side effects of the objectives of nature conservation and landscape management

Objectives of nature conservation and landscape management	**Health-related side effects**
Biological diversity	

• Conservation of biological diversity in terms of species, biological communities, habitats and ecosystems	• Health promotion, because biodiversity is considered beautiful, and thereby enhances welfare (aesthetic appreciation) • Health promotion/enhancement of well-being by characteristic, natural area typical habitats and species as potential for identity formation (e.g. crane in Brandenburg 'Stork village') • Provides ways to reduce the spread of vector-borne diseases.
Water	
• Protection of groundwater and surface waters from pollutants	• Protection of human health by preventing the contamination of drinking water
• Conservation and development of water areas	• Health promotion/enhancement of well-being through positive bioclimatic effects during the day (cooling) as well as positive impact on humidity • Health promotion/enhancement of well-being due to special attractiveness of water bodies for recreational use • Health promotion/increase in mental well-being through mental relaxation and stress reduction
• Protection of groundwater resources • Conservation of groundwater and surface water: preventing artificially induced lowering of ground water or lowering the water level	• Protection of human health by quantitative ensuring of drinking and industrial water supply
Climate/Air	
• Protection of bioclimatic compensation function	• Health promotion/enhancement of well-being through the preservation and development of bioclimatic comfort islands and cold air producing areas / cold air corridors • Protection of human health through prevention, reduction or elimination of bioclimatically negative areas • Protection of human health through early consideration of bioclimatic stress increase due to climate change
• Protection of air quality compensation function	• Health promotion/enhancement of well-being through the preservation and development of fresh air forming regions / fresh air corridors • Protection of human health through prevention, reduction or elimination of areas with air-hygienic nuisance (e.g. by heavy traffic) and areas with a lack of ventilation (in some cases through a closed canopy through which pollutants can accumulate in the street area) • Protection of human health through early consideration of

	increased air hygienic nuisance due to climate change
Soil	
• Protecting the retention function and the soil function 'compensation body in the water cycle'	• Protection of human health by storing, infiltration, evaporation of precipitation and flood water
• Protecting its filtering, buffering and substance conversion function	• Protection of human health by avoiding adverse health contamination of soil, groundwater and drinking water • Protection of human health through remediation of contaminated sites and, as a result, improved groundwater protection
• Protection of the natural yield function	• Protection of human health by ensuring the natural conditions for food production
• Protection of the archive function of geotopes	• Promotion of recreation and regional identity through perception of natural and cultural historically important, rare, typical geotopes
Diversity, uniqueness and beauty of nature and landscape, open-space recreation	
• Protection of landscape and recreational function	• Increase well-being through the preservation and development of natural, semi-natural and cultural characteristic landscape elements and green spaces, promote regional identity through visibility of local, historical elements • Protection and improvement of human health through prevention, reduction or elimination of factors impairing recreation (in particular acoustic, visual, olfactory, as well as pollution of soil, water, air) • Health promotion/enhancement of well-being by preserving and developing the accessibility of green spaces • Health promotion/enhancement of well-being through the preservation and development of various types of green space for the highest possible health-promoting diversity of use (exercise, interaction, relaxation and regeneration, nature experience, etc.)

Lehnes et al. (1997) suggest similarly that the impact of projects on the abiotic protected assets and consequently on human health must be considered more than ever. In contrast to the classification in Table 6, they reverse the cause-effect relationship, so they do not put the nature conservation objectives first, but rather the health effects of nature conservation and thereby initiate protection and development of abiotic goods into broader society interests, namely also health.

For example, the protection of groundwater against pollutants is seen as deriving from the primary objective of protecting human health. Groundwater protection is therefore not an end in itself, but an assurance of a clean drinking water supply is needed (Table 7).

Table 7: Relationship between primary and secondary objectives (Crecelius 2010, p 106 modified slightly)

Derived (protection) target (abiot-	**Primary goal behind regarding subject of protection human beings**
• Protection of groundwater against pollution	• Protection of human health through prevention of drinking water contamination

• Protection of climate	• Protection of human health and well-being by reducing air pollutants and promoting pleasant climate conditions (temperature, humidity etc.)
• Protection of cultural goods	• Promotion of recreation and regional identity through perception of historical elements and undisturbed historic ensembles
• Compensation body in the water cycle	• Retention of precipitation (thereby possibly protect the population against floods)

6.3 Health as an independent 'subject of protection' of landscape planning

The most comprehensive and most thorough way to integrate the issue of health into landscape planning is to treat them as a separate subject of protection or to treat it at least as an explicit part of the subject of protection recreation. This would not only identify, assess and present the health effects of green spaces, but also develop aims and measures to improve appropriate building potential. This is not legally mandatory, but can be useful for various reasons, e.g. reduction of urban heat as a result of climate change, adaptation to demographic changes, improvement of the quality of landscape-related recreational opportunities and thus overall increase the quality of life in a town or community.

The development of methods for concrete implementation of this approach could not be achieved within the framework of the project. As a starting point for reviews, which will always be more locally specific, the criteria and characteristics listed in Chapter 5 can be used. Of particular importance (compared to the established contents of landscape planning in the case of 'subject of protection health') is the consideration of socio-spatial factors[19]; this is because the health-related potentials and effects of green spaces as well as their evaluation and promotion depend heavily on user-specific requirements. Regarding the 'target dimensions' of nature conservation referred to in § 1 BNatSchG, the tangible features (health-related ecosystem functions) and intangible features (experience and perception of nature and landscape) in particular are of significance for human health (see Bruns et al. 2005; Mengel 2011).

In addition, the following points should be noted:

- Health is explicitly integrated into all phases of plan development, to ensure that it is treated consistently and stringently at every step.
- If necessary, health-related content is also cartographically represented, for which appropriate plan symbols should be developed.
- The qualitative and quantitative supply of the population with green spaces and access to nature experiences should be addressed. Quantitative studies (supply values, distances) are used to analyze the supply situation and, if necessary, their improvement, qualitative analysis address the existence of different green space types (forest, park, playground,

[19] 'Socio-spatial factors' refer to the spatial distribution of the population according to socio-structural characteristics, such as origin, age, income or education.

fallow, etc.), as well as the actual suitability of specific green spaces for health promotion, their usability and spatial networking. Since some spatial differences can be determined in this way, issues of environmental justice can thereby also be discussed.

- Content should be a 'recreation and exercise composite' aimed at an overall citywide level, under which existing green spaces are designed and complemented to create a network. This should consist of multifunctional green and open spaces with high amenity value as well as path connections that at least partially may overlap with parts of an integrated habitat network. The aim is therefore not a large continuous green space for the whole city, but the connection of different sized green spaces with different functions by linear green structures, such as clearly demarcated pedestrian and cyclist routes safe from the road, which also have connections to highly frequented locations. This can increase the attractiveness of walking and cycling, and thereby promote daily physical activity. The activities with 'recreation and exercise composite' see themselves as a counterpart to the biotope network, and can be superimposed where possible without conflict.
- Health is one of many 'subjects of protection' and therefore included in the same way as all the others in the analysis and solution of nature protection objective conflicts. It is not per se a priority over other matters, such as species and habitat protection.

Table 8 shows other contents that work in municipal landscape plans beyond the aforementioned higher-ranking aspects in a systematic and explicit integration of the topic of health in the various planning stages.

Table 8: Possible health-related content in municipal landscape plans (not exhaustive)

Information on health-related aspects of the existing and anticipated state of nature and landscape (inventory and assessment)
Existing and expected health-endangering factors / health stressors, e.g. areas with • Noise pollution • Air pollution • Bioclimatic deficits • Contaminated soil, contaminated sites • Flood hazard • Adverse effects caused by vibrations • Adverse effects caused by electromagnetic pollution • Adverse effects caused by artificial light • Temporarily increased pollen / 'allergen centres' (increased occurrence of birch, hazel or uncut meadows, etc.)

Existing and expected health-promoting potential of green spaces (criteria see Chapter 3.2) such as the designation of special suitability and/or deficit areas for

- Health-related ecosystem functions, e.g. fresh and cold air producing areas, as well as ventilation corridors, particularly quiet areas, etc. (see Table 5).
- Exercise
- Social contact and interaction
- Integration of people of different cultures, ages, handicaps, etc.
- Nature-based recreation
- Quiet recreation
- Creative activities in green spaces
- Independent gardening and harvesting
- Active participation in the design and maintenance of green areas

Additional health-related information for the assessment:

- Existing and anticipated situation regarding health of vulnerable groups (e.g. older, disadvantaged groups, migrants) or other selected target groups (children and young families) for the purposes of an analysis of user-oriented needs and user-specific needs
- Considering the increase of bioclimatic stress situations caused by climate change

SWOT analysis (for integrating environmental justice issues) by superimposing

- Residential and recreational areas of health-vulnerable groups, or other selected target groups
- Areas with health stressors and health-promoting potential

Specific health-related goals of nature conservation and landscape management, including requirements and measures for the implementation of health-related goals

Avoidance, reduction or elimination of negative health factors inside and outside of green spaces, as well as health-related impairments of nature and landscape

Protection, quality improvement and regeneration of soil, water, air and climate

Conservation and development of diversity, uniqueness and beauty and the recreational value of nature and landscape by health-promoting green spaces in populated and non-populated areas (for characteristics of health-promoting green spaces see Chapter 5.2).

Providing spatial conditions for exercise, such as

- Walking, jogging, Nordic walking; hiking, etc.
- Cycling, inline skating, pushing prams, wheelchairs or walkers, etc.
- Motion games (such as climbing and balancing, trampolining, kite flying, catch, ball games, bowling, fitness, yoga, Qi Gong, aerobics, etc.)
- Water related exercise like rowing, canoeing, sailing, surfing, bathing, swimming
- Skating, curling, cross-country skiing, sledging
- Outdoor draughts/chess

Providing spatial conditions for social contact and interaction:

- Recreation areas, picnic areas and car parks, areas without defined use
- Attractive meeting places across cultures, generations and user groups

Providing spatial conditions for outdoor recreation (nature experience)

- for quiet recreation (relaxation and regeneration) e.g. through possibilities to linger, reading/writing, drawing/photography, for observing nature (vegetation, animals, waters), people, as well as enjoying views
- for creative activities in green spaces
- for independent gardening and harvesting
- active participation in the design and maintenance of green areas

Designation of a citywide 'recreation and exercise network' • Connection of health promoting green spaces as the main areas (core areas) and other open spaces (e.g. pedestrian zones, squares) with paths (footpaths and cycle tracks, possibly even on roads with little traffic), possibly also ecological network axes as connecting elements, in addition combined with public transport (including any stops)
Development of a concept for the adequate supply of different health-promoting green spaces for the population • Supply analysis in terms of (selected) user groups and different green spaces (playgrounds, sports fields, parks, etc.) • Consideration of different spatial levels from individual free space at the local level up to the citywide level

In practice, no examples of landscape plans that take full account of health aspects are so far known to the authors of this report. Initial signs can be found in the landscape plan of the city Hohen Neuendorf (draft December 2010)[20]. These are now presented briefly in conclusion.

In the chapter 'Open-space recreation' (p 93), health is treated as an aspect that must be considered in the assessment and planning of open spaces (**emphasis** by the authors of this report):

Table 9: Health-related information in the landscape plan of the city of Hohen Neuendorf - 1

Values for open space recreation and derived objectives and measures For the public interest in recreation provision, the following has generally to be considered: Residential and living environment function of open spaces ▪ Reducing fragmentation effects (including by interconnecting routes and recreational areas) ▪ Eliminating adverse effects on the townscape and landscape ▪ Conservation and development of green and recreational areas in residential areas and residential area boundaries (**healthy** living environment, after work recreation) ▪ Maintaining and improving climate conditions optimally on the basis of a climate report (air corridors, cold air paths, etc.) ▪ Greening of residential areas (reduction of heat stress, humidity) ▪ Promotion of non-motorized individual transport (cycling and walking) ▪ Clean air planning (including more restrictive requirements for local heating plants) ▪ Reduction of possibly **hazardous** radiation / electromagnetic pollution ▪ Considering **health-promoting** aspects of re-planning parts of residential areas (distance from noise sources, climate aspects) On the individual points a close relationship with the subject of protection human beings and **human health** can be seen

In the chapter 'Open space structures / green area supply' (p.95 ff), objectives and measures are also justified by health arguments. It also discusses relevant use claims.

Table 10: Health-related information in the landscape plan of the city of Hohen Neuendorf - 2

[20] City Hohen Neuendorf, Fugmann Janotta office for landscape architecture (2010): available online at http://www.buergerplaene.de/landschaft/bericht (accessed on 24.05.2013)

The importance of urban green is very closely linked to demographic development. It increasingly requires parks near to residential areas and green spaces in the city that can be reached even with low mobility and meet a variety of aesthetic, ecological and social functions. (p 103)

Central City Park

The conclusions of the draft landscape plan of the city of Hohen Neuendorf give great significance to inner city green space for the care of the residents and their different usage demands on open spaces, as well as the image of a town like Hohen Neuendorf. (p 103) …
Notable individual measures are:

- Provision of play areas for young and old
- Creation of a large multi-functional 'gymnastics meadow' for individual exercise and leisure activities such as kite flying, Qigong, etc., space for cultural events such as open-air concerts, etc.
- Designation of an integrated public park in the Land Use Plan (LUP)

Small Park on Rosenthaler Street

In the study of the green network the site was proposed as a neighbourhood park and the following recommendations made, which join the landscape plan:

- Transformation to publicly accessible and qualitatively appealing green area (neighbourhood park) along the railway line
- Integration of user possibilities for different age groups
- Creating a lookout point with sightlines
- Change of use designation in LUP: green space / park, including land acquisition
- Connection via narrow green corridors to the north and west

Niederheide active forest

The existing pine forest in Niederheide represents a green network between Stolper Heide in the south and Briesetal; it is therefore of great significance locally for humans and animals. Moreover, the area has an important function for the ecosystem and for human health by acting as a climate corridor.

Since the sports facility development concept for Hohen Neuendorf is looking for landscapes in which sports can take place, Niederheide active forest should be equipped with a fitness trail and a jogging route. A route concept has a high priority, since the areas for near-residential recreation are currently barely usable. It is important to create a way of connection Rosenthalerstraße to Havelstraße (Niederheide), as a link of a planned east-west interconnection between Havel and Mauergrünzug to Bergfelde.

In detail

- Important element in the active hot spot concept
- Attractive opportunities in recreational sports such as fitness trail, jogging route
- Fundamental acknowledgement as a forest area in the LUP
- Protection of public use, recreational forest
- Possibly designation of the bottleneck between Niederheide sports facility and the Niederheide residential area north of the Goethestraße as a public green space, because the area has become too narrow for economic forest use or for redesign as an ecological forest and development of forest edges.
- Replanting with deciduous trees to create a city forest, furnishing with seating, etc.

Chapter 4.4 is devoted exclusively to human health, but in terms of SEA of landscape planning and limited to health (noise, air pollution).

7 Conclusions and future outlook

The previous chapters have shown that there are many points of contact between health concerns, especially health promotion, on the one hand, and urban nature conservation and its planning instruments, on the other hand. Many green spaces exert positive effects on human health or have at least the potential for this. At the same time they can be of great importance for urban nature conservation, in particular, the protection and development of biodiversity, although it should be noted that 'City Green' and 'biodiversity' do not equate per se. After all, the actual contribution of green areas to the conservation of biological diversity is critically dependent on its species features, use intensity, location and other site conditions. Similarly, conflicts between health promotion and nature conservation interests can arise in individual cases; however, they will usually be resolved with the help of different strategies. Against this background, a central part of this report is Chapter 5 'Work materials'; this provides materials for practitioners in administrations, planning offices and associations that can help them to take into account health aspects more than ever in the context of urban nature conservation and urban open space planning. Substantial parts of this chapter are based on suggestions from workshops in the four participating municipalities (Eckernförde, Leipzig, Munich, Norderstedt). Moreover, it is stated that, and in what ways the topic of 'health' can also be integrated into the formal instrument of local landscape planning.

Firstly, the report provides a solid argumentation base for the discussion of 'nature in the city' and urban green spaces and their health benefits. Secondly, arguments for and the first methodological approaches for the consideration of health promotion in landscape and open space planning are delivered. At the same time this implies enhanced cooperation between actors from urban nature conservation, landscape and open space planning on the one hand, and the health sector ahead of the other. This indicates that for the implementation of the proposed consideration of health issues in the framework of urban nature conservation, there is a need for both practical action as well as a need for further scientific research which could not be handled within the framework of this project.

Both the health sciences as well as (research on) urban nature conservation and landscape and open space planning are application-oriented disciplines, aimed at practical implementation of results on the ground. Therefore, research and practice-oriented action in these disciplines are often interlinked, and many research questions can be best answered in close cooperation with the respective practice. Therefore in the following there is no strictly separation between research and action; the sequence rather describes a gradient from basic scientific research to requirements for already affordable steps in community practice.

7.1 Basic scientific health research requirements

Although numerous studies have demonstrated the positive effect of urban green spaces on human health, there are also individual research results that cannot prove clear relationships (e.g. see Dallimer et al (2012) on the question of the relationship between species richness and well-being; Richardson et al (2012). on the issue of the relationship between mortality and urban green facilities). Presumably the many links between green spaces and health are too complex to describe with clear causal relationships between a few variables. Further in-

vestigations would be helpful here, including resolving the contradictions of the present research findings.

Other studies that address the relationship between health and urban green spaces are often so complex that causalities cannot be clearly determined. Often, cross-sectional studies are carried out, which can only detect associations. Thus, it remains unclear whether urban spatial green facilities contribute to improved health status or whether this is not due to other (socio-economic) factors, especially material prosperity, which enable people to live in a 'green environment' (e.g. Francis et al. (2012), which demonstrates lower psychosocial stress for residents from urban neighbourhoods with high quality open spaces). Such assumptions are strengthened by the findings of Giles-Corti & Donovan (2002), according to which individual and social environmental factors strongly influence the motivation to be physically active, rather than the quality of the spatial environment. Aspects of behavioural prevention (e.g. motivation) were not considered in this report because they were not the subject of research, but they play an important role in health promotion. There is therefore need for further research on differentiated weighting of the health-promoting importance of individual and social factors on the one hand, and urban-spatial circumstances on the other. In addition, long-term studies could help to understand the causality of the underlying relationships between 'Green and Health'.

While there are numerous qualitative studies on the relationship of green spaces and human health, research is also necessary with regard to quantitative evidence on the subject. Initial studies exhibit individual quantitative effects (e.g. Thompson et al. (2012) show that green spaces have a stress-reducing effect on the basis of the hormone cortisol, which is used as a biomarker for stress). Overall, however, there is considerable need for further quantitative evidence of the health-related effects of nature and landscape.

7.2 Practice-oriented research requirements

The practical need for research relates to urban nature conservation, landscaping, open space and urban planning, as well as interdisciplinary topics that are to be treated together with medicine, health and possibly social sciences, but especially with the participation of local practice, or at least in close contact with it. In this way solutions can be tested and, if necessary, improved. The open questions which came up in the scope of this project are listed as bullet points below.

- Studies on use requirements of different population groups in terms of urban open spaces and green spaces: this can help to create needs-based green spaces, while taking into account that findings of such studies cannot replace the involvement of the potential users.
- Monetization of green health benefits: As part of the international discussion on ecosystem services, and therefore often closely linked issue of economic valuation of such benefits, a determination of the effective economic effects of the health effects of green spaces could help to increase their social and political appreciation. It should be noted, however, that many ecosystem services cannot be validly assessed in an economic way (thus far and probably in the future) without thereby being insignificant.

- Practicability and health scientific basis of reference values for the provision of green-space: the variety and diversity of existing and applied reference values for green space for the population raises questions about their justifiability, healthy scientific foundation, application and acceptance; these questions should be answered by in-depth research projects.
- Practical testing and evaluation of consideration of health aspects in landscape planning: in this way, the proposed measures in Chapter 6 for active planning consideration of the topic of health in municipal landscape planning practice could be checked, modified and further developed. Among other things, an examination of what data is required for this purpose, in what way they were collected or are based, how they can be used and processed in detail, and how to deal with potential adverse effects resulting from their use. Falling property or rental prices in less health-promoting districts are addressed here. Last but not least, possibilities for cooperation of stakeholders in landscape planning and public health can be developed.
- Determination of ways to integrate health promotion into other planning instruments: this in particular concerns municipal development planning (land-use planning and zoning planning), by which corresponding goals of landscape planning become legally binding in most Federal states. In addition, the protected area categories 'Landscape Protection Area' and 'Nature Park' seem to be particularly suited to address aspects of health promotion as many of these areas are designated because of their special importance for recreation. Whether and to what extent this is actually the case, and in what way health concerns can be reflected in the reserve regulations, is so far unclear.
- Development of the best solutions for connecting urban nature protection and health promotion: this can both relate to the inclusion of certain target groups (health-risk groups; especially vulnerable groups; groups with special needs) as well as sub-regional or citywide concepts and approaches; for example, in the improvement of green facilities in socially disadvantaged neighbourhoods, promoting physical activity on the way to work or to school, or of conflict resolution between the protection of biodiversity and of the health promotion in particularly valuable nature conservation areas.

7.3 Action required in community practice

In municipalities there is already the possibility for cooperation between health-promotion and urban nature conservation as well as landscape planning. To make this good and successfully, to combine the themes of health and conservation more, and also to convince decision makers and the population, the following points are of particular importance:

- Development and improvement of communication between the specialist administrations involved as well as establishing new collaborations in addition to conservationists, landscape planners and health professionals; for example, involving schools, local initiatives, sports authorities and associations, health insurance companies or tourist offices, and in particular town planning. It is essential here to raise the profile of the significance of urban green spaces for human health in the focus of urban planning.

- The objectives and measures of health promotion have to be specified with regard to content and method so that they are represented and integrated in landscape and land-use planning documents. It is necessary to systematically address the health-related aspects of specific spatial situations as well as to formulate requirements for the health-promoting design of green spaces. For this purpose the 'working materials' presented in this report should provide support.
- Finally, the context of the topics of nature conservation, recreation, physical activity and health also has to be conveyed to the population. Possibilities for this include shared campaigns of planning, nature conservation and health authorities, target group specific educational programmes, and many more. On the one hand, the acceptance of green spaces particularly valuable for nature conservation are promoted in the city, and on the other hand people are motivated to actively participate in the design of their city or living environment. However, the necessary structural conditions for participation as well as the political will to take account of 'citizens' votes' must be present for such an ambitious goal.

Lastly, it remains to be noted that the use of synergies and solution of potential conflicts between urban nature conservation and health promotion can offer considerable opportunities for both sides. Exploiting these opportunities is undoubtedly not a foregone conclusion and also fraught with difficulties. Nevertheless: ''the 'healthy city' … can only be understood as an interdisciplinary task and as the product of a concerted effort of many actors'' (Klages 2012, p. 333).

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