Int J Public Health (2010) 55:59–69
DOI 10.1007/s00038-009-0069-z

REVIEW

Landscape and well-being: a scoping study on the health-promoting impact of outdoor environments

Andrea Abraham · Kathrin Sommerhalder · Thomas Abel

Received: 10 January 2009 / Revised: 10 June 2009 / Accepted: 27 June 2009 / Published online: 19 September 2009

Abstract
Objectives The present literature review conceptualises landscape as a health resource that promotes physical, mental, and social well-being. Different health-promoting landscape characteristics are discussed.
Methods This article is based on a scoping study which represents a special kind of qualitative literature review. Over 120 studies have been reviewed in a five-step-procedure, resulting in a heuristic device.
Results A set of meaningful pathways that link landscape and health have been identified. Landscapes have the potential to promote mental well-being through attention restoration, stress reduction, and the evocation of positive emotions; physical well-being through the promotion of physical activity in daily life as well as leisure time and through walkable environments; and social well-being through social integration, social engagement and participation, and through social support and security.
Conclusion This scoping study allows us to systematically describe the potential of landscape as a resource for physical, mental and social well-being. A heuristic framework is presented that can be applied in future studies, facilitating systematic and focused research approaches and informing practical public health interventions.

Keywords Landscape · Well-being · Health-promoting behaviour · Resources · Scoping study

A. Abraham · K. Sommerhalder · T. Abel (✉)
Division of Social and Behavioural Health Research,
Department of Social and Preventive Medicine,
University of Bern, Niesenweg 6,
3012 Bern, Switzerland
e-mail: abel@ispm.unibe.ch

Introduction

An appealing landscape contributes to people's health. From a health promotion perspective, this popular and general statement about landscape provokes a number of questions on the more specific links between outdoor environments and health. One might ask how landscape can promote health in its different dimensions, i.e. physical, mental, and social well-being? How should landscapes look like to promote people's health? And who might benefit from a health-promoting landscape? There are three major challenges in addressing these questions.

First, "landscape" as an analytical term is difficult to define. The European Landscape Convention (Council of Europe 2000) currently defines landscape as 'a zone or area as perceived by local people or visitors, whose visual features and character are the result of the action of natural and/or cultural (that is, human) factors' (Art. 1). According to the CE's convention, landscape develops in a procedural manner through the interaction between nature and human beings. This is clearly different from former landscape definitions which were influenced by a strong nature/culture dualism and an environmental determinism (Ingold 1992). Furthermore, landscape can be imagined as a continuum between "wild" nature and designed environment such as urban and rural forests, green spaces, parks, gardens, waters, and neighbourhood areas.

Second, in relation to health and well-being, open questions remain concerning pathways of conscious perception of the environment: How is landscape perceived, experienced and used as a resource for healthy behaviour? Empirical as well as theoretical work suggests that landscape is linked to a dual perception. On one hand, landscape is experienced physically in a multisensory manner, in particular through sight, hearing, touching, and

smelling: Landscape, from this perspective, is a conglomerate of different types of "scapes", such as soundscape (Adams et al. 2006; Atkinson 2007; Carles et al. 1999; Ge and Hokao 2005; Gidlöf-Gunnarsson and Öhrström 2007; O'Connor 2008; Raimbault and Dubois 2005; Yang and Kang 2005) and smellscape (Porteous 1990). On the other hand, landscape is also a matter of individuals' perceptions and trajectories: this means that landscape as an analytical concept is characterised by an inherently dialectical relationship between physical reality and metaphoric and social construction. The same landscape can, from this point of view, be perceived completely different. The explanation for this lies in the fact that landscape is linked to meaning, identity, attachment, belonging, memory, and history (Augenstein 2002; Davenport and Anderson 2005; Frumkin 2003; Oreszczyn and Lane 2000; Parsons and Daniel 2002; Rishbeth and Finney 2006).

Third, although a relatively large body of multidisciplinary evidence exists about the health-promoting impact of landscape in industrialised countries (St Leger 2003; Maller et al. 2006), current evidence seems too scattered to draw any specific or sound conclusions. The challenges of a literature review are the lack of consistent definitions and systematic concepts in this research field. With a methodological approach called "scoping study", we aim at overcoming these challenges and to map out criteria for landscape as a resource for better health and well-being.

The scoping study presented in this paper is characterised by its resource-oriented perspective on the links between landscape and health. It is focused on human perceptions and behaviours related to different characteristics of landscapes and does not include studies on environmental risks for health. To our knowledge, no such focused review is available today. Current literature reviews on landscape and health focus either on the links between "wild" nature and health (Frumkin 2001; Health Council of the Netherlands 2004; Maller et al. 2006) or between the built environment and health (Jackson 2003). Our main interest, however, lies on the spaces of landscape which are situated between "wild" nature and built environment.

Against this background, this paper first provides a scoping study of publications on the health-promoting influence of landscape. Second, drawing on this overview, we propose a new heuristic framework to link landscape and health in a way that is amenable to health promotion research and practice. The current findings illustrate how the three dimensions of health—physical, mental and social well-being—are promoted through designed, constructional, and aesthetic aspects of landscape. The results of this study might be used as a basis for specific research projects and interventions that address landscape as a health resource.

Methods

As a particular method in qualitative literature reviews, scoping studies have distinct characteristics (Arksey and O'Malley 2005; Badger et al. 2000). Unlike systematic reviews, they address broader topics and topic areas, in which many different study designs might be applicable (Arksey and O'Malley 2005). This approach was suitable to identify the relevant and often non-standardised pieces of evidence of the health-promoting effects of landscape. Table 1 displays the major characteristics that were followed in the present study:

Five steps were involved in collection, evaluation, and presentation of the literature. First, we defined the research focus as well as specific inclusion and exclusion criteria for the literature search. By focusing on the links between landscape and physical, mental and social well-being, we included all literature presenting theoretical or empirical approaches on a health-promoting impact of landscape. We only included studies from industrialised countries and excluded all literature focused on environmental hazards (noise, air pollution, etc.) and their pathogenetic impact, as well as studies on agricultural use of landscape which are related to food, foodscapes, and material well-being. Foodscapes have been excluded here because they refer primarily to the distribution of commodities. As such they are directly linked to retail mechanisms and market structures which make them distinctly different from our conception of landscapes.

Table 1 Characteristics of scoping studies according to Arksey and O'Malley (2005)

- Identification of all relevant literature regardless of methods and study designs applied
- Non-linear, iterative, and reflexive process
- No quality assessments of studies reviewed
- Presenting account of existing literature with an analytic framework or thematic construction
- 5-step framework

1. Definition of research focus, inclusion and exclusion criteria for the literature search
2. Identification of all relevant studies, literature reviews and reports in electronic databases, key journals, reference lists of earlier studies, and topic-related expert networks and organisations with selected key words
3. Selection of literature to be closely reviewed in a comparative and consensus orientated team process, determination of further inclusion and exclusion criteria
4. Full-text reading and charting of literature in a descriptive-analytical way
5. Collation, summary, structuring and report of reviewed literature

Second, all relevant original studies and literature reviews from peer-reviewed journals and scientific reports were identified in the following sources:

- electronic databases (Web of Science, Pub Med, central online catalogue of the Swiss university libraries);
- single key journals relevant in areas that relate to landscape and health promotion;
- reference lists of earlier studies;
- topic-related expert networks and relevant organisations.

Keywords for the literature search were selected from two broad areas: landscape and health. For landscape, keywords such as landscape, healthy environment, healthy place, nature, city, urban, rural, wood, forest, park and garden were used; for health, keywords such as health, well-being, quality of life, restoration, stress recovery, mental health, physical activity, social capital and social support were used as search terms. All possible two-word combinations of single terms from both areas were employed.

In total, we found about 500 studies, reviews and reports related to our research focus. All studies were collected and systematised using a bibliography-managing software (EndNote®).

In the third step, the literature to be closely reviewed was selected by two members of the research team (AA, KS) in a comparative and consensus orientated process. The limitations in research resources required us to select only the most relevant items. Thus, further exclusion criteria were applied: Studies that focus on isolated elements of landscape like single buildings, functions of buildings, indoor environments, and those that address the therapeutic impact of certain landscape aspects in health care settings were excluded. Yet, studies focusing on built environment in terms of public places such as meeting points or streets were included. We further excluded the literature that was published before 1995 except basic literature reviews. At the end of this step, 123 studies, reviews and reports remained for full-text reading and for inclusion in the review.

In the fourth step, the data were charted. According to Arksey and O'Malley (2005), charting 'describes a technique for synthesising and interpreting qualitative data by sifting, charting and sorting material according to key issues and themes […]'. This methodical step was conducted in a descriptive-analytical way. For this purpose, the literature was analysed and sorted according to each study's key results and design (see Table 2 for an extract of the reviewed studies). Following the principles of a scoping study, no systematic assessment of the quality of evidence was sought.

In the fifth step, the reviewed literature was collated, summarised and reported. Results were structured thematically along the three dimensions of health, namely physical, mental and social well-being. Based on the results from all five steps we developed a heuristic framework (see Fig. 1). This framework was derived from the data and underwent a communicative, consensual validation process (Bauer and Gaskell 2000; Kvale 1995; Lamnek 2005; Steinke 2003) with external experts working in the area of landscape and health. Figure 1 illustrates the different ways landscape might promote mental, physical, and social well-being and might be used as heuristic device in future studies.

Results

The following section presents an overview on studies that illustrate the mechanisms through which landscape serves as a resource for people's health-promoting activities. The results are divided into three subsections each focusing on mental, physical, and social well-being.

Mental well-being: landscape as a restorative

In their book 'The experience of nature: a psychological perspective', Kaplan and Kaplan (1989) laid the theoretical foundation for explaining landscape's potential influence on cognitive attention restoration. They established four characteristics for restorative environments (Kaplan and Kaplan 1989; Kaplan 1995a, b). First, restorative environments enable people to get some distance from their daily life. Second, they attract people's attention without being exhausting. Third, they enable constant discovery of new things, mostly compatible with already existing information about the environment. Fourth, they are in line with the intentions of their users, i.e. the environment enables the users to do what they want to do. Herzog et al. (1997) added that these kinds of environments contribute to attention restoration in terms of clarifying and ordering thoughts and of reflecting on personal goals and vital matters.

Other studies included in our review have highlighted the fact that a natural landscape is more restorative than an urban one. Hartig et al. (2003) showed that walks in natural landscapes have a stronger effect on the ability to concentrate than urban walks. This goes with other studies that emphasised that people prefer natural landscape such as beaches, waters, forests, parks, and mountains for recovery from mental fatigue (Korpela and Hartig 1996; Korpela et al. 2001; Staats et al. 2003; Staats and Hartig 2004). Furthermore, as the literature suggests, public open spaces used for public entertainment and sports have an intermediate restorative effect in contrast to natural settings, which have a high restorative potential, or urban settings, which

Table 2 Overview of the literature on the health-promoting influence of landscape

Health dimension	Health-promoting landscape effect	Landscape characteristics	Study design	Author(s)
Mental well-being	Attention restoration and recovery from mental fatigue	Natural landscapes such as beaches, waters, forests, parks, mountains	Conceptual accounts/literature reviews	Health Council of the Netherlands (2004); Frumkin (2003, 2001); Kaplan (1995a, b); Kaplan and Kaplan (1989); Maller et al. (2006)
		Availability of public open spaces used for public entertainment and sports	Survey-studies (cross-sectional studies, longitudinal studies)	Herzog et al. (1997); Korpela and Hartig (1996); Korpela et al. (2001); Tennessen and Cimprich (1995)
			Experimental studies	Berto (2005); Hartig et al. (1996, 2003); Kuo (2001); Staats and Hartig (2004); Staats et al. (2003)
	Recovery from stress	Landscape perceived as pleasant, i.e. landscape contains visual stimuli such as moderate complexity and richness of natural elements like waters or vegetation	Conceptual accounts/literature reviews	Frumkin (2001); Health Council of the Netherlands (2004); Maller et al. (2006)
			Survey-studies (cross-sectional studies, longitudinal studies)	Gidlöf-Gunnarsson and Öhrström (2007)
			Experimental studies	Hartig et al. (1996, 1999, 2003); Laumann et al. (2003); Parsons et al. (1998); Ulrich et al. (1991, 2003)
		Easy access to green areas with lower sound levels from road traffic		
	Positive emotions	Landscape perceived as pleasant	Survey-studies (cross-sectional studies, longitudinal studies)	Herzog and Chernick (2000); Kaplan (2001); Korpela et al. (2002); Kuo and Sullivan (2001b); Kuo et al. (1998)
		Open and accessible forests		
		Perceived amount of open space and vegetation (urban landscapes)	Experimental studies	Cackowski and Nasar (2003); Kuo and Sullivan (2001a); Staats et al. (1997)
			Qualitative studies	Milligan and Bingley (2007)
Physical well-being	Physical outdoor activity in cities	Daily life:	Conceptual accounts/literature reviews	Frank and Engelke (2001); French et al. (2001); Frumkin (2003); Frumkin et al. (2004); Health Council of the Netherlands (2004); Kaspar and Bühler (2006); McCormack et al. (2004); Pikora et al. (2003); Popkin et al. (2005); Powell (2005); Sallis and Glanz (2006)
		Access to and presence of physical activity-promoting facilities		
		General functionality of urban districts (e.g., sidewalks, traffic regulation, bicycle and walking paths)		
		Leisure time:	Survey-studies (cross-sectional studies, longitudinal studies)	Addy et al. (2004); Ball et al. (2001); Booth et al. (2000); Cervero and Duncan (2003); Craig et al. (2002); Giles-Corti and Donovan (2002); Gordon-Larsen et al. (2006); Humpel et al. (2004a ,b); Lee et al. (2001); Leslie et al. (2005); Li et al. (2005); Neff et al. (2000); Ozguner and Kendle (2006); Payne et al. (2002); Pikora et al. (2006); Saelens et al. (2003); Titze et al. (2005); Wendel-Vos et al. (2004)
		Land-use-mix		
		Street connectivity		
		Traffic safety (e.g. pedestrian zones)		
		Aesthetically appealing landscapes		
		Trust in neighbours, active neighbours		
		Nearby parks, playgrounds and sport fields	Qualitative studies	Coen and Ross (2006); Eyler et al. (1998); Wilbur et al. (2002)
		Access to places for physical activities		
	Physical outdoor activity outside cities	Aesthetically appealing rural green landscapes (e.g. forests)	Conceptual accounts/literature reviews	Gasser and Kaufmann-Hayoz (2004)
			Survey-studies (cross-sectional studies, longitudinal studies)	Baur and Gilgen (1999); Swiss Federal Office for the Environment (1999); Lamprecht and Stamm (2002); Marti et al. (2002); Pretty et al. (2005a)
			Experimental studies	Pretty et al. (2005b)

Table 2 continued

Health dimension	Health-promoting landscape effect	Landscape characteristics	Study design	Author(s)
Social well-being	Social integration	Parks Community gardens Sufficient level of safety, attractive, walkable, serve multiple purposes Rich in vegetation	Conceptual accounts/literature reviews	Brown and Jameton (2000); Frumkin (2003); Frumkin et al. (2004); Hancock (2001); Health Council of the Netherlands (2004); Maller et al. (2006); Twiss et al. (2003);
			Survey-studies (cross-sectional studies, longitudinal studies)	Armstrong (2000); Booth et al. (2000); Coley et al. (1997); Kuo et al. (1998); Kweon et al. (1998); Leyden (2003); Seeland and Ballestros (2004); Stigsdotter and Grahn (2004); Sullivan et al. (2004); Waliczek et al. (2005)
			Experimental studies	Doyle and Krasny (2003)
			Qualitative studies	Baum and Palmer (2002); Irvine et al. (1999); Milligan et al. (2004); Rishbeth and Finney (2006); Wakefield et al. (2007)
	Collectively experiencing nature	"Wild" nature	Survey-studies (cross-sectional studies, longitudinal studies)	Ewert (1991)
			Experimental studies	Staats and Hartig (2004)
			Qualitative studies	Fredrickson and Anderson (1999); Pohl et al. (2000); Sharpe (2005)

have a low restorative potential (Herzog et al. 1997). The restorative potential of natural landscapes was also demonstrated in an experimental study by Berto (2005), in which visual confrontation with pictures of natural landscapes had a restorative effect on mental fatigue in students. Such results are in line with findings of two earlier studies, which measured the effect of a view of a landscape on concentration (Kuo 2001; Tennessen and Cimprich 1995). Our scoping study also reveals the importance of low sound levels for rest and relaxation: Gidlöf-Gunnarsson and Öhrström (2007) point out that people who have easy access to green areas, can reduce noise annoyances and thus become more relaxed.

Parallel to studies on the restorative impact on mental fatigue, other studies included in our review have demonstrated a similar effect when it comes to stress reduction. Ulrich et al. (1991) showed that when people look at a natural landscape, immediate, unconsciously released emotional reactions significantly affect their stress recovery. These effects concern their attention, conscious mental processing, behaviour and physiological reactions. While looking at a landscape that is perceived as pleasant, negative feelings and thoughts—which were previously induced by negative stress exposure—are replaced by positive feelings such as interest, cheerfulness and calmness (Hartig et al. 1996). As the literature shows, this reaction takes place when the landscape contains particular visual stimuli such as a moderate complexity and richness of natural elements like waters or vegetation (Hartig et al. 1996). Indicators for a positive effect are lower physiological excitation in terms of lower pulse rates and lower emotional arousal (Laumann et al. 2003; Parsons et al. 1998; Ulrich et al. 1991, 2003). However, reviewed studies assume a difference between the effects of natural and urban landscapes: Hartig et al. (2003) pointed out that study participants taking a walk in the woods yielded lower emotional and physical stress levels when compared to those taking an urban walk.

Some studies in our review indicate that views of a natural landscape promote people's ability to express positive feelings like joy and satisfaction more easily (Hartig et al. 1999; Kaplan 2001; Korpela et al. 2002). More specifically, open and accessible forests are suggested to enhance positive emotions more than dense and less accessible forests (Milligan and Bingley 2007; Staats et al. 1997). With respect to the positive impact of landscape on general mood, Cackowski and Nasar (2003) showed that a pleasant landscape contributes to higher frustration tolerance, whereas other authors found that lower crime rates and feelings of safety in cities are associated with constructional conditions (e.g. the perceived amount of open space, level of vegetation) (Herzog and Chernick 2000; Kuo et al. 1998; Kuo and Sullivan 2001a, b).

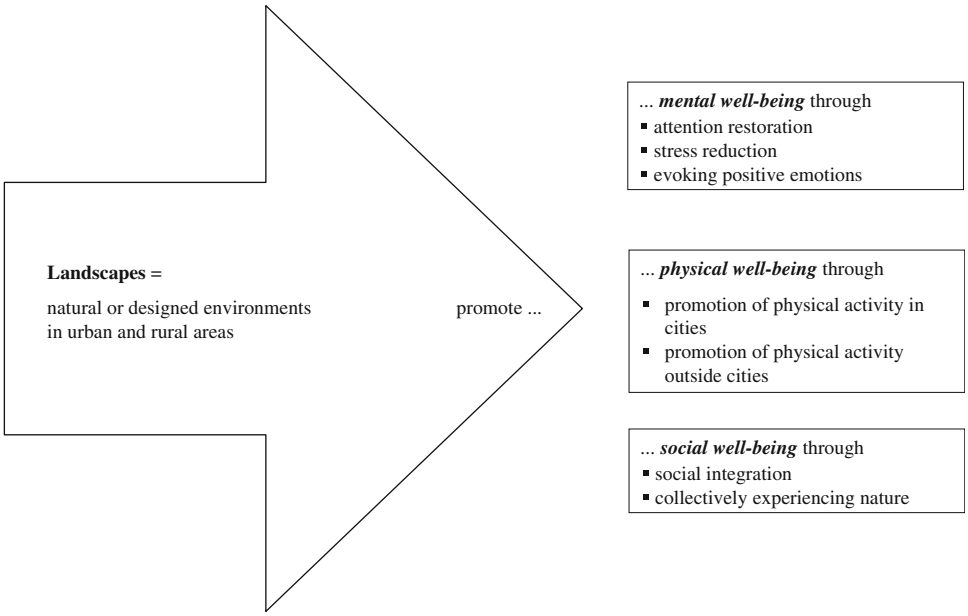

Fig. 1 Heuristic framework on the health-promoting impact of landscape

Physical well-being: walkable landscape

The literature reveals that the way the urban landscape and environment is designed and built is crucial for the level of physical activity in daily life, work and leisure time (Frumkin et al. 2004; Humpel et al. 2004a, b; McCormack et al. 2004; Powell 2005). Pikora et al. (2003, 2005) considered access to destinations, the presence of physical activity-promoting facilities, and the general functionality of urban districts (e.g. sidewalks, traffic regulation) as aspects of landscape that promote and enable physical activity. Further, constructional conditions are bicycle and walking paths for better walkability (Cervero and Duncan 2003; Craig et al. 2002; Frank and Engelke 2001; Li et al. 2005), land-use-mix, street connectivity, traffic safety (e.g. pedestrian zones), and an aesthetically appealing landscape (French et al. 2001; Humpel et al. 2004a, b; Leslie et al. 2005; Saelens et al. 2003; Titze et al. 2005). In terms of physical activity in leisure time, our review illustrates that location and infrastructure, e.g. of a park, safety aspects, and the absence of traffic, play an essential role (Ball et al. 2001; Booth et al. 2000; Neff et al. 2000). Addy et al. (2004) found that people gain additional motivation for regular physical activity when they trust their neighbours, when they perceive their neighbours as active, and when they have the opportunity to use nearby parks, playgrounds and sport fields.

As for social differentiation, studies have indicated that the preferences and needs related to places as well as the access to places for physical activity vary according to gender, age and ethnic background (Eyler et al. 1998; Kaspar and Bühler 2006; Lee et al. 2001; Payne et al. 2002; Wilbur et al. 2002). Authors have emphasised the importance of providing basic constructional conditions to make spaces for health-promoting physical activities as user friendly as possible (Giles-Corti and Donovan 2002; Wendel-Vos et al. 2004). However, recent studies have clearly shown that many city dwellers in socially deprived areas lack access to places for physical activity (Coen and Ross 2006; Gordon-Larsen et al. 2006; Popkin et al. 2005).

As many studies in our review have illustrated, forests play an important role when it comes to outdoor physical activity outside cities, including walking, hiking, kayaking, and fishing. People use forests for physical activity mainly to recreate and exercise (Baur and Gilgen 1999; Gasser and Kaufmann-Hayoz 2004; Lamprecht and Stamm 2002; Marti et al. 2002; Pretty et al. 2005a, b; Swiss Federal Office for the Environment 1999). In order to be perceived as an option for physical activity, rural green landscapes must be aesthetically appealing to their users (Pretty et al. 2005a, b).

Social well-being: landscape as a bonding structure

According to Armstrong (2000) and Leyden (2003), urban parks and other public places can enhance social integration if they facilitate social contacts, exchange, collective work, community building, empowerment, social networks and mutual trust. Also, socially integrative functions of landscape were found in studies with elderly people (Booth et al. 2000; Kweon et al. 1998; Milligan et al. 2004) and migrants (Rishbeth and Finney 2006; Seeland and Ballesteros 2004). As the literature suggests, urban landscape should provide a sufficient level of safety (e.g. park controls), attractiveness, walkability, should serve multiple

purposes (Baum and Palmer 2002; Leyden 2003) and be rich in vegetation (Coley et al. 1997; Kuo et al. 1998; Sullivan et al. 2004) to promote social integration.

In a recent article the health-promoting impact of community gardening was addressed: Among other benefits, community gardening was found to foster the development of community networks, social support and to motivate people for community engagement (Wakefield et al. 2007). With their results the authors complemented findings from earlier studies about the health benefits of community and private gardens (Armstrong 2000; Brown and Jameton 2000; Doyle and Krasny 2003, Hancock 2001; Irvine et al. 1999; Stigsdotter and Grahn 2004; Twiss et al. 2003; Waliczek et al. 2005).

As our scoping study illustrates, collective nature experience programmes have become popular in the fields of education, management and psychology over the last 20 years. The collective experience of nature in non-urban areas has been linked to various aspects of health: '[…] wilderness experiences may be salutary because of the benefits of companionship, being physically active, taking a vacation, or meeting a challenge, and not because of nature contact per se' (Frumkin 2003). Besides individual outcomes, (Fredrickson and Anderson 1999; Pohl et al. 2000), many of these programmes concentrate on the collective experience of group dynamics. As we found in the literature, such programmes provide experience of equality and community (Sharpe 2005), social decision-making and responsibility, social bonding and support (Fredrickson and Anderson 1999; Pohl et al. 2000), and feelings of being protected (Staats and Hartig 2004). They further facilitate the building of integrative groups, collective solving of spontaneously emerging problems and collective landscape planning and design (Ewert 1991).

Discussion

In the field of health promotion, landscape should be understood to be a multi-faceted resource for physical, mental and social health and well-being. This is the general conclusion that can be drawn from the findings of the present study. More specifically however, a synthesis of the results provides the first answers to the specific questions raised at the beginning of this paper:

How can landscape promote health?

Landscape might function as a spatial framework for health-promoting activities in physical, mental, and social realms. These activities are linked to health outcomes and improvements such as:

- attention restoration,
- stress recovery,
- evocation of positive emotions,
- physical outdoor activities in and outside cities,
- social integration,
- collective experience of nature.

How should landscape look like to promote people's health?

In order to promote health, landscapes need to have certain characteristics that influence human well-being directly or indirectly (see Table 2), and which turn them into "good places" for health (Frumkin 2003). Most important among these are easy access to natural landscapes and the availability of nearby (green) public open spaces. Landscapes need to be perceived as pleasant and attractive for all senses, and safe in terms of well-lit streets, presence of other people and sidewalks, which make people feel safe from crime and traffic dangers. Furthermore, neighbourhoods need to provide a general functionality (e.g. street connectivity, pedestrian zones, bicycle tracks) to promote walkability: A walking-friendly design enables independence from automobiles and promotes healthy physical behaviour through easy access. Landscapes also foster healthy behaviour and emotional well-being if they offer the possibility of meeting and engaging with other people in public open spaces.

Who might benefit from a health-promoting landscape?

Many of the studies reviewed emphasised that landscape should promote everyone's health in daily life, suggesting that all people should have access to health-promoting landscapes at home, at work, and during leisure time. This demand is clearly supported by the Ottawa-Charter's call to create supportive environments for everyone (WHO 1986). However, there are apparent challenges to this: people's landscape preferences, needs, and uses are socially and culturally diverse. As documented in this review, health-promoting landscapes are perceived and used differently by various social groups and are therefore a group-specific matter. Moreover, not everybody has equal access to health-promoting landscapes. Thus, unequal access may function as a way in which inequalities in the distribution of resources contribute to the (re-)production of health inequalities. To cite just one case in point: socially deprived people, who do not have access to safe outdoor spaces for physical activity, are likely to suffer more often from obesity than people with access to such spaces (Gordon-Larsen et al. 2006; Popkin et al. 2005). And in contrast, people who live in a safe neighbourhood, which

provides a certain number of sport fields and which enables children to walk to school or go there by bike, are physically more active than other people (Sallis and Glanz 2006).

From a health-promoting perspective, our findings provide strong additional and new support for understanding landscapes as a health resource and health determinant (Frumkin 2003; Maller et al. 2006). According to the results of the present scoping study, the relationship between landscape and health shows two main features: first, health-promoting landscapes contribute to healthy lifestyles in terms of physical activity and mental and emotional relaxation. Second, health-promoting landscapes promote the acquisition of resources for health such as social support, concentration and emotional stability. Beyond these findings, the study provides an up-to-date overview of the current literature and a new framework as a heuristic tool. As such it may be useful for future research and practice to systematically explore and foster the health-promoting impact of landscape on mental, physical and social well-being. Disciplines dealing with the relation between landscape and health differ widely in terms of terminology, methodologies, aims and scopes. The framework proposed in this paper, may also serve as a starting point for interdisciplinary discourses geared to reach a common ground for explorations into the links between landscapes and health.

However, while current evidence of landscape as a health resource is considerable this evidence remains scattered. More research in this field is called to better understand the health-promoting impacts of different landscape characteristics. Future studies should address issues concerning variations in landscape needs in different social groups. To better understand the user needs, more participatively designed studies and interventions are needed (Buchecker et al. 2003; Takano and Nakamura 2004). As shown in Table 2, till date cross-sectional or experimental study designs make up the vast majority of research. The problem is, however, that they largely fail to grasp socially differentiated meanings of landscape. Thus, in terms of methodology, there is a need for more elaborate and diverse study designs such as qualitative studies, longitudinal analyses or cross-over studies. Furthermore, when it comes to health promotion and the social distribution of health resources, future studies should investigate the issues around access to health-promoting landscapes by different social groups. Such research should not be limited to descriptions of the presence or absence of health-promoting landscape resources in socially deprived areas. Much broader studies are needed that investigate the quality of health-promoting landscape resources, their social meaning and people's perception of their accessibility and relevance (Macintyre 2007). Finally, there is also a need to sharpen current landscape definitions, and to take into account that landscape is perceived with all senses. Literature on "soundscapes" (Adams et al. 2006; Atkinson 2007; Carles et al. 1999; Ge and Hokao 2005; Gidlöf-Gunnarsson and Öhrström 2007; O'Connor 2008; Raimbault and Dubois 2005; Yang and Kang 2005) and "smellscapes" (Porteous 1990) call attention to this multisensory conceptualisation of landscape. Comprehensive definitions of landscape which include multi-sensory aspects of perception are important also in terms of empirical operationalisation of concepts, the evaluation of their validity and comparability of study results.

Acknowledgments This literature review was partly funded by the Swiss Foundation for Landscape Conservation, the Swiss Society of Doctors for the Environment, the Swiss Federal Office of Public Health, and the Swiss Federal Office for the Environment. We express our appreciation to these organizations for making our scoping study possible.

References

Adams M, Cox T, Moore G, Croxford B, Refaee M, Sharples S (2006) Sustainable soundscapes: noise policy and the urban experience. Urban Stud 43:2385–2398

Addy CL, Wilson DK, Kirtland KA, Ainsworth BE, Sharpe P, Kimsey D (2004) Associations of perceived social and physical environmental supports with physical activity and walking behavior. Am J Public Health 94:440–443

Arksey H, O'Malley L (2005) Scoping studies: towards a methodological framework. Int J Soc Res Meth 8:19–32

Armstrong DA (2000) Survey of community gardens in upstate New York: implications for health promotion and community development. Health Place 6:319–327

Atkinson R (2007) Ecology of sound: the sonic order of urban space. Urban Stud 44:1905–1917

Augenstein I (2002) Die Ästhetik der Landschaft. Ein Bewertungsverfahren für die planerische Umweltvorsorge. Weissensee Verlag, Berlin

Badger D, Nursten J, Williams P, Woodward M (2000) Should all literature reviews be systematic? Eval Res Educ 14:220–230

Ball K, Bauman A, Leslie E, Owen N (2001) Perceived environmental aesthetics and convenience and company are associated with walking for exercise among Australian adults. Prev Med 33:434–440

Bauer MW, Gaskell G (2000) Qualitative researching with text, image and sound: a practical handbook. SAGE, Thousand Oaks

Baum F, Palmer C (2002) 'Opportunity structures': urban landscape, social capital and health promotion in Australia. Health Promot Int 17:351–361

Baur B, Gilgen C (1999) Der Allschwiler Wald (The forest of Allschwil.). Verkehrs- und Kulturverein, Allschwil

Berto R (2005) Exposure to restorative environments helps restore attentional capacity. J Environ Psychol 25:249–259

Booth ML, Owen N, Bauman A, Clavisi O, Leslie E (2000) Social-cognitive and perceived environment influences associated with physical activity in older Australians. Prev Med 31:15–22

Brown KH, Jameton AL (2000) Public health implications of urban agriculture. J Public Health Policy 21:20–39

Buchecker M, Hunziker M, Kienast F (2003) Participatory landscape development: overcoming social barriers to public involvement. Landsc Urban Plan 64:29–46

Cackowski JM, Nasar JL (2003) The restorative effects of roadside vegetation—implications for automobile driver anger and frustration. Environ Behav 35:736–751

Carles JL, Lopez Barrio I, de Lucio JA (1999) Sound influence on landscape values. Landsc Urban Plan 43:191–200

Cervero R, Duncan M (2003) Walking, bicycling, and urban landscapes: evidence from the San Francisco Bay Area. Am J Public Health 93:1478–1483

Coen SE, Ross NA (2006) Exploring the material basis for health: characteristics of parks in Montreal neighborhoods with contrasting health outcomes. Health Place 12:361–371

Coley RL, Kuo FE, Sullivan WC (1997) Where does community grow? The social context created by nature in urban public housing. Environ Behav 29:468–494

Council of Europe (2000) European landscape convention. Vol European Treaty Series No. 176:1–9

Craig CL, Brownson RC, Cragg SE, Dunn AL (2002) Exploring the effect of the environment on physical activity: a study examining walking to work. Am J Prev Med 23:36–43

Davenport MA, Anderson DH (2005) Getting from sense of place to place-based management: an interpretive investigation of place meanings and perceptions of landscape change. Soc Nat Resour 18:625–641

Doyle R, Krasny M (2003) Participatory rural appraisal as an approach to environmental education in urban community gardens. Environ Educ Res 9:91–115

Ewert AHJ (1991) Group development in the natural environment. Expectations, outcomes and techniques. Environ Behav 23:592–615

Eyler AA, Baker E, Cromer L, King AC, Brownson RC, Donatelle RJ (1998) Physical activity and minority women: a qualitative study. Health Educ Behav 25:640–652

Frank LD, Engelke PO (2001) The built environment and human activity patterns: exploring the impacts of urban form on public health. J Plan Lit 16:202–218

Fredrickson LM, Anderson DH (1999) A qualitative exploration of the wilderness experience as a source of spiritual inspiration. J Environ Psychol 19:21–39

French SA, Story M, Jeffery RW (2001) Environmental influences on eating and physical activity. Annu Rev Public Health 22:309–335

Frumkin P (2001) Beyond toxicity—human health and the natural environment. Am J Prev Med 20:234–240

Frumkin H (2003) Healthy places: exploring the evidence. Am J Public Health 93:1451–1456

Frumkin H, Frank L, Jackson R (2004) Urban sprawl and public health. Island, Washington

Gasser K, Kaufmann-Hayoz R (2004) Woods, trees and human health & well-being (Wald und Volksgesundheit). Literatur und projekte aus der Schweiz. Interfakultäre Koordinationsstelle für Allgemeine Ökologie (IKAÖ), Bern

Ge J, Hokao K (2005) Applying the methods of image evaluation and spatial analysis to study the sound environment of urban street areas. J Environ Psychol 25:455–466

Gidlöf-Gunnarsson A, Öhrström E (2007) Noise and well-being in urban residential environments: the potential role of perceived availability to nearby green areas. Landsc Urban Plan 83:115–126

Giles-Corti B, Donovan RJ (2002) The relative influence of individual, social and physical environment determinants of physical activity. Soc Sci Med 54:1793–1812

Gordon-Larsen P, Nelson MC, Page P, Popkin BM (2006) Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics 117:417–424

Hancock T (2001) People, partnerships and human progress: building community capital. Health Promot Int 16:275–280

Hartig T, Book A, Garvill J, Olsson T, Garling T (1996) Environmental influences on psychological restoration. Scand J Psychol 37:378–393

Hartig T, Nyberg L, Nilsson LG, Garling T (1999) Testing for mood congruent recall with environmentally induced mood. J Environ Psychol 19:353–367

Hartig T, Evans GW, Jamner LD, Davis DS, Garling T (2003) Tracking restoration in natural and urban field settings. J Environ Psychol 23:109–123

Health Council of the Netherlands, Dutch Advisory Council for Research on Spatial Planning NatE. Nature and Health (2004) The influence of nature on social, psychological and physical well-being. Health Council of the Netherlands and RMNO, The Hague

Herzog TR, Chernick KK (2000) Tranquility and danger in urban and natural settings. J Environ Psychol 20:29–39

Herzog TR, Black AM, Fountaine KA, Knotts DJ (1997) Reflection and attentional recovery as distinctive benefits of restorative environments. J Environ Psychol 17:165–170

Humpel N, Marshall AL, Leslie E, Bauman A, Owen N (2004a) Changes in neighborhood walking are related to changes in perceptions of environmental attributes. Ann Behav Med 27:60–67

Humpel N, Owen N, Iverson D, Leslie E, Bauman A (2004b) Perceived environment attributes, residential location, and walking for particular purposes. Am J Prev Med 26:119–125

Ingold T (1992) Culture and the perception of the environment. In: Parkin D, Croll E (eds) Bush base, forest farm: culture, environment and development. Routledge, London, pp 39–56

Irvine S, Johnson L, Peters K (1999) Community gardens and sustainable land use planning: a case-study of the Alex Wilson community garden. Local Environ 4:33–46

Jackson LE (2003) The relationship of urban design to human health and condition. Landsc Urban Plan 64:191–200

Kaplan S (1995a) The restorative benefits of nature: toward an integrative framework. J Environ Psychol 15:169–182

Kaplan S (1995b) The urban forest as a source of psychological well-being. In: Bradley GA (ed) Urban forest landscapes: integrating multidisciplinary perspectives. University of Washington Press, Seattle, pp 101–108

Kaplan R (2001) The nature of the view from home—psychological benefits. Environ Behav 33:507–542

Kaplan R, Kaplan S (1989) The experience of nature: a psychological perspective. Cambridge University Press, Cambridge

Kaspar H, Bühler E (2006) Räume und Orte als soziale Konstrukte. Plädoyer für einen verstärkten Einbezug sozialer Aspekte in die Gestaltung städtischer Parkanlagen (Spaces and places as social constructs. A plea for considering social aspects in the design of urban parks.). RaumPlanung 125:37–41

Korpela K, Hartig T (1996) Restorative qualities of favorite places. J Environ Psychol 16:221–233

Korpela KM, Hartig T, Kaiser FG, Fuhrer U (2001) Restorative experience and self-regulation in favorite places. Environ Behav 33:572–589

Korpela KM, Klementtila T, Hietanen JK (2002) Evidence for rapid affective evaluation of environmental scenes. Environ Behav 34:634–650

Kuo FE (2001) Coping with poverty—impacts of environment and attention in the inner city. Environ Behav 33:5–34

Kuo FE, Sullivan WC (2001a) Aggression and violence in the inner city—effects of environment via mental fatigue. Environ Behav 33:543–571

Kuo FE, Sullivan WC (2001b) Environment and crime in the inner city—does vegetation reduce crime? Environ Behav 33:343–367

Kuo FE, Bacaicoa M, Sullivan WC (1998) Transforming inner-city landscapes—trees, sense of safety, and preference. Environ Behav 30:28–59

Kvale S (1995) The social construction of validity. Qual Inq 1:19–40
Kweon BS, Sullivan WC, Wiley AR (1998) Green common spaces and the social integration of inner-city older adults. Environ Behav 30:832–858
Lamnek S (2005) Qualitative Sozialforschung. Beltz Verlag, Weinheim
Lamprecht M, Stamm H (2002) Bekanntheit, Nutzung und Bewertung der Vita Parcours durch die Schweizer Bevölkerung. Unveröffentlichter Bericht, Zürich
Laumann K, Garling T, Stormark KM (2003) Selective attention and heart rate responses to natural and urban environments. J Environ Psychol 23:125–134
Lee JH, Scott D, Floyd MF (2001) Structural inequalities in outdoor recreation participation: a multiple hierarchy stratification perspective. J Leisure Res 33:427–449
Leslie E, Saelens B, Frank L et al (2005) Residents' perceptions of walkability attributes in objectively different neighbourhoods: a pilot study. Health Place 11:227–236
Leyden KM (2003) Social capital and the built environment: the importance of walkable neighborhoods. Am J Public Health 93:1546–1551
Li F, Fisher KJ, Brownson RC, Bosworth M (2005) Multilevel modelling of built environment characteristics related to neighbourhood walking activity in older adults. J Epidemiol Community Health 59:558–564
Macintyre S (2007) Deprivation amplification revisited; or, is it always true that poorer places have poorer access to resources for healthy diets and physical activity? Int J Behav Nutr Phys Act 4:1–7
Maller C, Townsend M, Pryor A, Brown P, St Leger L (2006) Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations. Health Promot Int 21:45–54
Marti B, Lamprecht M, Bächler J, Spring S, Gutzwiller F (2002) Bekanntheit, Nutzung und Bewertung des Vitaparcours: Vergleich zwischen 1997 und 2001 (Attitude towards, use of the fitness trail «Vitaparcours»: comparison between 1997 and 2001.). Schweiz Z Sportmedizin und Sporttraumatologie 50:161–163
McCormack G, Giles-Corti B, Lange A, Smith T, Martin K, Pikora TJ (2004) An update of recent evidence of the relationship between objective and self-report measures of the physical environment and physical activity behaviours. J Sci Med Sport 7:81–92
Milligan C, Bingley A (2007) Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults. Health Place 13:799–811
Milligan C, Gatrell A, Bingley A (2004) 'Cultivating health': therapeutic landscapes and older people in northern England. Soc Sci Med 58:1781–1793
Neff LJ, Ainsworth BE, Wheeler FC, Krumwiede SE, Trepal AJ (2000) Assessment of trail use in a community park. Fam Community Health 23:76–84
O'Connor P (2008) The sound of silence: valuing acoustics in heritage conservation. Geogr Res 46:361–373
Oreszczyn S, Lane A (2000) The meaning of hedgerows in the English landscape: different stakeholder perspectives and the implications for future hedge management. J Environm Manage 60:101–118
Parsons R, Daniel TC (2002) Good looking: in defense of scenic landscape aesthetics. Landsc Urban Plan 60:43–56
Parsons R, Tassinary LG, Ulrich RS, Hebl MR, Grossman-Alexander M (1998) The view from the road: implications for stress recovery and immunization. J Environ Psychol 18:113–140
Payne LL, Mowen AJ, Orsega-Smith E (2002) An examination of park preferences and behaviors among urban residents: the role of residential location, race, and age. Leis Sci 24:181–198
Pikora T, Giles-Corti B, Bull F, Jamrozik K, Donovan R (2003) Developing a framework for assessment of the environmental determinants of walking and cycling. Soc Sci Med 56:1693–1703
Pikora TJ, Giles-Corti B, Knuiman MW, Bull FC, Jamrozik K, Donovan RJ (2006) Neighborhood environmental factors correlated with walking near home: using SPACES. Med Sci Sports Exerc 38:708–714
Pohl SL, Borrie WT, Patterson ME (2000) Women, wilderness, and everyday life: a documentation of the connection between wilderness recreation and women's everyday lives. J Leis Res 32:415–434
Popkin BM, Duffey K, Gordon-Larsen P (2005) Environmental influences on food choice, physical activity and energy balance. Physiol Behav 86:603–613
Porteous JD (1990) Landscapes of the mind: worlds of sense and metaphor. University of Toronto Press, Toronto
Powell KE (2005) Land use, the built environment, and physical activity: a public health mixture; a public health solution. Am J Prev Med 28:216–217
Pretty J, Griffin M, Peacock J, Hine R, Sellens M, South NA (2005a) Countryside for health and wellbeing: the physical and mental health benefits of green exercise. Sheffield Hallam University, Countryside Recreation Network, Sheffield
Pretty J, Peacock J, Sellens M, Griffin M (2005b) The mental and physical health outcomes of green exercise. Int J Environ Health Res 15:319–337
Raimbault M, Dubois D (2005) Urban soundscapes: experiences and knowledge. Cities 22:339–350
Rishbeth C, Finney N (2006) Novelty and nostalgia in urban greenspace: refugee perspectives. Tijdschr Econ Soc Geogr 97:281–295
Saelens BE, Sallis JF, Black JB, Chen D (2003) Neighborhood-based differences in physical activity: an environment scale evaluation. Am J Public Health 93:1552–1558
Sallis JF, Glanz K (2006) The role of built environments in physical activity, eating, and obesity in childhood. Future Child 16:89–108
Seeland K, Ballesteros N (2004) Kulturvergleichende Untersuchungen zum sozialintegrativen Potential gestalteter urbaner Naturräume in den Agglomerationen Genf, Lugano und Zürich. Forstwissenschaftliche Beiträge 31
Sharpe EK (2005) Delivering communitas: wilderness adventure and the making of community. J Leisure Res 37:255–280
St Leger L (2003) Health and nature—new challenges for health promotion. Health Promot Int 18:173–175
Staats H, Hartig T (2004) Alone or with a friend: a social context for psychological restoration and environmental preferences. J Environ Psychol 24:199–211
Staats H, Gatersleben B, Hartig T (1997) Change in mood as a function of environmental design: arousal and pleasure on a simulated forest hike. J Environ Psychol 17:283–300
Staats H, Kieviet A, Hartig T (2003) Where to recover from attentional fatigue: an expectancy-value analysis of environmental preference. J Environ Psychol 23:147–157
Steinke I (2003) Gütekriterien qualitativer Forschung. In: Flick U, von Kardorff E, Steinke I (eds) Qualitative Forschung, Ein Handbuch. Rowohlt Taschenbuch Verlag, Reinbek bei Hamburg, pp 319–331
Stigsdotter U, Grahn P (2004) A garden at your doorstep may reduce stress—private gardens as restorative environments in the city. OPENspace—an international conference on inclusive environments. Edinburgh
Sullivan WC, Kuo FE, DePooter SF (2004) The fruit of urban nature—vital neighborhood spaces. Environ Behav 36:678–700
Swiss Federal Office for the Environment (1999) Gesellschaftliche Ansprüche an den Schweizer Wald. Meinungsumfrage (Social

requirements on Swiss forests. Opinion survey.). Swiss Federal Office for the Environment, Bern

Takano T, Nakamura K (2004) Participatory research to enhance vision sharing for Healthy Town initiatives in Japan. Health Promot Int 19:299–307

Tennessen C, Cimprich B (1995) Views to nature. Effects on attention. J Environ Psychol 15:77–85

Titze S, Stronegger W, Owen N (2005) Prospective study of individual, social, and environmental predictors of physical activity: women's leisure running. Psychol Sport Exerc 6:363–376

Twiss J, Dickinson J, Duma S, Kleinman T, Paulsen H, Rilveria L (2003) Community gardens: lessons learned from California healthy cities and communities. Am J Public Health 93:1435–1438

Ulrich R, Simons R, Losito B, Fiorito E, Miles M, Zelson M (1991) Stress recovery during exposure to natural and urban environments. J Environ Psychol 11:201–203

Ulrich RS, Simons RF, Miles MA (2003) Effects of environmental simulations and television on blood donor stress. J Archit Plann Res 20:38–47

Wakefield S, Yeudall F, Taron C, Reynolds J, Skinner A (2007) Growing urban health: community gardening in South-East Toronto. Health Promot Int 22:92–101

Waliczek TM, Zajicek JM, Lineberger RD (2005) The influence of gardening activities on consumer perceptions of life satisfaction. Hortscience 40:1360–1365

Wendel-Vos GCW, Schuit AJ, De Niet R, Boshuizen HC, Saris WHM, Kromhout D (2004) Factors of the physical environment associated with walking and bicycling. Med Sci Sports Exerc 36:725–730

WHO (1986) Ottawa-charter for health promotion. First International Conference on Health Promotion. Ottawa, Canada

Wilbur J, Chandler P, Dancy B, Choi J, Plonczynski D (2002) Environmental, policy, and cultural factors related to physical activity in urban, African American women. Women's Health 36:17–28

Yang W, Kang J (2005) Acoustic comfort evaluation in urban open public spaces. Appl Acoust 66:211–229