

*Green spaces in urban areas and human health:  
Exploring the connections*



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2013



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**A Master thesis in Sustainable Development 30 EC**

Track Global Change and Ecosystems

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## Acknowledgments

This thesis was inspired by the work I have done in Estonian Health Service and in RIVM, where I had a possibility to work next to professionals and get to know more about urgent health issues and environmental health problems. It was written from a desire to provide academic research with practical applicability and possible contribution in on-going scientific projects. I would like to thank Irene van Kamp from RIVM for her inspiring work and ideas and for offering me supervision and feedback to my progress. Hanneke Kruize: Thank you for your guidance and help, and for possibility to participate in work conference GEZONDRONDOM. And thank you both for your patience and dedicated time next to your busy schedules.

My deepest gratitude goes to my supervisor Jeroen van der Sluijs for such a constructive guidance and support. From a start he has provided me with good guidance and productive feedback to my work; and for his patience to have the discussions with me in my often quite clumsy Dutch.

And also many thanks to my dear Roel for supporting me on this road and for friends and family for believing in me.

## Abstract

There is growing body of literature investigating the benefits of nature to human health. Current study aims to contribute to scientific research and explores the connections between green spaces and human health and well-being by investigating the mechanisms behind the salutogenic effect of green space. A literature search of academic literature was conducted according to inclusion criteria related to the health effects of green space. Narrative synthesis was implemented for the selected studies to identify: different definitions and characteristics of natural outdoor environment; green spaces health effects and mechanisms behind; indicators and cofounders used to determine those connections; methods used and evidence level of source studies. Based on results cognitive map of green spaces health effects and beneficial mechanisms is presented. Practical knowledge is tested by case studies: by participant observation during work conference GEZONDRONDOM in the Netherlands and paralleled with WHO study tour summary report outcomes.

Results indicate that the most commonly used green space descriptions are: **Green space, park, forest, natural environment, green area and beach**. Narrative syntheses based on evidence derived from selected literature, showed that the most common health effects of green spaces are: **Stress mitigation, Increase of physical activity, Restorative experiences, Attention fatigue amelioration and Mental health improvement**. The most common mechanisms to achieve those salutogenic benefits are: **Exposure to nature and closer contact with nature, Positive perception of the area, Thermal comfort, Physical activity stimulation and Improving environmental health**. Case study showed that benefits of green space to human health are well known in the Netherlands and there are various methods and tools to receive extra knowledge and practical examples. The biggest challenge is to integrate that knowledge into everyday planning practice. Therefore current study could add the knowledge and offer an overview of the mechanism behind the health effects of green space, which could be integrated into everyday urban planning methods.

**Keywords:** *Green space, human health, health effects, salutogenic mechanisms, Urban planning*

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## Abbreviations

ART- Attention Restoration Theory

BMI- Body Mass Index

NAMG - **Nationale Aanpak Milieu en Gezondheid** (National Environmental Health Action plan)

RIVM – Rijks Instituut voor Volksgezondheid en Milieu (The National Institute for Public Health and the Environment)

TU/e – Technische Universiteit Eindhoven ( Eindhoven University of Technology)

UGS- Urban Green Space

UHI- Urban Heat Island

UNFPA- the United Nations Population Fund

PHENOTYPE- Positive Health Effects of the Natural Outdoor environment in TYPical Populations of different regions in Europe

VWS - Ministerie van Volksgezondheid, Welzijn en Sport (Ministry of Public health, Wellbeing and Sport)

WHO- World Health Organisation

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## 1. Introduction

There is a general perception and growing body of scientific literature indicating that close contact with nature influences human health and our physical and mental well-being in a positive way (Kaplan, 1995; Maas et al. 2006; Maller et al. 2006; Nielsen and Hansen, 2007; Stigsdotter et al. 2010 etc). Importance of contacts with nature is especially crucial in urban areas, where green and blue areas often are the only contact with nature for its inhabitants. Cities are increasing on daily bases and by now the majority of the World's population live in the cities (UNFPA, 2012). Therefore the sustainable city planning and integration of outdoor environment into that process is of increasing importance. Cities are the centres of living environmental urban ecosystems, where people spend a great majority of their life. Therefore better understanding of the natural outdoor environments (green spaces), its characteristics and effects to urban environment is a key to find out potential interconnections between urban inhabitants and natural green areas or spaces (urban ecosystems) within the city and nearby, and their effects on human health. Growth of the cities and urbanisation is one of the present sustainability problems (Brundtland report, 1987). Often the urban expansion takes place at the expense of nature. Quality green spaces are decreasing and nature areas are shifting far away from city centres, alienating its habitants increasingly from the nature. This tendency is in conflict with common values of restorative environments, as people prefer relatively natural environments which is perceived and related to the possibilities of offering them psychological restoration (van den Berg et al., 2007) and suitable place for physical activity (Sugiyama et al., 2008). Restoration in the present context stands for *a return of something or someone* (mental and physical health in current context) *to a former, original, normal, or unimpaired condition* (Dictionary.com, 2013), and is closely related to Kaplan and Kaplan Attention Restoration Theory, which proposes that effortful directed attention can become fatigued in modern urban environments. Restoration can occur in a setting that evokes fascination (Kaplan and Kaplan, 1989; Kaplan, 1995).

### 1.1. Social relevance

Life tempo and rhythm have increased and time for relaxation and reflection has diminished notably. Therefore access to outdoor areas and restorative value of the area is at the foreground to help people deal with every day stress, while offering them also a place for physical activity and social interaction. Green spaces are also buffers against urban pollution (noise, air combustion) and climate change effects, like urban heat stress (Lafortezza et al. 2009). It is an important area to investigate in order to assist in creating a sustainable urban environment. It contributes also to sustainability from a public health point of view. Green spaces can offer people place for physical activity and at the same time offer place to unwind from every day stress in the restorative environment (i.e. Richardson and Mitchell, 2010). Quality of the natural outdoor areas within a city is a key element in providing all the benefits to its dwellers, and helps to increase urban climate change resilience overall. Thus it is necessary to find out the characteristics of quality outdoor areas and mechanisms which help to create quality green space, to be able to offer recommendations and guidelines for policy makers, urban planners, landscape architects and for other related professional practitioners.

By understanding the mechanisms behind salutogenic (from latin word *Salus, Salutis* =health- the origin of health, Funk and Wagnalls, 1977) functions of green space, it helps to design the green spaces stemming from those connections.

### 1.2. Scientific relevance

As mentioned there is a growing body of literature and the importance of the natural outdoor environment to human health has been brought up in several studies. Due to its broad meaning, the most scientific studies concentrate on specific nature-health relations. Kaplan, Nordh et al for example, accentuate the restorative benefits of nature in relation to stress and mental health (Kaplan, 1995; Nordh et al, 2009). Maas et al, Richardson et al., Stigsdotter et al., are investigating the connections with mortality and morbidity (Maas et al., 2009; Richardson et al., 2010; Stigsdotter et al., 2010). Recently it is become very actual to investigate the green space potential to offer mitigation to climate change effects, especially to heat stress (Laforteza et al., 2009; Rosenzweig et al., 2006; Smith and Roebber, 2011 etc.). But on the other hand, there are not many scientific studies to be found, where all the possible effects are investigated as a whole and bound together to offer a holistic approach and overview of supporting mechanisms. In similar literature review by Lee and Macheswaran (2010) about the health benefits of urban green spaces, they investigate evidence by grading the evidence of causal relationship based on academic and grey literature. The grading was based on setting, study design and findings, therefore not many specifics were included about mechanism or indicators and results showed weak evidence for the links between physical, mental health and well-being, and urban green space. They noted in their conclusion, that establishing a causal relationship is difficult, as the relation is complex (Lee and Maheswaran, 2010). Therefore at the moment we are standing on the point, where scientific efforts are made to apply a more holistic approach and to investigate and understand more closely the mechanisms how exactly close contact with nature (i.e. in form of green space) benefits human health and well-being. One of such projects is a Collaborative Project funded by the European Commission's seventh Framework Programme: "*Positive Health Effects of the Natural Outdoor environment in Typical Populations of different regions in Europe (PHENOTYPE)*" project (phenotype.eu). Current research is also inspired by the concept and is aiming to contribute to a *Mechanism assessment* part. Dr Hanneke Kruize from RIVM, who is one of the partners in this project, is also one of the supervisors of current study. Albeit the current study do not cover entirely the scope of 48 months research project *PHENOTYPE*, but is more concentrating to explore the connections between urban green space and human health. Although the research is narrowed down to urban green space conditions, it still aims to offer a base to a broader concept of natural environment and its benefits to health. By investigating the mechanism of green spaces, it is possible to bring out the main functions and indicators to determine the quality of green or natural area.

Therefore an extended literature review can help to summarize and share light to quality urban green space characteristics and the mechanisms how those interconnections work. Then it is possible to find out how such information and knowledge is actually used by professional practitioners as they have to benefit from scientific evidence by including the principles into their daily practices. A case study in the course of national work conference

“GEZONDRONDOM”, on 15 May 2013 in Den Haag, and data driven from the WHO Study Tour 27-29 February 2012 in the Netherlands “*Planning-Public Health-Urban Design*”, addresses the knowledge in practice.

### *1.3. Aim of the research*

Recently, there has been an increasing interest in the potential health benefits of area, particularly green spaces (Gesler, 1992; Williams, 1999; Nielsen and Hansen, 2007; PHENOTYPE, 2012). The challenge is to understand the interconnections between outdoor nature, human health and wellbeing, to be able to benefit from these relations. Therefore the main aim is to find the linkages between positive human health effects and the outdoor environment and its synergy with closeness to a nature overall. To understand those linkages it is necessary to find out what health effects natural outdoor spaces have and what is the common practice in urban planning concerned. Therefore the main research question is:

***To what extent do natural outdoor environments in the cities and nearby green spaces have positive effects on human health and wellbeing and how can this knowledge be used in urban planning?***

To be able to answer that research question, it is necessary to answer the following sub-questions:

1. How can urban environments be described?
2. What are the types and characteristics of natural outdoor environments inside urban environment and nearby green spaces?
3. Which health effects do natural outdoor environments (green spaces) have?
4. Which indicators have been used to describe the effects of natural green spaces on human health and wellbeing?
5. Which methods have been used to investigate the relationships of natural green spaces on human health and wellbeing?
6. Which are the common mechanisms by which green spaces promote human health and wellbeing?
7. Which are the outdoor environment prerequisites of areas in urban spatial planning that would be suitable for a healthy local environment?
8. In what way can policymakers and urban planners manage and design an outdoor environment with maximal positive effects on health and urban climate?

### *1.4. Reading guide*

This research is presented in 5 chapters and extended appendices. The next chapter (Chapter 2: Method), describes methods used to identify and evaluate the connections between urban green spaces and human health. In Chapter 3, results are presented in order to answer the

research sub-questions, and a cognitive map is presented, where main interrelations are visualized. In the Discussion (Chapter 4), the results of the study are discussed and compared with the aim of the study and available scientific knowledge. The strongest points and weaknesses are indicated, aside from presenting suggestions for further research and bringing out the present practical value. In the Conclusions (Chapter 5) the answers to posed research question and its sub-questions are brought out in summary and recommendations presented. In appendices full tables of results and supportive material are presented.

## 2. Method

To be able to answer to main research question and sub-questions there are several processes. To answer the sub-question 1-6 the literature review is conducted for a period 1990 till present. To find the answers to questions 7-8, a case study was carried out. The opinion of professionals, who participated in the workshop “GEZONDRONDOM” in den Haag were noted, related to the case study, plus the workshop itself provided additional contribution. To add an international angle, the report from WHO Study Tour 27-29 February 2012 in the Netherlands “*Planning-Public Health-Urban Design*” was used as additional comparison. For that case study, the results of the literature review were prerequisite to be introduced during the workshop and to compare with different opinions, practical knowledge etc. Based on the results of the literature review combined and supported by the outcomes of workshop, the main research question will be answered and results presented.

### 2.1. Literature review

Thorough search is best achieved by using both electronic and manual search methods, although the latter is not preliminary, but more complementary. Scopus has been selected as the main search database, because of its wide selection of scientific journals and its detailed search options and combinations. Via Scopus it is possible to export the articles to Mendeley program to sort and manage the research documents. From Scopus the references and other necessary data are also transferred to excel, for necessary additional actions. Web of Science is another main search database, because Scopus does not cover that well articles published before 1996. Thus to search papers between 1990- 96, the Web of Science is used. Google Scholar, Omega is used to get extra studies, what might have not been included in Scopus or Web of Science. PubMed is used to get extra studies, what is more health related.

To conduct an effective and feasible search, a list of keyword combinations has been developed and tested accordingly (table 1).

Search nr.	Keyword expression	Nr. of hits	Useful to research question nr:	comments	Decision to go on (0-no,off topic; 1=yes)
1	City environment	25 960	1	Too many hits	0
2	Characteristics city environment	3520	1	Too many unrelated papers	0
3	Urban outdoor environment	1339	1,2	Might not be specific enough	1
4	Characteristics urban outdoor environment	173	1,2		1
5	Urban green areas	2,893	1	Maybe too wide	0
6	Urban AND green areas OR green spaces AND Characteristics OR types	696	1,2	Already represented under previous keyword results	0
7	Health AND green space OR area	1306	2	Similar to kw 8	0
8	Health effects AND outdoor environment OR green areas OR green space	803	3		1
9	Health effects AND urban green OR urban environment	2214	2	Too wide	0
10	Health effects urban green OR urban natural outdoor environment	178	2	Too specific, might miss some	0
11	Health effects AND urban green OR urban outdoor environment	257	3		1
12	Nature contact health	1050	2	Not specific enough	0
13	Indicators green health	305	4	Noted some good studies	1
14	Indicators environment health	5,062	3	Not specific enough, too wide	0
15	Environment AND public health AND indicator	1108	3	Too wide	0
16	Relation natural environment health	587	5	Lot of unrelated papers- not the best keyword combination	0
17	Relationship outdoor environment health	173	5		1
18	Method AND natural environment AND health	1,739	5	Too many, not a good keyword	0
19	Outdoor environment health promotion	63	6		1
20	Restoration AND Green area OR green space	389	5		1
	together	<b>4198</b>			

Table 1: Keyword combinations testing.

The number of results had to be feasible to be worked through on given time, but at the same time sufficient to carry out proper review and synthesis. Therefore decision was made which keyword combinations were used to be able to cover research area offering answers to first 6 research sub-questions. Used keywords are shown in table 2.

Search nr.	Keyword expression	Nr. of papers found	Useful to research question nr:
3	Urban outdoor environment	1339	1,2
4	Characteristics urban outdoor environment	173	1,2
8	Health effects AND outdoor environment OR green areas OR green space	803	3
11	Health effects AND urban green OR urban outdoor environment	257	3
13	Indicators green health	305	4
17	Relationship outdoor environment health	173	5
19	Outdoor environment health promotion	63	6
20	Restoration AND Green area OR green space	389	5
	together	4198	

**Table 2: Selected Keywords.**

In the Scopus search engine, the keywords were applied for, and only English language papers were included. Excluded were papers related to *computer science* as during keyword testing it was obvious that computer science papers often appeared under the same expressions, but were not related with current research aim and topic.

All the abstracts of the papers found, were screened and scored in the excel, according to inclusion criteria (table 3) which was worked out to help with selection. It reflects also RIVM interests related to *PHENOTYPE* project (see Appendix I). According to inclusion criteria (13 all together), the source could receive 0-26 points. For every criteria, the source study abstract were scored for compatibility to criteria. Compatibility was scored accordingly:

0- no (relation);

1- partly (related);

2-yes, (in accordance).

<b>Related to natural outdoor environment/ green spaces in urban context</b>
<b>Describes health effects of environment / green spaces</b>
<b>Includes indicators related to environment/ green effects on health</b>
Methods described in context
Mechanisms described in context
Related to spatial planning
Related to urban climate
Policy related
Specific population / target group
Specific area is investigated
Confounders brought out
Results are mapped
Related to sustainability

**Table 3: Inclusion criteria.**

The search strategy was to first scan title and abstract for possible suitability with inclusion criteria. The results of the two first keywords ( Search nr. 3 and 4) were neglected at first due to prioritizing of possible outcomes of other keywords. Later it was excluded completely as not necessary literature to support the research, because the information hoped to gain came out under the more related keyword result literature. Then all the selected papers (or abstracts if full text was not available) were downloaded and exported to bibliography-managing software program Mendeley (Mendeley, 2013) and parallel to an excel file named after keyword search number. Mendeley program downloaded same paper only one time, avoiding doubling. Then the abstracts were more thoroughly read through and scored according to inclusion criteria as explained earlier. Scores were marked down (see extract of the scoring table – Table 4). If the first three inclusion criteria (marked with red in table 3) were scored 0, then the paper was excluded immediately and deleted from the selection. Overall there were 215 relevant studies selected and scored (figure 1.).

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Authors, Title, Year, Link	full tekst	inc.cr. 1	2	3	4	5	6	7	8	9	10	11	12	13	score
1 Aldous D.E., "The people-plant-place paradigm", 2011, "http://www.scopus.com/inward/record.url?eid=2-s2.0-84859388321&partnerID=40&md5=9621c78fd0e24bb2faa0e018da8de3d1"	no	2	2	1	2	2	1	1	1	0	0	0	0	2	14
2 Annerstedt M., Ostergren P.-O., Bjork J., Grahn P., Skarback E., Wahrborg P., "Green qualities in the neighbourhood and mental health - Results from a longitudinal cohort study in Southern Sweden", 2012, "http://www.scopus.com/inward/record.url?eid=2-s2.0-84859388321&partnerID=40&md5=9621c78fd0e24bb2faa0e018da8de3d1"	no	1	2	1	2	1	0	0	0	1	1	0	1	0	10
3 Bennet S.A., Yiannakoulias N., Williams A.M., Kitchen P., "Playground Accessibility and Neighbourhood Social Interaction Among Parents", 2012, "http://www.scopus.com/inward/record.url?eid=2-s2.0-84864382963&partnerID=40&md5=64dc5477c354a3fc64ac5e2c6ca3f875"	no	1	0	0	0	0	0	0	0	2	1	1	0	0	5
4 Bjornsdottir G., Arnadottir S.A., Halldorsdottir S., "Facilitators of and barriers to physical activity in retirement communities: Experiences of older women in urban areas", 2012, "http://www.scopus.com/inward/record.url?eid=2-s2.0-84859203206&partnerID=40&md5=9621c78fd0e24bb2faa0e018da8de3d1"	yes	0	1	1	2	0	0	0	0	2	0	0	1	0	7
5															

Table 4: Scoring according to inclusion criteria.

All the scores were written down in Mendeley into each papers note section. Then the papers were systemised into three groups according score rates: Score 3-6; Score 7-13; Score 14-24. All papers were moved under applicable group after the scoring.

Before starting the full text review and narrative synthesis, the availability check had to be conducted as from Scopus it was possible to retrieve 118 full texts and 97 abstracts only. An extra electronic databases and Google Scholar search was conducted and it was able to get access to an extra 59 papers. From the relevant papers 38 remained unavailable.

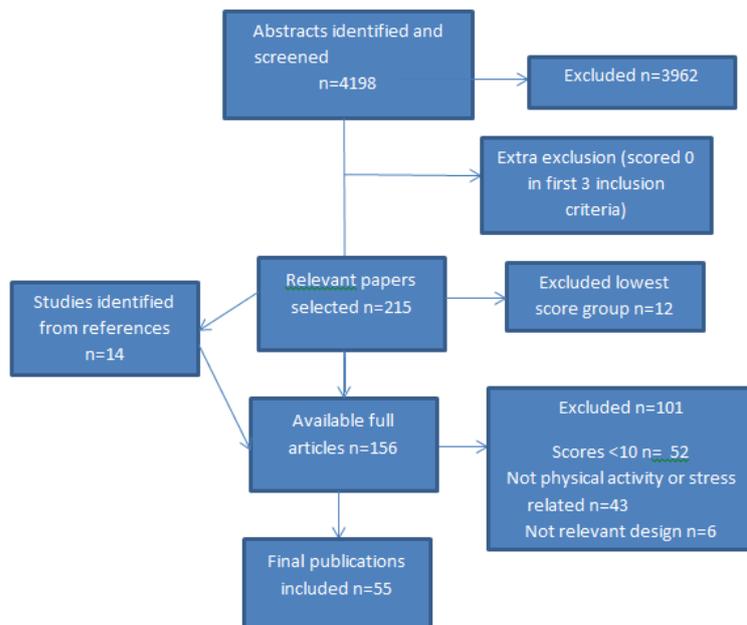


Figure 1: Selection process.

Before availability check, a decision was made to exclude the lowest score group (3-6). Later in accordance with supervisors, the decision was made to select from the middle score group only papers with score higher than 10 and to select only papers related to green space and physiological wellbeing/ mental stress and/or physical activity / obesity. Therefore half of the included publications (28 of 55) are more concentrated into specific health benefits of green space, while first 27 is more generally selected without including or excluding any specific health relations. During the syntheses extra 6 publications were excluded due to not applicable and irrelevant design. Thus 55 publications were finally synthesised (Figure 1).

## *2.2. Narrative synthesis*

Synthesis is the key element of a systematic review, which brings together the findings from the relevant studies in order to draw conclusions based on the body of published evidence (Popay et al., 2006). For the synthesis a hypotheses was made that there is a (positive) connection between health and urban green areas. To find out how the intervention works, why and for whom, the following data and findings were looked up and recorded from the literature:

### *– Study*

Name of the study, authors and the year of publication.

### *– Setting*

Country/-is involved, name of the places (cities, villages, neighbourhoods etc), settings more closely (park, forest, green spaces overall etc.) or where the data is originated (national survey or database, medical records etc.).

### *– Participants*

Who were the participants, how many respondents/ participants or from whom the information is received.

### *– Study design*

How the study is built up, which methods are used (cross-sectional survey, literature research, quantitative analyses etc.)

### *– Findings*

Results and main findings of the study.

### *– Urban environments involved*

Which urban environments were involved and how were they commonly characterized (urban park, coastal area, green space, community forest, public space, vertical greening etc.)

### *– Health effects described*

Mentioned health effects (both positive and negative) in relation to urban green (thermal comfort, restoration, impact on physical activity, stress mitigation etc.).

– *Indicators/indexes*

All mentioned indicators and indexes used to describe urban or green areas in relation with the health effects (UHI- Urban Heat Island, green space coverage, perceived restoration, self-reported health status etc.)

– *Cofounders*

Additional effects and reasons, what might influence health or which might be influenced by green areas or play an important role while assessing the connections ( social and demographic characteristics, exposure to violence, personal barriers etc.)

– *Weiss level of evidence scale*

Interpreted level of evidence score based on Weiss level of evidence scale (Table 5), which helps to evaluate the credibility and likelihood of the casual links established in each study. As all relevant articles were published in peer-reviewed journals, the source credibility was not evaluated.

Level Score	Bayesian Probability	IPCC Scale	Informal Scientific Scale	Authors interpretation
10	100%	(not in scale)	Firmly Established, has stood the test of time	Very extended worldwide research. Quantitative research supported with in-situ experiments over a substantial time period. Supported by a numerous literature.
9	99%	"Virtually Certain"	Rigorously proven	Same as upper level, but not necessary on worldwide level
8	90-99%	"Very Likely"	Substantially Proven	Can be like upper levels, only not supported by in-situ experiments
7	80-90%	"Likely"	Very Probable	Good setting and wide range of participants. Extensive methods are used to gather and analyse the results.
6	67-80%	"Likely"	Probable	Good results, but some limiting factors i.e. participants, setting or analysing methods. Nevertheless well proven under circumstances.
5	50-67%	"Medium Likelihood"	"If I must choose, this seems more probable than not"	Scientifically sound, but not supported by wide range of evidence due to limited search methods. Gives a good ground for further research.
4	33-50%	"Medium Likelihood"	Evidence is increasing but not preponderant	Scientifically sound, but setting is very local and results might not reflect the situation in similar conditions under different setting. Not very extensive methods used, but evidence is supported.
3	10-33%	"Unlikely"	Plausible, Backed by some evidence	Very limited study and not fully supported by evidence. Reason to doubt
2	1-10%	"Unlikely"	Possible	Unlikely, no really supportive evidence
1	<1%	"Very Unlikely"	Unlikely	Very unlikely that such literature is even included during first selection
0	0%	(not in scale)	Violates well established laws	--

**Table 5: Adapted Weiss scale, based on scales of scientific evidence (Weiss 2003).**

Gathered information helps to create an overview of the most common mechanisms and connections between health and green areas and offers overview of the current scientific findings, which help to find answers to the sub-questions of the research and contribute to the main questions substantially.

Based on narrative synthesis table (Appendix IIA-B) it is possible to start mapping the results and connections. Based on the selected criteria of selected studies, the preliminary synthesis of findings is developed and further exploring of the relationships between health and green areas are conducted.

### 2.3. Conceptual mapping

To group the findings that are empirically and/or conceptually similar and to identify relations between these groupings, the conceptual mapping is carried out (Popey et al., 2006). To link multiple pieces of evidence extracted from individual studies and to represent relationship between health and green areas, illustrative map is used. Such a cognitive mapping represents problems in a more comprehensible manner. It is based on cause-effect relationships (Van Kouwen et al., 2007). Such relationship mapping helps to give a better overview of relationships and connections between urban green areas and human health. The created map is explained and represented under results (Chapter 3.2.3.).

### 2.4. Case study

To test the gained knowledge in practice, a case study was conducted to find out if every day public health and urban planning decision makers and practitioners are aware of all the beneficial connections between urban green and health, and if they agree with present findings. What are their experiences and knowledge of planning and designing urban outdoor environment, and how it is possible to maximise the efforts and effects in accordance with local policy. For that, work conference '*GEZONDRONDOM*' held by The Ministry of Infrastructure and Environment (the Netherlands) in cooperation with other organisations (incl. RIVM), who are related with ***Nationale Aanpak Milieu en Gezondheid (NAMG)***<sup>1</sup>, was used to gather the information from professionals. It was held on 15 May in den Haag and was full day event with presentations, workshops, excursions and discussion panels. The work conference was meant for professionals, whose work is related with improving the living quality: public officials, architects, urban developers, school boards, health authorities and interest groups. Round 300 professionals gathered to hear each other and to get to see what has already done, and to receive advice and inspiration for the future. The conference was held in Dutch and was meant for local professionals. The program of work conference is presented in Appendix III. During workshops and discussions lot of knowledge and experiences were shared. Considering the topic of current research, workshop "*Gezond Ontwerpen. Een leefomgeving die (ver)leidt tot gezond leven*"<sup>2</sup> was chosen for

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1 National environmental health action plan. Authors translation.

2 Healthy planning. A living environment what leads to healthy living. Authors translation.

active participation. During the workshop and brakes, there was possibility to talk with professionals and ask questions. Dictaphone was used to record the presentations and discussions during workshops and discussion panels to contribute to participant's observations. For this work conference the preparing questions were worked out to gather necessary information for current research (Table 6). Also short introduction of the current research was made in Dutch to be able to present the work and results done so far (Annex IV). In total 11 different Dutch professionals opinions were recorded, noted and used as bases to compare current study findings with practical experiences and knowledge. The transcriptions from recorded material is presented in Appendix V.

<ul style="list-style-type: none"> <li>• <b>Importance of green planning and green spaces:</b></li> </ul>
-Does local municipality see any need of, or have intentions to introduce, urban green planning? If yes, why? Give examples.
- What importance do you believe green spaces in urban environment will have in the future?
- How will the municipality handle future expansion of the city? Which areas will be exploited?
- Are there enough green spaces in your local municipality? Are those developed green spaces important for the local life quality and sustainability? Are they widely used and for what?
<ul style="list-style-type: none"> <li>• <b>Experiences and new knowledge:</b></li> </ul>
- In the work with green planning- what data have been recorded concerning health effects of green space?
- Is there a certain health related area prerequisites considered/counted, when planning new green space?
- How are these strategies and objectives expressed in the planning work?
- What planning tools/ guidelines do you use, e.g. GIS, own databases or other tools? Give examples.

**Table 6: Prepared questions for work conference.**

As supportive material also report from WHO Collaborating Centre for Healthy Urban Environments, South West Regional Public Health Group, 27-29 February 2012 in the Netherlands "*Planning-Public Health-Urban Design*", was used. To be clear, there is no direct connection with author of current research and this case study. Author has not participated in those case studies nor contributed to report, therefore all the results reflected here are derived from the summary record and photo report of that study tour (WHO, 2012). The purpose of the study was for participants, who all have leadership roles in relation to local authorities in the United Kingdom, to visit exemplary case studies overseas and to see how healthy sustainable urban development works in practice (WHO, 2012). In the Netherlands following case studies were conducted:

### **Case studies: healthy urban environments in practice**

- **Houten: a cycling city;**
- **Leidsche Rijn: building a new community ;**
- **GWL Terrein: car-free and community led;**
- **Rotterdam: developing a healthy city;**

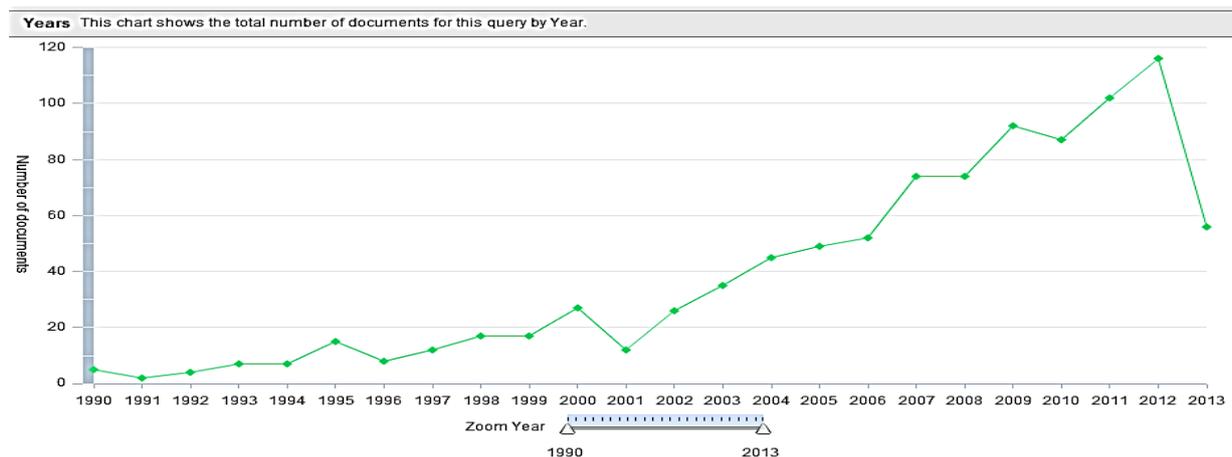
Those case studies were in nature similar to Den Haag workshop, only held on several days and in different places and for international participants. This additional information is added to give more international angle to current case study part. The results are divided and presented in the table according to prepared questions for work conference.

### 3. Results

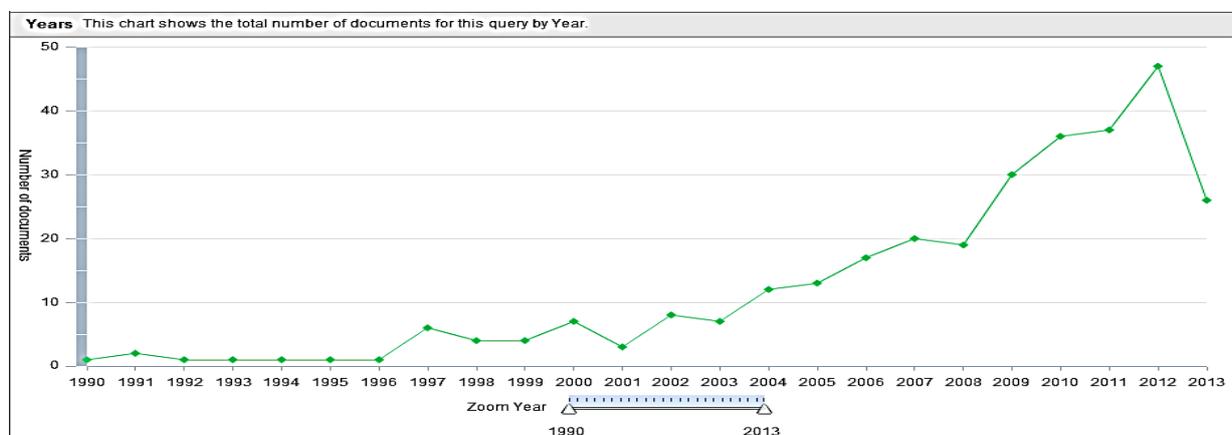
The main aim of the research is to find the linkages between positive human health effects and the outdoor environment, concentrating on urban green areas. First, it was necessary to find out what is already presented in the existing scientific literature and second, test the knowledge and its usage in practice.

#### 3.1. Literature review

Literature review keyword search indicated that there is a wide selection of literature that can be relevant and most of the papers are presented quite recently. The overview of the literature results detected by using selected keywords is presented in figures 2a-f.



**Figure 2a: Keyword nr. 8 'Health effects AND outdoor environment OR green areas OR green space' hits (Scopus, 2013)**



**Figure 2b: Keyword nr. 11 'Health effects AND urban green OR urban outdoor environment' hits (Scopus, 2013)**

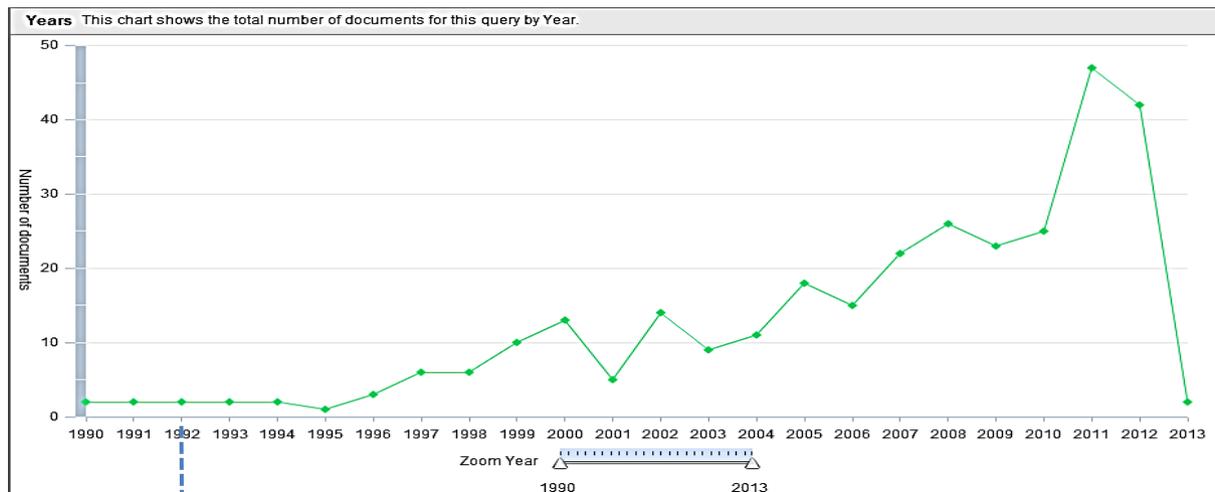


Figure 2c: Keyword nr. 13' Indicators green health' hits (Scopus, 2013)

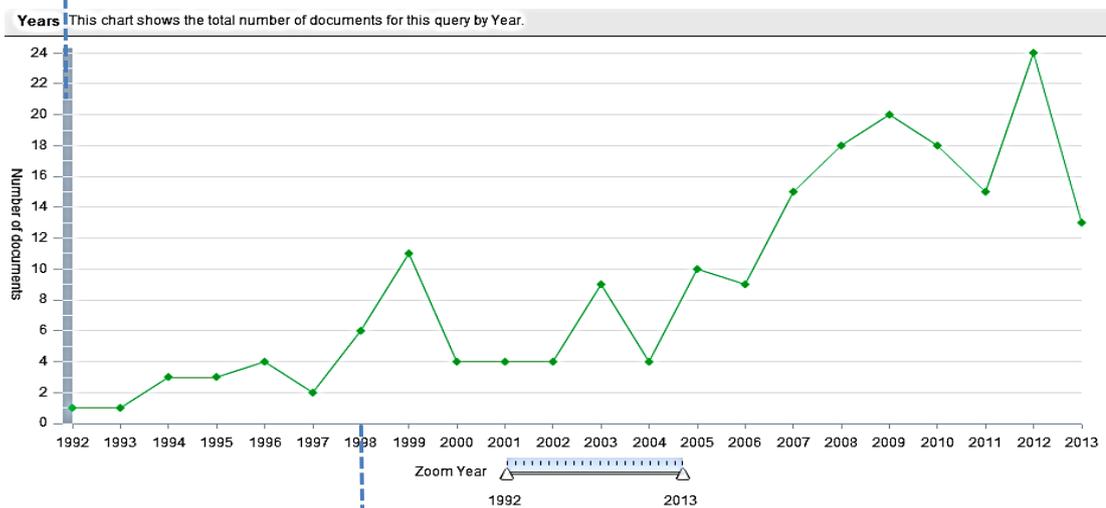


Figure 2d: Keyword nr. 17'Relationship outdoor environment health' hits (Scopus, 2013)

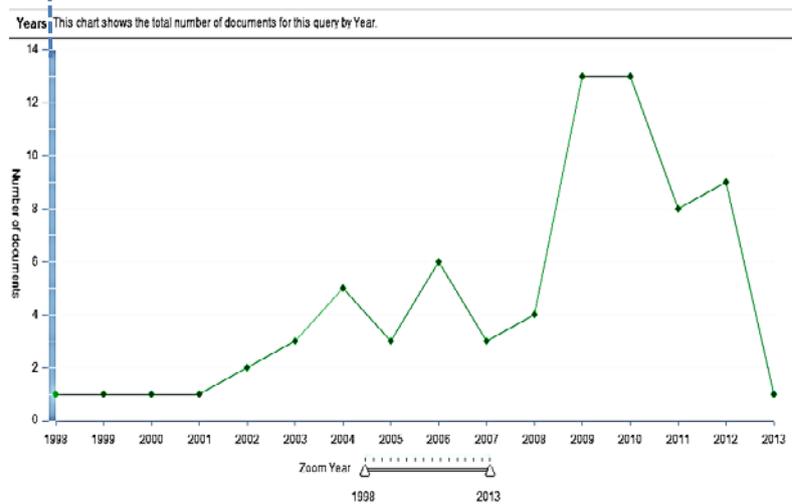
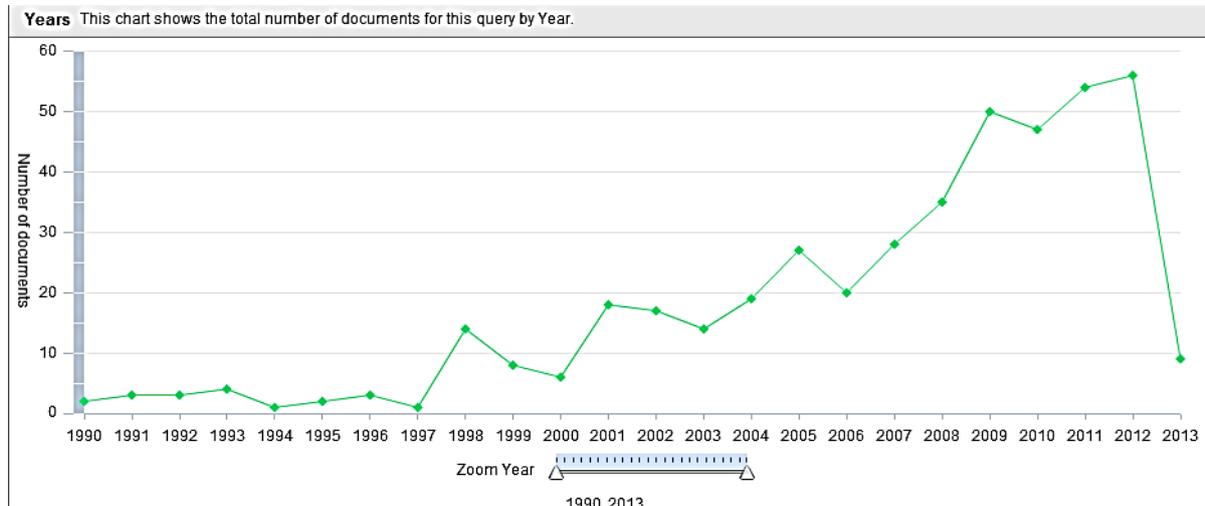


Figure 2e: Keyword nr. 19'Outdoor environment health promotion' hits (Scopus, 2013)



**Figure 2f: Keyword nr. 20 'Restoration AND Green area OR Green space' hits (Scopus, 2013)**

The figures show that related topics were not that popular in the beginning of nineties. There were no scientific studies present in connection with outdoor environment and health promotion before 1992 (according to Scopus) and restoration in connection to green area or space was not established in scientific literature before 1998 (Scopus, 2013). Majority of the topics have had gradual popularity rise around year 2000 and although some fluctuations have occurred during later publishing years, the tendency is towards increased interest. Exception is keyword nr.19 'Outdoor environment health promotion' (Figure 2e), which results indicate that there has been sudden fall in amounts of related published documents after peak period 2008-2010. But in general, there is a growing trend.

After reading and sorting the first selection of abstracts, 215 papers were selected and scored by inclusion criteria (Table 3, full table with scores in Appendix IIA-B). The scores were summed overall criteria to obtain the total score. There were 28 papers scored with 14-24; 152 with 7-13 and 32 papers received lowest scores 3-6. The decision was made to exclude the lowest score papers from further research. At the end 55 papers were selected for narrative syntheses. Most studies were conducted in Europe, but there was worldwide representation (Figure 3). Overall 20 different countries were represented. The biggest share of studies originated from Europe -UK, Sweden and the Netherlands.

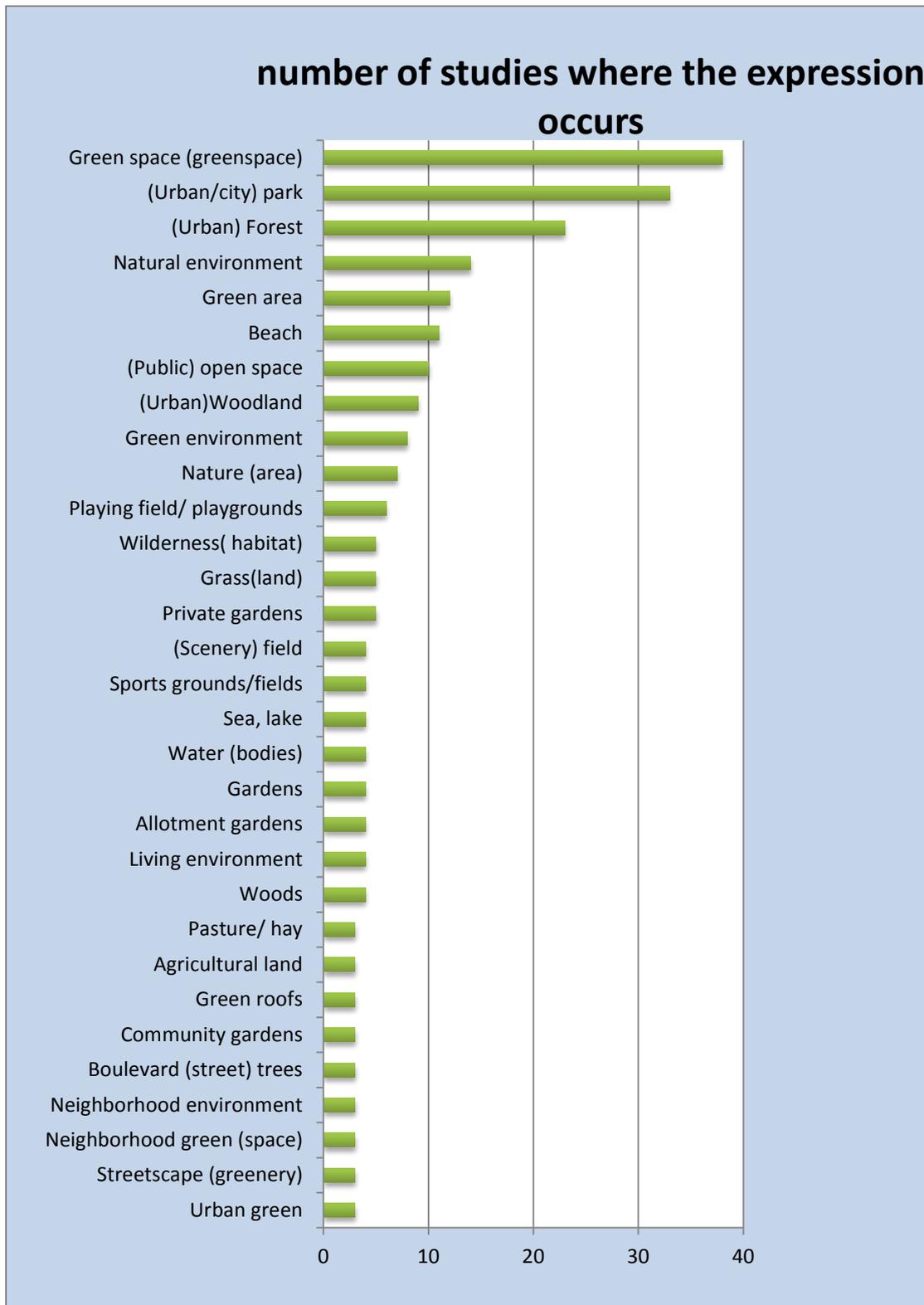


characteristics of the mentioned natural outdoor areas were also extracted. Table nr 7 presents most encountered descriptions of the natural outdoor environments related to urban environment and in Appendix VI the full table with all descriptions are presented. When possible, also characterisation was added as stated in specific literature (referred in last column). Literature number in last column indicates the number of the literature in the main Narrative Synthesis table (Appendix IIA-B). In the figure 4, the most used expressions are brought out.

Terms used	number of studies where it occurs	characterisation	Lit. Nr
<b>(sustainable)(natural)(Urban) Green space (greenspace), (UGS)</b>	38	Space in a 1-km and 3-km radius around the respondents home	1
		22 CORINE land cover categories pertaining to natural, land-based (i.e., excluding water bodies) environment	10
		Defined as "open, undeveloped land with natural vegetation" and include parks, forests, playing fields, and river corridors.	13
		Green space defining in CLUD database: category includes parks, other open spaces, and agricultural land, but excludes domestic gardens.	13
		Built-up green spaces (large green lots, green areas within housing blocks, decorative plantations and glorious flowers, traffic green areas such as wind-breaks, green lanes and tree avenues, parks including grass and plantations)	14
		Urban green, agricultural green, forests and nature areas	20
		Definition of green space included natural areas (e.g., parks, beaches, and fields) but excluded aquatic areas (e.g., lakes and the sea)	22
		Natural urban green spaces has been described as any open space, vegetated land or water located and managed within the urban environment and could include plant communities and assets that include public and private green space, grassed sporting facilities, residential lawns, golf courses, airfields, churches, colleges and university grounds (Aldous, 2009)	24
		Generalised Land use Database for England defines greenspace as parks, open spaces and agricultural land, excluding domestic gardens	37
		Including for example, parks, forests and grass, but excluding domestic gardens	43
		Refers to all public parks, schools (i.e., school fields) and recreation areas (e.g., public riverfront) within the city->1 km <sup>2</sup>	44
Is defined as all accessible open spaces with a high degree of vegetation in urban or peri-urban (in the immediate vicinity of a town or a city) areas.	52		

<b>(Urban/city) park</b>	33	Natural environments, larger contiguous green spaces	10, 13
<b>(Urban) Forest</b>	23	Pine-birch forest	39
		Wild and tended	54
<b>Natural environment</b>	14	Such as forest and vegetation	36
		Includes many different types of green space such as wilderness areas, allotments, urban parks, open countryside, country parks, woodlands, and wildlife reserves	38
<b>Green area</b>	12	Defined as parks, forests, nature and recreation areas	5
		Urban green areas were considered as all soils made mainly by permeable surfaces and covered for any kind of vegetation as lawns, shrubs and trees, from public or private property and to meet environmental, recreational or productive functions). Different types of green areas were classified into two main groups (public and private), subdivided into five systems (public services, roads, natural, productive and private) and 12 subsystems related to land use (recreational, sports, education, streets, heritage natural areas, farming, industrial, commercial, tourist, residential, mixed land uses and derelict land)	18
		Parks or squares	50
<b>Beach</b>	11	Described as location suitable for bathing in lake/ocean	12
<b>(Public) open space</b>	10	Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	16
<b>(Urban)Woodland</b>	9	Extensively managed natural settings	14
<b>Green environment</b>	8	Natural environment	15
<b>Nature (area)</b>	7	Large forest areas, small-scale wooded areas, scenery fields and meadows, small-scale natural state areas such as river valleys, wetlands, bushes and rocks)	14

**Table nr 7: Mostly used descriptions of types and characteristics of urban natural outdoor areas.**



**Figure 4: The most used expressions to describe the types of urban natural outdoor environments.**

From 55 selected literatures 168 different types of natural outdoor environments in urban settings were identified. As it is possible to see from figure 4, the most used expressions to

describe such environment were *'green space'*, *'park'*, *'forest'*, *'natural environment'*, *'beach'* *'green area'*. The last expression was initially also used to describe this research, but after the results of mostly used descriptions it was changed to *'green space'* due to its most frequent usage in scientific literature to describe natural outdoor environments in urban areas. There were lot of different neighbourhood related descriptions like *'Neighbourhood green'* and *'Neighbourhood environment'*, same with the word *'environment'* – *'living environment'*, *'Green environment'* etc. Due to many possible combinations, those terms did not rose up in numbers. It indicates how hard is to determine how *'nature'* is understood for different people. Pinder et al. found in their research that *'nature'* was not understood as a hermetically sealed externality, but had shifting meanings resulting from people's mode of acting in the world (Pinder et al., 2009). By comparing the different use of word combinations, it was possible to see what terms been preferred in scientific literature and in what context they were used. Beside to that, get an overall overview of all the areas considered as part of urban natural environment.

### 3.2.2. Health effects of green spaces

One of the important research sub-questions was to identify the main health effects of green spaces:

- Research sub-question 3:

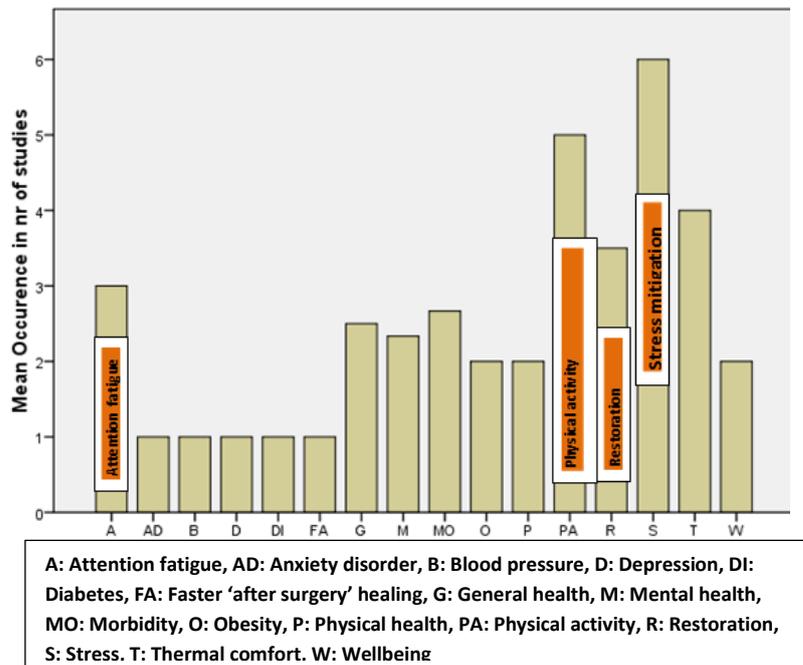
*'Which health effects do natural outdoor environments (green spaces) have?'*

To find out the effects of the green spaces, the findings of the relevant studies were brought out, and to specify the connection to health also the mentioned health effects were recorded separately. A same criterion also offers answer to :

- research sub-question 6:

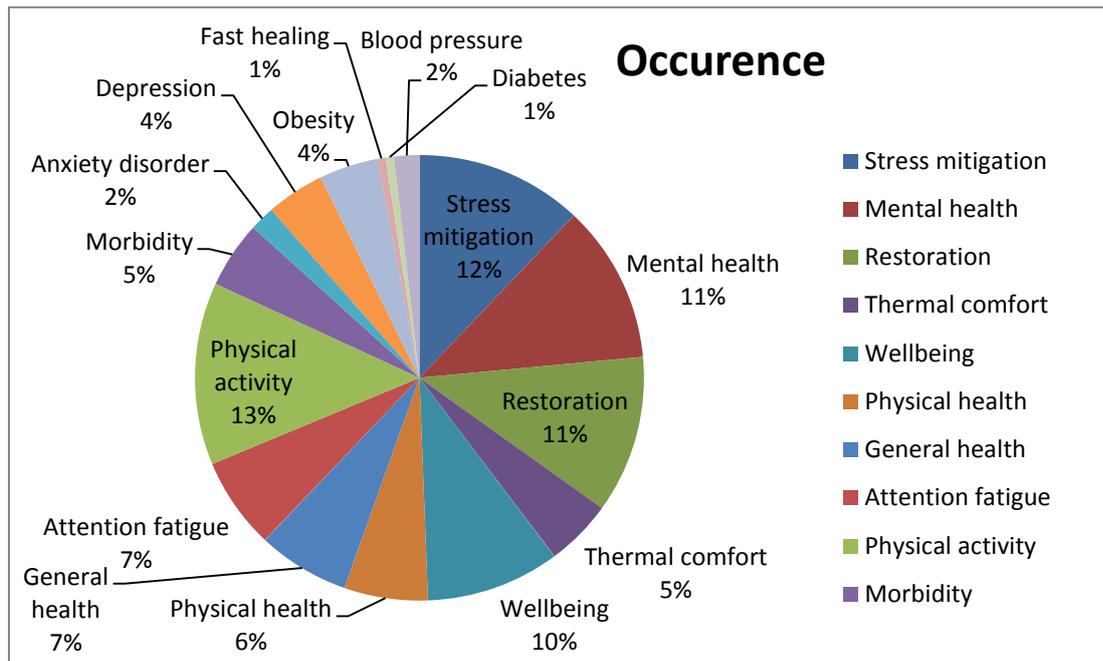
*'Which are the common mechanisms by which green spaces promote human health and wellbeing?'*

Appendix IIA presents the general findings of the studies and Appendix IIB described health effects. The same table has been taken as bases for the cognitive mapping. The first selected 27 literatures where about all kind of health issues/effects connected to natural green environments. Figure 5 presents the more specific main health issues related to green space health effects. This led to focus current analysis on the mental stress, attention fatigue, restoration and physical activity. It was justified, because those are according to the literature, the most common health effects green spaces provide.



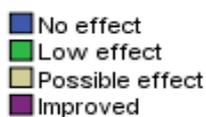
**Figure 5: Mean occurrence of mentioned different health issues of green spaces in the first 27 selected studies.**

Figure 6 shows most improved health issues/effects contributed to green space, described in all the selected studies. As it is possible to see, the main health effects studied in the relation to green space were in the case of *physical activity*, *stress mitigation* and *restoration*. The term restoration comes from Kaplan & Kaplan Attention Restoration Theory (ART), and asserts that people can concentrate better after spending time in nature, or even looking at scenes of nature (Kaplan and Kaplan, 1989). Several more detailed health issues have been studied, which qualified under stress and are not separately brought out, like *burnout syndrome*, *insomnia*, *feeling panic* etc. Lot of related feelings have been investigated, like self-esteem and mood improvement when visiting green spaces (Barton and Pretty, 2010). The therapeutic influence of the green and or blue space was also studied closely by Völker and Kistemann (2013). Blue space was brought out in several cases as important part of the green area. In the Finnish study of most restorative and favourite places, the waterside environment was valued highly (Korpela et al., 2008) therefore also the word 'beach' was one of the most used descriptions of the natural green spaces (Figure 4).

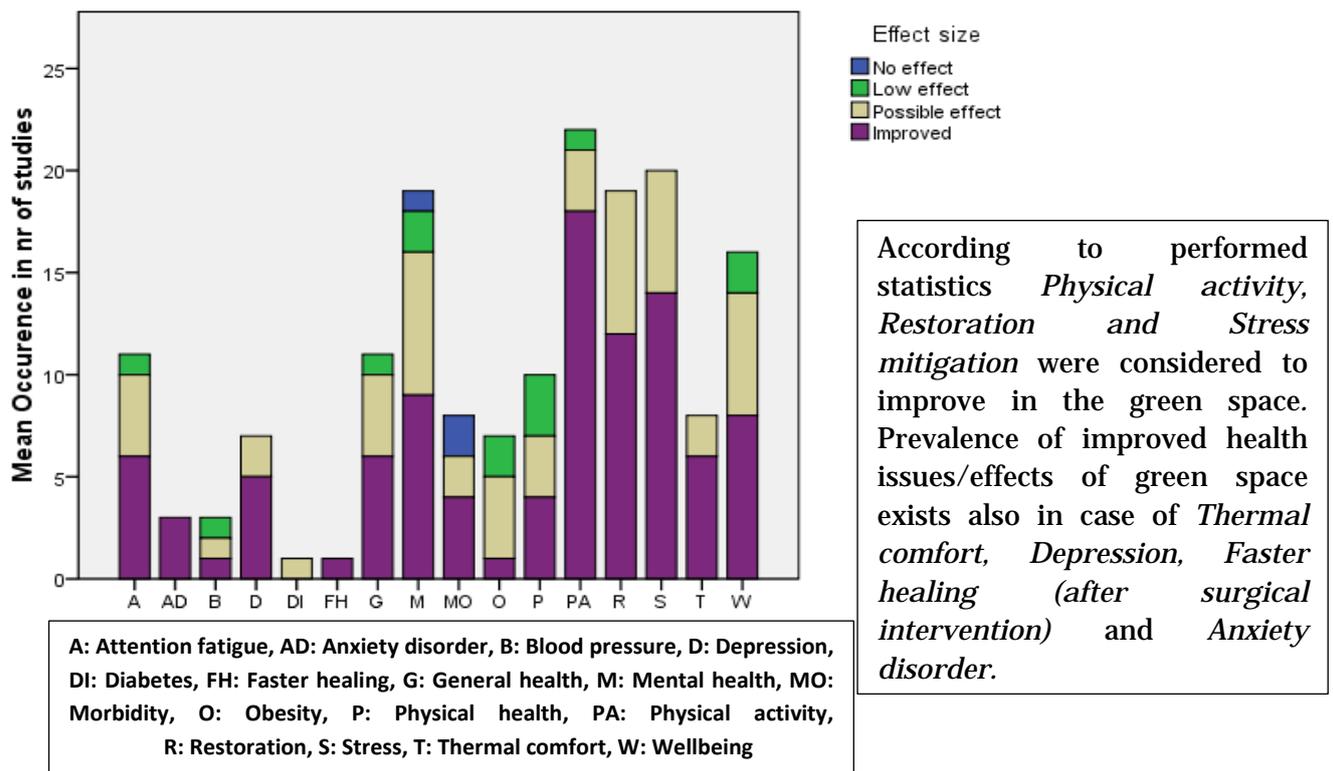


**Figure 6: Occurrence of the different green space contribution to improved health issues/effects in the literature.**

The assumed effect has not always been proven. To measure effect size to a human health, the effects described were divided into 4 groups:



Most cases evidence exist that health had indeed improved ( figure 7), but there were lot of studies were the actual mechanism and reason for improvement was not so clear. Often could the effect be only considered as possible effect, because in some cases it was hard to find direct connections between improvement of health and green space, like in case of obesity where only closeness of green space were connected with occurrence of obesity(Potestio et al., 2009). It is possible to conclude that those who live close to green spaces are more unlikely to be overweight, but at the same time it is hard to control cofounders and dedicate all the improved health statistics to green space. One can think of lifestyle choises and social-economic background. Cofounders are brought out and discussed further under the indicator part (Chapter 3.2.4.).Closeness to green areas and its effect to different health aspects was one of the most studied mechanisms (Grahn and Stigsdotter, 2003, Nielsen and Hansen, 2007, Maas et al., 2009, Van der Berg et al., 2010, Stigsdotter et al., 2010.). Grahn and Stigsdotter also came to conclusion that the distance to public urban open green spaces are of decisive importance. Their research results show that people who visit more often green spaces suffer less often from stress-related illnesses (Grahn and Stigsdotter, 2003). Green spaces salutogenic effect to stress-related illnesses is widely investigated.



**Figure 7: Different effect sizes in relation to health effects of green space according to selected literature.**

Most mentioned health effect related to green space is restoration from stress and attention fatigue (Groenewegen et al., 2006; Hartig, 2008; Woo et al.; 2009, Van der Berg et al.; 2010, Stigsdotter et al., 2010; Richardson et al., 2010; Abraham et al., 2010; Van Dillen et al., 2012; Lottrup et al., 2012; Ward Thompson et al., 2012). Mechanism behind it is simple exposure to nature in the form of green space, van den Berg et al. conclusion support that claim by determining that contact with green area can provide restoration from stress and mental fatigue (Van der Berg et al., 2010). Parson describes how attention fatigue mitigation works: “When nature captures people’s attention, executive systems that regulate directed attention get to rest, pessimistic thoughts are blocked, and negative emotions are replaced by positive ones” (Parsons, 1991). Those are relatively simple mechanisms how green area can be beneficial and salutogenic to urban population. As it is seen from figure 7 restorational benefits are in most cases improved or given that there is possible effect. No encountered research found that green space can have only low or no effect to persons mental restoration. Nordh et al. findings are in line with claims that the greener or how they say “more natural” the outdoor environment, the better it is for restoration (Nordh et al., 2009). Although results often indicate that bigger the area the better effect is, there is enough evidence that also small pocket parks, trees on streetscape and even a simply greener view can have already effect (Groenewegen et al., 2006; Van Dillen et al., 2010). Positive affective preception of the area is one of the key mechanisms to achive beneficial effects from the contact to green, even in small scale. Pinder et al. brought out in their findings: “The idea of green environments as being intrinsically ‘good for us’ was part of a stock of common sense knowledge that both professionals and people from most communities subscribed to, and to some extent saw as a social right.” (Pinder et al., 2009).

In a wider scale the importance of the green in the city can have effect even to climate change, for example by mitigating the effects of climate change. This has contributed a lot to recent research. The widely investigated climate change effect is Urban Heat Island (UHI) and raise in overall temperatures, causing negative health effects. An increase in the intensity and frequency of heat waves has been linked with heat stroke, hyperthermia and increased mortality rates (Bowler et al., 2010a). Therefore one of the important benefits what urban green area offers is improved thermal comfort (Rosenzweig et al., 2006; Laforteza et al., 2009, Pena-Salmon and Rojas-Caldelas, 2009; Makhelouf, 2009; Bowler et al., 2010a), by providing shade and cooling and as vegetated area contributing to evaporation intensity, which lowers temperature overall (Smith and Roebber, 2011; Papangelis et al., 2012). And another more indirect effect to human health of the urban green area is the fact that it improves also environmental health, like air quality by adding oxygen and removing carbon or offers barrier against noise pollution etc. Thus one of the mechanisms how green area improves human health is its function what leads to a less polluted environment.

Very well established health effect in the literature was increase of physical activity in green areas. As figure 6 indicates, in the biggest share of selected literature (13%) was this health effect of urban green area brought out. Figure 6 shows that in most investigated cases the physical activity had increased in connection to green areas (De Vries et al., 2003; Groenewegen et al., 2006; Laforteza et al., 2009; Amorim et al., 2010; Bowler et al., 2010b; Richardson and Mitchell, 2010; Richardson et al., 2010; Lee and Maeswaran, 2011; Fan et al., 2011; Van Dillen et al., 2012; Annerstedt et al., 2012; Mitchell, 2012; Lebel et al., 2012; De Jong et al., 2012). There was also new terming used to describe physical activity in the green area – “green exercise” (Pretty et al., 2007; Barton and Pretty, 2010). Thus one of the mechanisms how the health effect of green area works is that it increases the practice of physical activity (walking, cycling, running etc.), which is beneficial to human health. Physical activity can have positive benefits for mental health, for instance lowering depression (Bowler et al., 2010b). Physical activity obviously has effect against obesity and overweight (Nielsen and Hansen, 2007; Potestio et al., 2009; Stigsdotter et al., 2010; Cummins and Fagg, 2012; Lebel et al., 2012). For example Dutch public health recommendations for physical activity states, that people should engage in at least 30 minutes of moderate-intensity physical activity on at least 5 days per week (Maas et al., 2008). Some epidemiological research's has gone as far as to connect the presence of green area with mortality rates and the results have showed great importance of received lower risk of all-cause mortality in more greener areas (Mitchell and Popham, 2008; Richardson and Mitchell, 2010; Maheswaran, 2011; Mitchell et al., 2011). Especially elderly and children were considered as the most beneficial age-group, because they are also the most vulnerable age-groups.

In summary 5 main health effects green spaces provide have been identified:

- **Stress mitigation**
- **Increase of physical activity**
- **Restorative experiences**
- **Attention fatigue amelioration**
- **Mental health improvement**

The 5 most common mechanisms by which the green spaces promote health are:

- **Exposure and closer contact with nature**
- **Positive perception of the area**
- **Thermal comfort**
- **Improving environmental health**
- **Physical activity stimulation**

### 3.2.3. Conceptual mapping

To bring the results of green space health effects and mechanisms together in more illustrative way, a conceptual map has been designed, based on findings of narrative syntheses of literature review (Figure 8). On the map the green space is central as a mediator. It can be compared to rehabilitation centre, where certain negative health issues can be treated through certain curing functions (mechanisms) which offer certain beneficial health effects as a result. On a top row in blue square boxes, the negative health effects are presented. Each effect is written in different colour and arrows directing to functioning mechanism and resulting health effects, are in corresponding colour. Idea behind is to make it easier to follow the issue-mechanism-effect line connected to a specific health issue and see which mechanism works best and what salutogenic effect it leads to. For example *Physical health*, considered as negative issue, indicates that we deal with person's poor physical health problem. The arrows are leading to 3 different mechanisms, which are facilitated by green space: *Exposure to nature*, *Positive perception* and *Simulation of physical activity*. Hence those are the mechanisms how green area can influence person's physical health. Following the corresponding colour lines, we can see that in case of poor *physical health*, the exposure to nature mediated by green space can result to lower *mortality*. Practical example could be fast healing after surgical intervention. *Positive perception* again leads to *increased physical health*, which is probably the most expected result. This can be explained by the fact that the *positive perception* of the green space stimulates people to spend more time outside, which is

salutogenic to their *physical health* condition. Probably, the most evidential function of *green space* is its ability to *stimulate physical activity*. People are stimulated by nature to be more active and spend more active time during the visit. It results beside *improved physical health*, also to *lower mortality* rates as they are interconnected. Both negative health issues and resulting health effects are interconnected as one can lead to another or one can be driven by another – think of poor *physical health* leading to *overweight* or/ and higher *mortality* etc. As it can be seen, the mechanisms are offering more beneficial health effects – i.e. *Physical activity stimulation* can also *lower stress*. Considering variability of stemming health effects, then *Exposure to nature* and *Perception* are contributing to the most resulting positive health effects. Those are relatively simple mechanism, which can be achieved by simple methods – i.e. integrating more *green spaces* into urban planning. From there it can be possible to design them the way that also the other mechanisms would function there. That it would be climate adaptive to offer *thermal comfort*, so that it would attract people to visit it and/or exercise there. That there would be good air quality, good noise free soundscape (*environmental health*), which all contribute to *stress mitigation* and *positive perception*. Thus also mechanisms are interconnected. Therefore approach to green spaces health effects should be holistic and intrinsic at the same time-to see the ‘big picture’ through simple basic elements. This map offers a basic overview of the interrelated connections between urban green space and human health.

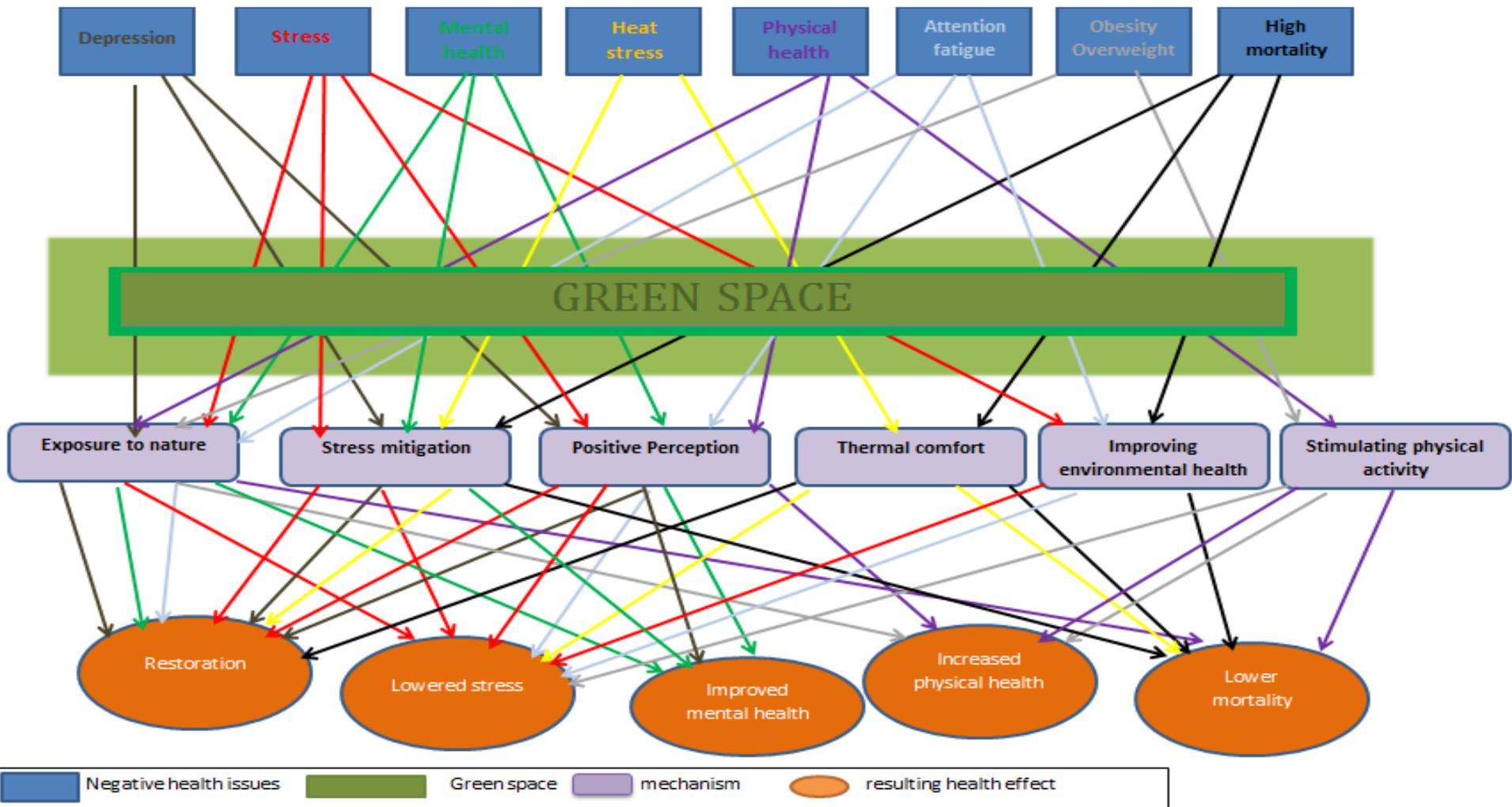


Figure 8: Conceptual map of green spaces health effects and beneficial mechanisms.

### 3.2.4. Indicators and indexes

To have an overview of used indicators, the criteria *indicators and indexes* have been used. The indicators have been divided into 3 different groups: *health related*, *Environment related* and *cofounders*. Often is the same indicator used in different studies under different context. Therefore one indicator can be in one study considered as indicator and in in other as cofounder. Nevertheless all mentioned indicators and cofounders have been brought out in 3 tables (Table 8-10) to answer the research sub-question 4:

*'Which indicators have been used to describe the effects of natural green areas on human health and wellbeing?'*

Table 8 shows 10 of the most frequently used health related indicators. Altogether 82 different indicators were counted. A full table with all mentioned human health related indicators, is presented in Appendix VII.

Health related Indicators	Specifics	Sub-criteria if brought out explicitly	Occurs in the study nr3	C
Physical health	Self-reported physical health. The number of health complaints in the last 14 days		1, 27	
	Self-reported physical health scores(12-item short-form health survey)		32	
	General physical health information		40	
General Health	Self-reported general health. A single item measure of perceived general health ranging from 'excellent' to 'poor'		1	
	Self-reported general health. Number of symptoms experienced in the last 14 days	acute complaints, chronic illness, mental health, disabilities	20, 27	
	self-estimated health status (primarily concerned stress complaints), occurrence per year	Stress, Irritation, Fatigue, Cold(occurrence of common cold (viral infection)), Headache, Backache, Ache in the back of the head;	28	
	(Self-reported health )condition, health problems		30, 35, 14, 31, 48, 49, 50, 53, 55	c
	5 point scale, running from 'bad' to 'excellent'		5, 20	
Psychological health	Consists of five items to be score on a 6-point scale, with scores being transformed into a scale from 0 to 100. A score of 100 indicates perfect mental health		5	
	Perceived/Reported mental health status		27, 41	

3 Number indicates to the number presented front of the study in the main syntheses table Appendix IIA-B.

	Perceived mental health measured by the GHQ-12 (Dutch 12-item version of the General Health Questionnaire)		1	
	Mental health sores(12-item short-form health survey)		32	
	General psychological health		40	
	Poor mental health measured by the General Health Questionnaire (GHQ)		43	
<b>Well-being</b>	Perceived well-being	before and after the visit of green space	11	
	level of wellbeing measured by the Warwick Edinburgh Mental health and Wellbeing Score (WEMWBS)		43, 47	
	Mental well-being		45, 48	
	Physical well-being			
	social well-being			
	subjective measure of well-being -feeling well-balanced		51	
	Self-rated)Psychological well-being	eight subscales (“activation”, “arousal”, “good mood”, “reflection”, “calmness”, “lethargy”, “anger”, “depression”), each measured by five items, Scale 0-8		54
<b>Experienced stress</b>	Question asked: ‘Have you in the last 12 months felt: irritated, hunted, stressed, full of energy in the morning—or—concentrated and in a good mood on your job?’ The respondents would answer with the frequency of the feeling/experience mentioned on an ordinal scale with seven grades: almost every day, maximum once a week, maximum once every fourth night, maximum once per month, maximum once every quarter, single occurrences and finally—never.		12	
	stress as measured by levels and/or patterns of salivary cortisol secretion over the day		47, 53	
	prevalence of symptoms of stress		53	
<b>Perceived stress</b>	Perceived stress scale (0-16)	Perceived Stress Scale, comprising 10 items (e.g. feeling nervous and stressed; feeling on top of things; being angered because of things outside your control) measured on a 5-item response from ‘never’ to ‘very often’	8, 17, 35, 47	
<b>Physical activity</b>	the extent to which green spaces attract people for physical activity		6, 30	
	Assessed as total self-reported physical activity undertaken as part of work, domestic labour, sport and leisure in the last 4 weeks.		37	
	Level of physical activity	type and duration	41, 42, 48, 49	c

	The number of days on which physical activity (of sufficient exertion to raise breathing rate) reached or exceeded 30min, recalled over the past 4 weeks.		47	
	Leisure-time physical activity		50	
	Transport-related physical activity			
Amount of physical activity	amount of physical activity performed during the visit		11	
	amount of previous physical activity		30	c
	Physical activity per week	moderate and vigorous:-the total number of times during a typical week that the respondent was engaged in vigorous activities for at least 20min at a time and in moderate activities for at least 30 min at a time	8, 43	
Cause-specific mortality	(circulatory disease, lung cancer, cardiovascular disease, respiratory disease, and intentional self-harm)		6, 13, 15, 22	
BMI-Body Mass Index	Body Mass Index as indicator of overweight and obesity	category according to WHO classification	12, 37, 40, 44	
Lifestyle	Lifestyle correlates (second home, bicycling for work etc.), Vegetarian, sportive		12, 17, 27, 40	c

**Table 8: 10 most frequently used health related indicators, their specifics and referring to the number of the study, where this indicator is used. The letter 'c' at the end of the row indicates that in some studies this indicator is also used as cofounder.**

As the table 8 shows, the most popular indicators are also quite general ones, like *Physical/Psychological health* and *Wellbeing* and *General health*, under which also the previous ones can be classified. Stress and Physical condition related indexes are also prevalent as half of the selected studies concentrated on stress and physical activity related researches. As there were 82 different health indicators counted, therefore there were also lot of more specific indicators used to approach the health effect of the green space. Although most of the studies relied on self-reported health effects, there were also more complicated studies, supported by more objective medical measures, like telomere length or hormone and cortisol level after visiting or exercising in green space (Woo et al., 2009;Bowler et al., 2010b). Interesting results were provided by studies, which looked into perception based indicators, such as restoration, mood status, affection, self-esteem. They indicated that often, mere sight of green can already offer fast restoration, better mood, positive affections and end up raising self-esteem. Surprising is the relatively wide usage of mortality related indicators. This is probably explained by the fact that it requires relatively simple data, which can be obtained from statistical databases. Further, mortality indicates a better general health – if people live longer, they are usually also healthier and vice versa. Although it is a rather brusque connection, it is probably a convincing argument for policy makers.

With environment related indicators it is possible to see how environment related indicators are considered to support the investigation of health effects and what exactly has taken into consideration, when studying the mechanisms linking green space to human health. Appendix VIII presents a table with all 67 environmental related indicators found from selected literature. In Table 9, the ten most encountered environment (as whole incl. location) related indicators have been presented.

Indicators/indexes Environment or mechanism related	Specifics	Sub-criteria	Occurs in the study nr4	C
Percentages of green space	Only green spaces that dominate the land use in the 25x25 m grid cell (more than 50% of the grid cell is green) have been classified as green space in the dataset Small-scale green spaces, such as street trees and roadside vegetation were only included as green space if they were dominant in the grid cell.		7, 49	
	% of urban green, agricultural green, forests and nature areas		20	
	Percentages of green space in a 1-km and 3-km radius around home		1, 20, 49	
Greenness of the area	Greenness based on median split at 45 m <sup>2</sup> of green area per dwelling within 500 m or percentage		5	
	the number of parks/green spaces per 10,000 residents		44	
	area of parks/green space as a proportion of the total area within a community		44	
	average distance to a park/green space		44	
	The proportion of parks/green space service area as a proportion of the total area within a community.		44, 47	
Greenspace coverage	1 indicator:22 CORINE land cover categories pertaining to natural, land-based (i.e., excluding water bodies) environment; 2: OSMM contains a topography layer, which is delimited into nine themes, two of which were used for defining green space: (1) the terrain 'natural' subset, representing all natural (non-synthetic) topography; and (2) water (to include small 'blue spaces' such as river corridors). The third indicator was a 'hybrid' designed to offer a middle ground between CORINE (sensitive to larger spaces only) and OSMM (sensitive to ambient greenery).		10	
	percentage coverage of green space types for each urban neighbourhood		22, 43	
quality of green area	Assessed with 10 items, each on a 5 point scale	Accessibility	5	
		Maintenance		
		Variation		
		Naturalness		
		colourfulness		
		clear arrangement		
		shelter		
		absence of litter		
		safety		
	area-aggregated perceived green neighbourhood qualities (Scania Green Score; SGS)	qualities (dimensions) that humans appreciate in park environments (culture, serene, lush, spacious and wild)	48	

4 Number indicates to the number presented front of the study in the main syntheses table Appendix IIA-B.

<b>Urbanity</b>	This variable consists of five categories, ranging from very strongly urban (1) to non-urban (5). The indicator is based on the number of households per square kilometre.		1,7, 13, 20	c
<b>Distance to nearest green space</b>	travelled distance from home		8, 11, 12, 17, 35	
		walking distance	48	
<b>Frequency of the visit</b>	How often one visits the green area		11, 12, 14, 17, 28, 29, 31, 35, 43, 54	c
<b>Duration of stay</b>	How long one stays in the area		14, 28, 35, 51	c
<b>Temperature</b>	Air temperature within green and non-green sites within an urban area. Degree Celsius. Role and influence of green areas on climatic factors; Mean temperature		16, 23, 26, 33, 54	c
<b>Environment Walkability Scale</b>	Access to a park or nature reserve		32	
	Access to bicycle or walking paths			
	Presence of greenery			
	presence of tree cover or canopy along footpaths			
	Presence of pleasant natural features			
	Existence of sidewalks, Existence of green areas, Garbage accumulation, Existence of crime etc.		50	

**Table 9: 10 most used environment related indicators, their specifics and referring nr. of the study, where this indicator is used. The letter c at the end of the row indicates that in some studies this indicator is also used as cofounder.**

Table 9 shows the common approaches to study urban green effect to health. As common, the green space size in percentages (in most cases) or coverage counted by available parks, green spaces etc. has been chosen to reflect the possible effect size to human health. Very common is also to take into consideration the distance to green space from respondent home, the frequency of the visits and duration of the stay in green space. In various studies duration and frequency are handled as cofounders and not as direct indicators. Urbanity could be more clearly considered as cofounder. Temperature could be also considered as cofounder, but within this literature study it is prevalent as indicator. This can be explained by the nature of the studies, where climate comfort has often been the main object of research. Environment Walkability Scale is interesting indicator to assess the quality of green space. It concentrates on more practical matters such as access and presence of certain elements for instance: bicycle and walking paths, tree cover or canopy along footpaths, pleasant nature elements. In more negative way, this indicator reflects also the possible downsides of green space – such as garbage accumulation and existence of crime. The studies also contain several environmental health related indicators such as air quality, noise, CO<sub>2</sub>, dust in pm levels etc. Shading effect, humidity, wind, precipitation, albedo, surface coverage and colour are also present as supporting environmental indicators. Depending on the nature of the study, those indicators can be often considered as cofounders. A table with all the cofounders considered and marked accordingly is presented in Appendix IX. Altogether 86 cofounders are presented, the ten most common ones are represented in table 10.

Cofounders	Specifics	Occurs in the study nr5
Age	in years	1, 7, 8, 10, 11, 12, 15, 17, 20, 21, 22, 27, 28, 29, 30, 31, 32, 37, 38, 41, 43, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55
Gender/ sex	female or male	1, 7, 8, 10, 11, 12, 13, 15, 17, 20, 21, 22, 28, 29, 30, 31, 32, 33, 35, 37, 38, 40, 41, 43, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55
Education level	Elementary school, basic school, high school, university etc.	1, 7, 8, 12, 13, 17, 20, 21, 27, 31, 32, 35, 41, 48, 49, 52, 54
	community-level education	44
Urbanity	Degree of urbanity, 5 scale-very strongly urban (1) to non-urban (5); based on the number of households per square km; Urban/rural status	1,7, 13, 20, 27, 49
Socioeconomic status(SES)	was additionally implicitly measured by type of healthcare insurance (unknown, public or private). The type of healthcare insurance can be regarded as an indicator of SES in the Dutch context in 2001, as only people with a higher income had private health insurance, whereas people with a lower income had obligatory public health insurance. SES was operationalized as the level of education divided into three categories: higher education (university or higher vocational education), secondary education and primary or no education.	7
	or position	13, 15, 17, 27, 28, 42, 50, 53
	Social class as measured by head of household occupational social class: Professional Managerial, Skilled non-manual, Skilled manual, Semi-skilled manual Unskilled manual', Army or full-time education, Never worked	37
Economic activity/ employment status	Employed, unemployed, retired or other inactive	8, 12, 22, 37, 41, 51
Household income	households monthly income (21)	8, 20, 21, 32
	equalised household income	43
	family income as a proxy for an individual child's family income	44
Population density	persons per hectare as a measure of urbanity	10, 13, 15, 22, 27
Frequency of the visit	How often one visits the green area	11, 12, 14, 17, 28, 29, 31, 35, 43, 54
Duration of stay	How long one stays in the area	14, 28, 35, 51

**Table10: The ten most commonly used cofounders, their specifics and referring nr. of the study, where this indicator is used.**

5 Number indicates to the number presented front of the study in the main syntheses table Appendix IIA-B.

As expected, demographic and socioeconomic cofounders like *age, gender, education level, employment status, income* etc. are most commonly used within researches. Alike to environment related indicators, among cofounders also *frequency* of the green space visits and *duration* of the stay comes up. Therefore one can argue whether they can be used as indicators to describe the effect of the environment or as cofounder influencing the outcome. Rest of the cofounders vary from wall-to-wall and are taking into consideration e.g. the ethnic differences of respondents as well their lifestyle preferences and habits. Even seasonality and living conditions and childhood experiences are considered. The variety of cofounders also shows how many factors can influence the effect of the green space to health. It is a common misunderstanding that all people like green spaces and therefore the benefits should be clear. There are people, who have had traumatic experience in childhood in green space – i.e. attacked, got bitten by allergy causing insects, have fallen into swamp or water etc. Therefore it is important also to consider all the influencing factors what are always not so indirectly clear, but can be taken into consideration while planning or redesigning the green space. For example if the area has high criminality rate, then the safety of the green area should be improved by adding illumination and street lights. Avoiding creating 'shady corners', what also can offer cover and shade for criminal activity. If there is reported lot of allergic incidence in the neighbourhood, the biodiversity of the park should be assessed critically and all the possible sources of allergic outburst isolated or removed or at least warning signs with possible risks of high pollen season present. Once the developer realises the possible cofounders, it is much easier to avoid possible problems in the future related to environment and health.

### 3.2.5. Used methods

Research sub-question nr 5 addresses different research methods and study designs:

*'Which methods/study designs have been used to investigate the relationships of natural green areas on human health and wellbeing?'*

To have an overview of used methods and study designs, the table is presented in the Appendix IIB. Also the interpreted score of scientific evidence scale (adapted Weiss scale, Table 5) is brought out. Some of the studies, which have been received highest scores of interpreted score of scientific certainty, are brought out in table 11. Abstract score indicates to a score (0-24), the paper received in selection phase, where at first only abstracts were scored according to inclusion criteria (Table 3). According to this synthesis, the best 3 researches about green space and human health come from Europe (The Netherlands, Denmark and Finland), have relatively high amount of participants and have conducted by questionnaires. As usually in science, there is always in some degree uncertainties involved, therefore there was no research encountered, where the outcome was firmly established and/or rigorously proven. Thus none of the 55 selected studies received the highest score in scientific certainty scale. Biggest share of the studies received score 7, which indicated the probability between 80-90% and "very probable".

N R	Study	Abstract score	Setting	Participants	study design	Adapted Weiss evidence score
1	van den Berg A.E., Maas J., Verheij R.A., Groenewegen P.P., "Green space as a buffer between stressful life events and health", 2010	13	Various settings (urban, mixed urban-rural and rural) in the Netherlands	4529 Dutch respondents 18 years and older who had been registered as a resident in their current municipality for at least 12 months.	Dutch National Survey of General Practice (DNSGP-2), conducted in 2000–2002. Questionnaires were administered by trained interviewers in face-to-face interviews. To avoid seasonal patterns in morbidity, all interviews were carried out within 1 year (2001) and were distributed equally across all four seasons. Data were analysed using multilevel regression analysis, with GP practices as the group-level units. Environmental data were derived from the National Land Cover Classification database (LGN4) in 2001, which contains the dominant type of land use of each 25 x25m grid cell in the Netherlands.	8
2	Papangelis G., Tombrou M., Dandou A., Kontos T., "An urban "green planning" approach utilizing the Weather Research and Forecasting (WRF) modeling system. A case study of Athens, Greece", 2012	18	diverse urban landscape of the coastal city of Athens, Greece	not stated	The Weather Research and Forecasting (WRF) model, coupled to a single layer urban canopy model, is utilized to carry out high resolution (0.5 km) land use scenarios, focusing on proposed urban parks (sized 8 and 4 km <sup>2</sup> )	5
3	Nordh H., Hartig T., Hagerhall C.M., Fry G., "Components of small urban parks that predict the possibility for restoration", 2009	15	small (>3000m <sup>2</sup> ) public green spaces (pocket parks) in 72 parks, sampled from the capital cities Oslo, Stockholm, and Copenhagen, as well as a few other Scandinavian cities	Undergraduate and graduate students at the Swedish University of Agricultural Sciences N=52. The mean age among the participants was 26 years; 75% were women and 92% were Swedish.	quantitative analysis of the park photos, the psychological variables were measured by having groups of observers rate the parks. Following a pilot study in which a small group of students rated the photos on multiple items for each psychological variable related to restoration (ART)	4

Table 11: Highest scored studies according to interpreted score of scientific evidence scale.

In current syntheses it also indicated that the studies had good setting and wide range of participants and they used extensive methods to gather and analyse the results. The rest of the score distribution is seen in table 12. By bringing out methods and study design it is possible to give an overview of the techniques, how different results have been achieved and how different effects have been studied. This makes the whole syntheses more complete and can be used as resource for other research. The complete narrative syntheses table (Appendix A-B) helps to locate all the original sources of findings and indicators as well methods.

Score	Bayesian Probability	IPCC Scale	Informal Scientific Scale	Authors interpretation	Number of studies receiving the score ( out of 55)
10	100%	(not in scale)	Firmly Established, has stood the test of time	Very extended worldwide research. Quantitative research supported with in-situ experiments over a substantial time period. Supported by a numerous literature.	0
9	99%	"Virtually Certain"	Rigorously proven	Same as upper level, but not necessary on worldwide level	0
8	90-99%	"Very Likely"	Substantially Proven	Can be like upper levels, only not supported by in-situ experiments	3
7	80-90%	"Likely"	Very Probable	Good setting and wide range of participants. Extensive methods are used to gather and analyse the results.	18
6	67-80%	"Likely"	Probable	Good results, but some limiting factors i.e. participants, setting or analysing methods. Nevertheless well proven under circumstances.	12
5	50-67%	"Medium Likelihood"	"If I must choose, this seems more probable than not"	Scientifically sound, but not supported by wide range of evidence due to limited search methods. Gives a good ground for further research.	15
4	33-50%	"Medium Likelihood"	Evidence is increasing but not preponderant	Scientifically sound, but setting is very local and results might not reflect the situation in similar conditions under different setting. Not very extensive methods used, but evidence is supported.	7
3	10-33%	"Unlikely"	Plausible, Backed by some evidence	Very limited study and not fully supported by evidence. Reason to doubt	0
2	1-10%	"Unlikely"	Possible	Unlikely, no really supportive evidence	0
1	<1%	"Very Unlikely"	Unlikely	Very unlikely that such literature is even included during first selection	0
0	0%	(not in scale)	Violates well established laws	--	0

**Table 12: Scientific certainty score division between selected studies.**

### 3.3. Knowledge in practice

The last 2 research questions (7 and 8) aim to test the knowledge in practice:

*'Which are the outdoor environment prerequisites of areas in urban spatial planning that would be suitable for a healthy local environment?'*

*'In what way can policymakers and urban planners manage and design an outdoor environment with maximal positive effects on health and urban climate?'*

To be able to answer those question the knowledge and practical experiences of professionals were gained through case study. In this case work conference 'GEZONDRONDOM' in den Hague was used to conduct the study. For additional support, the WHO Collaborating Centre for Healthy Urban Environments, South West Regional Public Health Group, 27-29 February 2012 Netherlands Study Tour-*Planning-Public Health-Urban Design*, was used.

#### 3.3.1. Case study: Work conference 'GEZONDRONDOM'

Healthy living environment was the theme for the work conference 'GEZONDRONDOM' held by The Ministry of Infrastructure and Environment (The Netherlands) in cooperation with other organisations( incl. RIVM), who are related with **Nationale Aanpak Milieu en Gezondheid** (NAMG) 6 on 15 May in den Haag. During recent years the Dutch local ministries, provinces, municipalities, interest groups and companies have worked hard with the NAMG to improve the living environment. The work conference was meant for professionals, whose work is related with improving the living quality: public officials, architects, urban developers, school boards, health authorities and interest groups. Around 300 professionals gathered to hear each other and to get to see what has already done, and to receive advice and inspiration for the future. It was done through presentations, workshops and excursions. The conference was held in Dutch and was meant for local professionals. The program of the work conference is presented in Appendix III.

The conference was a full day event, which included two plenaries next to various workshops, presentations and excursions related to selected workshop themes. For the present study, the workshop '*Gezond Ontwerpen. Een leefomgeving die (ver)leidt tot gezond leven*'<sup>7</sup> was chosen for active participation. This workshop was meant for urban planners, public health, environmental and other professionals to share their knowledge and experiences in designing healthy neighbourhoods and to find unexpected connections and solutions related (Picture 1). People worked in groups and visited 9 different routes in 3 different case study areas (Picture 2).

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6 National environmental health action plan. Authors translation.

7 Healthy planning. A living environment what leads to healthy living. Authors translation.



Picture 1: Discussion around the table during the workshop in den Haag, 15.05.2013 (authors photo)

	Bezuidenhout	Transvaal	Binckhorst
Groene route	Groep 1. Reisleider: Annelies Acda (GGD) Guido Nas (Den Haag)	Groep 2. Reisleider: Hanneke Kruize (RIVM)	Groep 3. Reisleider: Diane Houweling (RIVM) Ria Aarnink (Den Haag)
Rode route (actieve mobiliteit)	Groep 4. Reisleider: Frank den Hertog (RIVM)	Groep 5. Reisleider: Hans van Gompel (TU/e) Egbert Schutte (Den Haag)	Groep 6. Reisleider: Maurice Korenblik (TU/e)
Blauwe route (bewegen, spelen en sport)	Groep 7. Reisleider: Jan Meijdam (GGD)	Groep 8. Reisleider: Pieter van Wesemael (TU/e)	Groep 9. Reisleider: Ad de Bont (TU/e)
Wijkverantwoordelijk	Frank den Hertog	Hanneke Kruize	Ad de Bont

Picture 2: An overview of the workshop routes and case study areas. Photo by Rob van Kleef 15.05.2013.

The three case study areas were neighbourhoods in Den Haag: Bezuidenhout, Transvaal and Binckhorst (Picture 3)-three very different areas with different future prospects. For each study area, there were prepared 3 different routes:

Green route –related to all the green in the area;

Red route- related to active mobility in the area;

Blue route – related to physical activity, playing and sport possibilities in the area.

The workshop was prepared and guided by RIVM (Hanneke Kruize, Frank den Hertog) and TU/e (Pieter van Wesemael, Ad de Bont).



**Picture 3: Visiting the case-study area during the Workshop in den Haag 15.05.2013 (authors photo)**

After excursion, the workgroups presented their discussion results and findings to end the workshop with summarizing end discussion (Picture 4)



**Picture 4: Presenting the results during the workshop in den Haag 15.05.2013 (authors photo)**

Beside active participation, the discussions were recorded and notes been made useful for the present case study. Afterwards the recordings were analysed and presentations and discussions partially transcribed to use for sorting out necessary information. The transcripts are presented in Appendix V. The aim of the case study – to find out how the knowledge is used in practice was fulfilled. The results are presented according to questions

prepared (table 6 in the method section) in table 13 next to results derived from WHO Collaborating Centre for Healthy Urban Environments, South West Regional Public Health Group, 27-29 February 2012 Netherlands Study Tour-*Planning-Public Health-Urban Design* report. In the table the source of information is indicated.

### 3.3.2. Supportive case study-WHO Study Tour: Planning, Public Health, Urban Design

WHO Study tour report is used as comparative material to add international angle, without changing the setting (both GEZONDRONDOM and WHO Study tour is held in the Netherlands). There is no direct connection with author of current research and this case study. Author has not participated in those case studies nor contributed to report, therefore all the results reflected here are derived from the summary record and photo report of that study tour (WHO, 2012). The study tour was held 27-29 February 2012 in different Dutch cities. The purpose of the study tour was for participants, who all have leadership roles in relation to local authorities in the United Kingdom, to visit exemplary case studies overseas and to see how healthy sustainable urban development works in practice (WHO, 2012). In the Netherlands following case studies were conducted:

#### 4 case studies under the theme: healthy urban environments in practice

##### ➤ Houten: a cycling city (Picture 5)

**Houten:** a town is situated in the province of Utrecht. Settlement in Houten dates from Roman times, but its modern day growth as a commuter town started in 1966. It was developed to meet the housing needs of Utrecht, growing in population from 4,000 people at the end of the 1970s to almost 50,000 today. Well served by train, buses and motorways, Houten is famous for its status as Netherlands 'Bicycle City 2008'. The settlement has a wide network of bicycle paths that connect different districts in the town and relegates cars to the outer ring road.



The extensive cycle network in Houten

Picture 5: Houten description and picture from the report (WHO, 2012)

##### ➤ Leidsche Rijn: building a new community (picture 6)

**Leidsche Rijn:** an urban extension to the city of Utrecht. Once complete, Leidsche Rijn will add an additional 30,000 homes and 180 commercial and public buildings. A new major transportation system is being put in place and neighbourhoods within the development are individually designed and constructed with varying architecture and layout. This allows flexibility to respond to local situations and meet the needs of 'target groups' such as communal elderly housing or live/work units for artists and former homeless.



Public transport in Leidsche Rijn

Picture 6: Leidsche Rijn description and picture from the report (WHO, 2012).

➤ **GWL Terrein: car-free and community led (picture 7)**

**GWL Terrein:** a former municipal waterworks located three kilometres from the centre of Amsterdam. The site was regenerated in 1989 into a car free residential area (645 dwellings with a mix of tenures) that has influenced not only car use as well as a shift in transport modes. It includes environmentally friendly design that is permeable to adjacent neighbourhoods. The development offers a vibrant example of how low carbon community and sustainable practices in the urban environment that encourage community engagement and activities.



Community allotments in GWL Terrein

**Picture 7: GWL Terrein description and picture from the report (WHO, 2012).**

➤ **Rotterdam: developing a healthy city (picture 8)**

**Rotterdam:** a former harbour area, Kop Van Zuid is located on the south bank of the Meuse River in the city of Rotterdam. It was redeveloped into a new mixed use town centre thanks to the vision of the local authority. Afrikaanderplein is a former football ground that is adjacent to the Kop Van Zuid area. This site was redeveloped into a very functional public park offering a weekly market, play ground and aviary in an area of the city characterised by cultural diversity.



A public park overlooking the Meuse River in Rotterdam

**Picture 8: Rotterdam description and picture from the report (WHO, 2012).**

**3.3.3. Summary of the results of case studies**

Based on the work conference and workshop in-situ in Den Haag and report of different case studies in Houten, Utrecht, Amsterdam and Houten, the following table 13 was combined to compare and bring out the findings according to prepared questions:

• Importance of green planning and green spaces:	
<b>-Does local policymakers see any need of, or have intentions to introduce, urban green planning? If yes, why? Give examples.</b>	
GEZONDRONDOM	WHO study tour report
<b>H.Kruize</b> (presentation): <i>Healthy planning and set-up of physical living environment is one of the</i>	<i>Planning and development in the United Kingdom is facing challenging conditions:</i>

<p>4 policy priorities from <b>Nationale Aanpak Milieu en Gezondheid</b> (NAMG)<sup>8</sup> 2008-2012. Reasons:</p> <ul style="list-style-type: none"> <li>• Growing health problems related to insufficient physical activity (obesity, diabetes), environmental pollution and heat stress. Here is most concern over people from vulnerable groups like elderly people, people with low socio-economic status and youth.</li> <li>• The increasing demands from citizens to their living environment quality. Quality of the living environment contributes to value creation, like good business climate and higher house prices. Preventive actions related to healthy planning are saving curative costs in the future.</li> </ul>	<p>shortage of land and houses in view of population migration, in particular in urban areas, need to improve housing quality and its resilience to environmental pressures.</p> <p>Sustainable transport, green space, shared community facilities, good quality housing (both market and socially rented), schools and jobs were all evident in the developments visited. It was clear that these are important elements of the community and act as a focal point for activities in the neighbourhood</p>
<p><b>Rients Dijkstra:</b> There is lot of mention of integrated planning. Lot of people use that word, but only few understand what it means. There is lot of discussions.</p>	
<p><b>J. van der Bogaard:</b> Most people want lot of green and there is lot of possibilities how you can make people happy by bringing more green in the city. Everybody feels that green is important for your health and for your living environment. It is important to realize it in the densely build cities and neighbourhoods Rotterdam for example. The people want to add more street green and places to sit, other wants routes to walk their dogs and other places where to play ball with kids. So you have to look how you can use the green and bring people to use it. You have to be creative with planning- think of vertical greening, garden green, rooftop green.</p>	
<p><b>H.Aalderink:</b> I find it is urgent need to direct people, not to back in time, but to bring them to value of nature. But it starts with those who offer it and they are planners. If you do not take into planning the integrated green aspect, then you also fail to involve health.</p>	
<p><b>P. van Wesemael:</b> I always think how you can bring people from area green and health together who are involved with developing and research etc. There are lot of pilots and researches and practical examples and the question is how to bring all that together. Second, how to you</p>	

<sup>8</sup> National environmental health action plan. Authors translation.

<p><i>determine and learn those very specifics, when working with projects, which factors etc. will influence healthy living environment. How do you have to change the area to make it healthier and to improve and stimulate the lifestyles?</i></p>	
<p><b>- What importance do you believe green spaces in urban environment will have in the future?</b></p>	
<p><b>Chris Kuijpers:</b> <i>During last decades we have known how to improve our environment. And therefore is it also healthier. To care for people's health is now and in the future the motor of the environmental policy. Clean air, clean water, clean soil and noise restraint: Those were and are the major environmental issues. Health will continue to be an important perspective of environmental policy. We shall, therefore, for the coming years as closely as possible to search for connections with the National Prevention Program of the VWS (Ministry of Public health, Sport and Wellbeing).</i></p> <p><i>There is still lot going on – it is a worldwide problems with climate, energy and CO2 . Climate change. Between those problems are also issues we deal with – peoples health, peoples safety etc what needs attention. So there is still lot of challenges in our work fiel , what have connection with health and environment policy, what we are busy implementing and therefore we cannot relax concerning those topics.</i></p>	<p><i>Healthy communities should be on every politician's agenda. We should have the confidence to deliver sustainable and healthy developments over the long term and to manage the short term challenges.</i></p>
<p><b>H.Aalderink:</b> <i>Green cares for relaxation, for space to discover nature and for fun way to play and not only between 4 walls. Beside that it leads us to place where we can once and a while to calm down and have peace. This solves also children's ADHD problems and not medicaments.</i></p>	

<p><b>P. van Wesemael</b> :It is very important, that we developers would realize that health is wider concept than we think and what should be taken into consideration. That it is clear from scientific research and practical experience, that living environment is very important and influential factor. That city is meant for people and not for cars and lifts and escalators. That you have to create neighbourhood centres, where community is central and not only that it is healthy, but that it also beautiful is and fun and exciting and that you learn to know all the people etc. But the specifics of the neighbourhood development is very complicated, especially in a modern lifestyle, where auto is a standard and lift and escalator is a standard.. Try to find a building, where still stairs are used. We know what should happen with the community, but how to you achieve that now?</p>	
<p><b>A. de Bont</b>: Already long time ago hygiene was a topic, also if there is place to cycle to play, for green, social contacts, sustainability. Nowadays are newer task: An attractive living environment that (far) leads to healthy living and more exercise.</p>	
<p><b>- How will the municipality handle future expansion of the city? Which areas will be exploited?</b></p>	
<p><b>Rients Dijkstra</b>: We are all agreed that healthy city development is a new important topic of our area and that means that there is also search for responsibility. Who is responsible- I am or somebody else? I think that this is not the way to deal with it and that you carefully have to ask from state officials, local officials, society, which part of healthy planning is state responsibility. And state officials have questions which part are they responsible and which part not. And I encourage them not to give up this responsibility to developers and markets, that they would make use of the tools and support platforms, what are developed from their budgets. And use to develop their laws and guidelines.</p>	<p>Rotterdam is currently trying to increase the number of people living in the city centre, and is aiming to double the 20,000 dwellings that currently exist in the city centre. They are actively trying to promote this through a number of methods, including:</p> <ul style="list-style-type: none"> <li>•encouraging high rise buildings;</li> <li>•promoting development of dwellings on the water;</li> <li>• building additional dwellings above existing terrace homes;</li> <li>•converting old offices into residences;</li> <li>•improving green space to make the area more attractive to live in; and</li> <li>• improving public transport and decreasing parking</li> </ul>

<p><b>A. de Bont:</b> <i>Green roofs are way to add green space and also cemetery's to use as quiet areas.</i></p>	<p><i>Participants on the study tour recognised that land control is critical to delivering a development such as the ones visited in the Netherlands. But even though the framework for development is quite different in the United Kingdom than in the Netherlands, participants emphasised that this should not be used as an excuse not to try to deliver the same level of quality and consideration. There are projects moving forward in the United Kingdom where opportunities for land assembly, land capture and development commissioning can help to deliver exemplary developments like GWL Terrein.</i></p>
	<p><i>Buildings were designed to be flexible in their use, both for different purposes. For example, including flats on the top floor of a school building that could be converted into classrooms if the school needed to expand. Another example was using the roof space on buildings for play space. Children's playgrounds were also integrated into the neighbourhood design. They were unfenced areas and were within the view of homes.</i></p>
<p><b>- Are there enough green spaces in the local municipality? Are those developed green spaces important for the local life quality and sustainability? Are they widely used and for what?</b></p>	
<p><b>Chris Kuijpers:</b> <i>I'm from Rotterdam-Overschie -beautiful place, but when I was young, there was often brown air as it was very polluted there. But it is a lot changed since then. If you look what under the Env. Policy have been done, it is impressive. Of course, there should always more and more happen. We do not have any more acid soils, dead fishes, brow air etc. Now we have one of the cleanest drinking water in the world. And we should be very proud. And what it all means for public health, it has been huge stimulant.</i></p>	<p><i>The function of the settlement in Houten has been considered at all scales - from small pocket parks to the overall transport network. Parks and water bodies are incorporated into the settlement layout and have been treated differently in Houten North and Houten South. In the north, the green spaces and waterways have been designed in a linear pattern, while in the south they are incorporated as a central feature and focus of the area. Attention has been given to the cycling experience and the comfort and convenience of the cyclist. Cycling infrastructure is integrated into the layout of the settlement and facilities are located in convenient and accessible locations making cycling the easy option.</i></p>
<p><b>H.Aalderink:</b> <i>We have lost lot of green around Randsdad and other areas. Children do not know anymore what outside playing is, parents bring them to beach with cars, even if the beach is 2 bus stops distance. This is related how we have equipped our city area, close to each other, intensive land use, few places to play and if you</i></p>	<p><i>In Leidsche Rijn children's play space is integrated into residential areas that provide passive surveillance and no need for fencing. The tenants and resident groups have a say in how space is used so they have a feeling of ownership and responsibility to the public spaces. Landscaping, community art and children's play</i></p>

<p><i>consider that kids have computers and iPods, then they barely spend time outside.</i></p>	<p><i>spaces are used to enhance public areas, in particular in smaller spaces.</i></p>
<p><b>A. de Bont:</b> <i>People are less physically active. If you do not want to put on physical effort, you do not have to- you can do everything with auto, even work in it... you can use escalators etc. it is recommended to sport at least 5 times 30 minutes per week. Also the youth, who are using scooters, escalators and come together online and sit behind computer to play instead sport club or park. It is also important for elders to prevent dementia to be more outside and physically active. The developers have to think how to make streets more usable and safe, so that people would come outside to walk beside children playgrounds and bicycle routes.</i></p>	<p><i>In GWL Terrein the development is built on the principles of ecological living, providing areas for local food growing and play, encouraging biodiversity and fostering community events. The site also has grey water recycling (although not as much as was originally envisaged) and energy efficiency measures. The development has successfully created well-used green space that is protected from the noisy surroundings of city life. Art, furniture and facilities for games are a key feature of the development. The development also has a very successful community allotment and has an abundance of bird life in the many bird boxes and nests incorporated into the building fabric. Good use of small spaces. Allotments and fruit trees are incorporated into the development and common spaces are used for community events, such as community parties, apple sharing and an apple pie festival. Open space includes a variety of uses and is segmented to encourage community ownership. This includes children's play space, basketball courts, grassed areas, allotments, fruit trees, table tennis and outdoor chess sets. There has been a variety of plant species and habitats created in the development to encourage wildlife. This has been delivered through careful layout and design of buildings and green spaces as well as the community-based management of common space.</i></p>
<p><b>D. van Loenen:</b> <i>For example in Nieuwe West-Amsterdam is neighbourhood were are lot of green spaces , sports places etc, but in the other hand also highest population density is and where most people do not exercise. So there is misconnection between offer and demand. So we are very interested how we can people, vulnerable groups to direct and guide to be physically active in that beautiful living environment.</i></p>	<p><i>In Rotterdam on the edge of Kop Van Zuid is the Afrikaanderplein, a former football ground which has been redeveloped into a functional public park that includes a children's playground, aviary and hosts a weekly market</i></p>
<p><b>H. Zoest:</b> <i>If the area around workplace would not be attractive and are neglected, I would prefer to go there with car and would not like to come out during lunch pauses. Therefore you have to make the area more attractive, so the people would come out during lunch pauses etc and u can start</i></p>	<p><i>Creative solutions for flooding often provided multiple benefits for the community, such as the provision of green space, improved biodiversity, food growing areas and community involvement in the management and maintenance of common space.</i></p>

<i>with small things.</i>	
<p><b>G. van Coorten:</b> <i>I cycle to work every morning(from Delft to Den Haag) and one part of the route is horrible- it do not feel safe, no proper lightning, no stoplights in some places to regulate traffic, so the cars and bikes can easily collide. Nothing nice to see, ugly old houses, no parks, air filled with combustion gases.</i></p>	
<p style="text-align: center;"><b>• Experiences and new knowledge:</b></p> <p><b>- In the work with green planning- what data have been recorded concerning health effects of green space?</b></p>	
<p><b>J. van der Bogaard :</b><i>Everybody feels that green is important for your living environment, for your health and that nobody feels that they need any scientific evidence. It is important that we do not have to wait for scientific reports or researches and till health insurance companies and city leaders get those results.</i></p>	<p><i>G.Scally: Today's threats to health come not from infectious diseases, but from the tidal wave of noncommunicable disease that is sweeping the developed world. A particular problem, which has reached substantial proportions in England, is that of obesity. We know that conventional medical treatment has little to offer in the prevention of obesity and, such is the scale of the problem, that looking to medicine for a cure would be foolish and wasteful. But the solutions are all around us. We need to not just change, but to transform the communities in which we live so that they support people living healthy, active lives. We also need communities that are inclusive and where the growing number of older people can feel safe and secure</i></p>
<p><b>H.Kruize:</b> <i>Aim of NAMG9is, that state knowledge would be available for practitioners who want that information and who can improve with that knowledge public health and health problems like overweight, heat stress. The group of people who would like that information is quite wide group – you can think of people from GGD, municipalities, housing associations urban planners. All those people are part to create healthy neighbourhoods.</i></p>	
<p><b>P. van Wesemael:</b> <i>we learn from already made projects, also from international, where lot of attention is set on healthy developments. But I think it is very important that we also approach the new projects . If you look local or international projects, you can see that they are often very limited and there is only few projects were proper research have been made – what is the problem, what are possible solutions etc.</i></p>	
<p><b>A. de Bont:</b> <i>It is very important that people with</i></p>	

<p><i>different backgrounds come together and have a discussion and share knowledge and experiences.. Developers have to meet with medical people, environment people, social people etc. Urgent problems are well known – Obesities, overweight. It is growing trend. It is related with physical activity .There is problem among children, but even more with adults. Less we walk and cycle, more we weight... This is not only problem, there is more like depression, heart and vascular disease, dementia .</i></p>	
<p><b>- Is there a certain health related area prerequisites considered/counted, when planning new green space?</b></p>	
<p><b>H.Kruize:</b> <i>Within NAMG10is gathered knowledge and the aim is to get attention to the topic (healthy living environment) It is different topics what get attention, like safety and also economical value of the area. And next to it is public health, what you can improve. If you think of the heat stress, then there is lot of ways how you can improve public health via living environment.</i></p>	<ul style="list-style-type: none"> <li>• <i>Vision and Leadership</i></li> <li><i>The importance of proactive and integrated planning</i></li> <li>• <i>Maximising Assets</i></li> <li><i>Building on people and place</i></li> <li>• <i>Planning for Movement</i></li> <li><i>Integrated transport solutions that prioritise the pedestrian and cyclist</i></li> <li>• <i>Flexibility and Creativity</i></li> <li><i>Innovative solutions that provide adaptability for future use</i></li> </ul>
<p><b>A. de Bont:</b> <i>We have green, but we need more knowledge how this works in medical and health promoting way. So researches have a task to study how the connections work i.e. with green and overweight etc. There is already studies, but not very many. Example of Bike, green and city. That in smaller cities the % of bicycle use is smaller than in bigger cities. It is related with several things (closeness to city, accessibility to bike paths and routes, Closeness of services, diversity, lifestyle?, parking load) More green leads to more playing, more health and more experiences.</i></p> <p><i>We have tried to bring together 10 important city characteristics: Clean city, safe city, climate adaptive city. Mobile city, green city, energy- and waste-rich city, food-rich city, physically active city, economical city, social participation city. In central are physical activity, active mobility and green in the city. That we more exercise, use more mobile transport methods ( bike) and green to adapt with the climate change.</i></p> <p><i>Example Grouwplein Rotterdam, Transvaal Wijkpark Den Haag, Kopenhagen Hauserplads: Not too small, more functions, open parks without fences, mix between park and plain, park area not</i></p>	<p><i>A key feature that participants highlighted was the asset based approach to the design of developments. This included focussing the development on aspects of both people and place, such as utilising the knowledge and experience of the community and the history and physical features of the place. This creates a sense of place and a respect for the history of the site.</i></p>

<p><i>in the edge of the area, but in the busiest place of the neighbourhood, well accessible functions, supervision and guidance, designed carefully with sustainable and beautiful materials, developed with or by habitants.</i></p>	
<p><b>D. van Loenen:</b> <i>For physical activity promotion it is important, that if you are going to city, that you instead car, take a bicycle to be faster there. That there is public sport parks in the neighbourhood, school plains what are still open after the school. So that there would be much more possibilities to play in the neighbourhood.</i></p>	
<p><b>A. de Bont:</b> <i>In Utrecht we have done research of the attractiveness of routes and if people walk or cycle along nice area, they have feeling that they have spent less time to get from A-to B. So the attractiveness of routes is important.</i> <i>Important are safety, traffic safety and also diversity of the living area, that areas where people live, feel also more safe, oversight.</i></p>	
<p><b>H. Zoest:</b> <i>You rather choose longer route where less traffic is and where more green is. You also do not want to live close to busy streets and you should not plan routes next to it. Safety is important, that you at evenings can safely walk and see easily around etc.</i> <i>Accesses to water- routes along water are very attractive. If u can combine closed areas along water so, that there no fences are and that you have nice view</i></p>	
<b>- How are these strategies and objectives expressed in the planning work?</b>	
<p><b>C. Kuijpers:</b> <i>This work conference is one of the important national events, where health and living environment gets more attention . It is important that there is bond, connection made between knowledge and policymakers within different governmental organisations like GGDs (Health services) , to go further with that topic. There is also lot of interesting topics worked out. Like ruimtelijke ontwerpen (special plannings, developmet) with health aspects.</i></p>	<p><i>Participants were particularly inspired by the way that the Dutch have managed to have a holistic view about what is needed for a place to grow, plan for it and then see it through to completion. This requires support and coordination from the top levels of government right down to individual communities. It requires communities and decision makers to be bold and creative. Plans need to be realistic but also ambitious. In Utrecht, they have plans to build over a motorway, creating a space for a new public park, linking two parts of the city currently divided by the motorway.</i></p>
<p><b>R.Dijkstra:</b> <i>There is lot of talk about integrated planning. People use that word often, everybody wants that to happen, but few people understand what it means. In integrated planning you have to learn that all related areas are bond in the planning process. There is lot of discussions. And</i></p>	<p><i>In the Netherlands, people are engaged to define the problems in the area, to identify values and to help develop solutions. This was particularly pertinent in the GWL Terrein development in Amsterdam where residents were empowered to participate in the design stage of the development, designing homes, gardens and</i></p>

<i>that is something we have to practice as when we do not apply integrated planning we cannot do healthy planning.</i>	<i>facilities. There was a greater delegation of responsibility to communities and the sense of ownership of common facilities and open space is evident.</i>
<p><b>P. van Wesemael:</b> <i>In my experience (12 year) there is very few medical field people involved with development.</i></p> <p><i>There is lot to do that people who come from development field, have different old-school background – they are more knowledgeable with modern city building and its connection with overweight problems, hygiene, social problems, but I have feeling that since 70ties that knowledge has decreased. Now the city development is more object bases. Environmental issues are dealt by environment officials, traffic issues by traffic officials... this not proper developing anymore.. They are also very sensitive about trends, like how city landscape is connected with health, what is very hype now. But if you look more further what is developers concept for what is healthy, then there are lot of issues about obesities, dementia, stress and burnout...</i></p>	
<b>G. van Cooten:</b> <i>Bringing together the management and knowledge.</i>	
<b>- What planning tools/ guidelines do you use, e.g. GIS, own databases or other tools? Give examples.</b>	
<b>C.Kuijpers:</b> <i>We have ATLAS Leefomgeving developed, so that people would get much more information, also in digital. Apps – few months ago I was by the introduction of RIVM's air-quality app, with what u can measure on spot air-quality. This all spreads to social media as people want to be informed in a better way, over the actual situation to be able to take precautions if necessary. GezondOntwerpWijzer is also introduced during this conference.</i>	<i>WHO European Healthy Cities Network</i>
<b>Rients Dijkstra:</b> <i>I encourage policy makers to make use of the tools and support platforms, which are developed from their budgets. And use to develop their laws and guidelines.</i>	<i>Centre for Sustainable Planning and Environments</i>
<b>H.Kruize:</b> <i>Digitally accessible products like Gezond Ontwerp Wijzer, where lot of information is incorporated. This is meant for people, to find information and inspiration how to do it. There is also examples and pilot projects, where you can learn how it works in the practice and how can</i>	

<p><i>you do even better. I.e. how green space for low income neighbourhood is developed with cooperation among different parties. This is not always easy and you can learn from it what you can next time in a better way do.</i></p>	
<p><b>A.de Bont:</b> <i>We are busy finding out what we already know and what we still do not know. And for that there is such a knowledge platform(ATLAS Leefomgeving). For that there is involved health experts, environment and sustainability experts, traffic engineers and should be also planners and city developers. It is also that health and space good co-operates.</i></p>	

**Table 13: Recorded findings and reflections of case studies divided according to prepared questions**

Such work conferences, work-shops and discussion panels show that there is common knowledge that green and health are very interrelated topics. It also shows that there is knowledge and active professionals, who are aware of the health problems and benefits related to living environment. But at the same time it also shows how fractured the different groups and professionals representing their area of expertise are. There are environmental specialists, infrastructure specialists, different policy makers, developers, scientist with various areas of research, health services, initiative groups, who stand for children or cycling promoters etc. But nowadays all those different fields are very interrelated and should be also integrated into a planning process of living environment (including green space), to achieve maximal positive effects on health and urban climate. It is not really a question, whether the health and green should be on foreground of urban planning. There is awareness of growing health problems related to stress and insufficient physical activity, like obesity. There is a vision what should happen with the community, but how do you achieve it now? Adding green spaces into city, always makes people happy, but how do you ensure that all people, especially those in vulnerable groups (elderly, children, overweight, low-income) make use of it, so it would be beneficial to their health? There can be beautiful big park, with all the playing and sport possibilities, but if you use it just to drive through with your motor scooter, does the salutogenic mechanisms work the same way? So there is lot to do with lifestyle choices and directing people towards healthy lifestyle. There are also safety reasons, what can keep people from using green spaces or inconvenient location. Quoting Ad de Bont: *“We have green, but we need more knowledge how this works in medical and health promoting way.”*. Integrated planning is discussed widely, but there is lot of opinions that although it is widely used word, not many people know the meaning behind it. It means there is still lot to learn and practice how to integrate all those related areas together into a planning process, like Riens Dijkstra noted: *“When we do not apply integrated planning we cannot do healthy planning.”*

As always there is lot of policy related discussions how exactly to fulfil those aims set with national agendas and how is responsibility divided. There were questions raised about funding all those nice plans and that often they cannot be called to life due to lack of finances. But it is positive that there are discussions and not only in closed circles, but both on government and community level as to bringing knowledge together and make it available

and usable for people related to healthy living environment planning, seems to be the key to success. There are practical examples, tools and knowledge platforms, where variety of information is available. Another question is how to orientate among and within them and make use of those possibilities. How to determine and learn those very specifics, when working with projects, which factors will influence healthy living environment? How do you have to change the area to make it healthier and to improve and stimulate the lifestyles? (P. van Wesemael). By answering those questions, it is possible to answer also current study research question 7: *Which are the outdoor environment prerequisites of areas in urban spatial planning that would be suitable for a healthy local environment?* And to find those questions and practical examples, such knowledge platforms and working groups are developed. For example, from knowledge platform Gezond Ontwerpen, we can find **10 important city characteristics: Clean city, safe city, climate adaptive city, mobile city, green city, energy- and waste-rich city, food-rich city, physically active city, economical city, social participation city** (Figure 9).

In central are **physical activity**, **active mobility** and **green in the city**. To stimulate people to exercise more, to use more mobile transport methods (bike) and green to adapt with the climate change (Figure 10).



Figure 9: 10 important city characteristics. Figure from A.de Bont presentation, (15.05.2013).

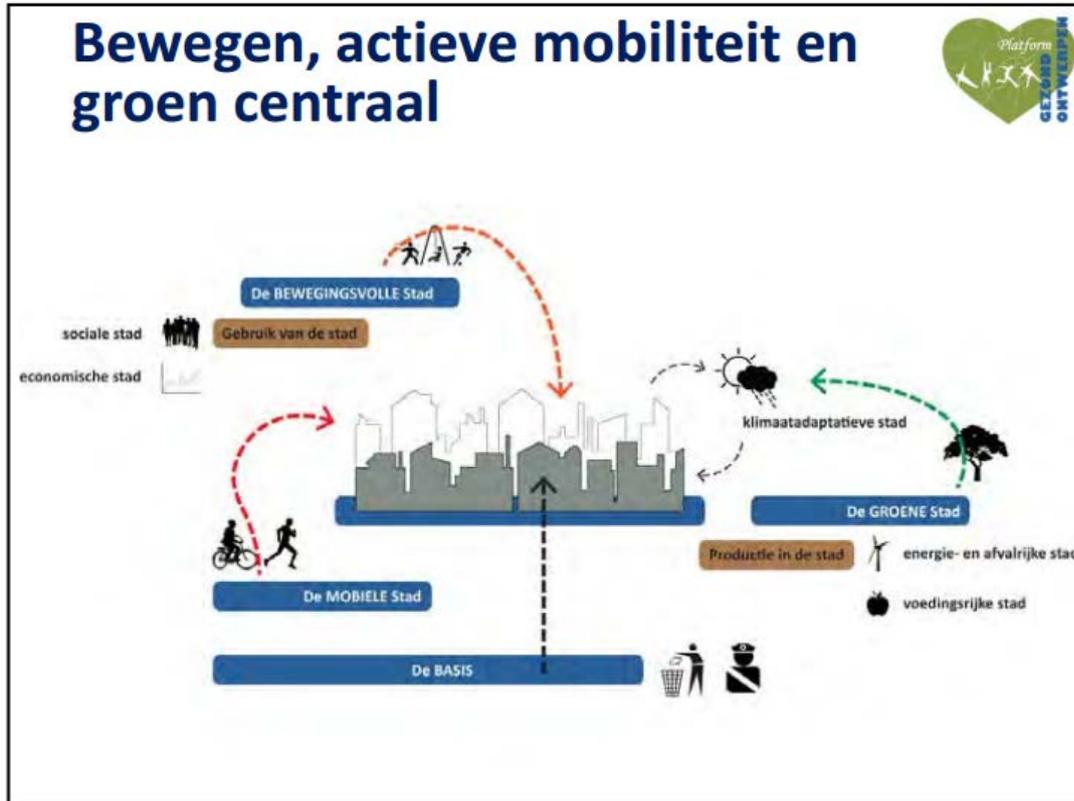


Figure 10: central characteristics. Figure from A.de Bont presentation(15.05.2013).

Thus there are basic environment prerequisites for healthy urban planning available to be effectuated in practice. There are still questions how this all exactly works in medical and health promoting way. There was also noted, that not many medical persons are related to planning process. Although as present study shows, there are already studies investigating and detecting those mechanisms, still there is need for researchers to study closely how the connections work i.e. with green and overweight, dementia etc. The connections are not always clear. For example why exactly there is increased bicycle use in the cities? Is it due to more greener and attractive cycle routes or is it to do with parking problems? And the questions like that keep rising, which shows the importance of giving attention and importance to working mechanisms between health and green space.

## 4. Discussion

### 4.1. Strongest and weakest points

Strong side of this study is that it attempts to bring various interrelated green-health connections together and analyses not only the findings and effects, but takes to synthesize also indicators, cofounders, settings, participants and study methods. Comparing to similar literature review studies, for example Lee and Maheswaran (2010), where only study design, findings and evidence grade were analysed, then current study as much wider range. There is a lot of published research about specific health effects and green space connections, but there haven't been many attempts to bring them together in a summarizing manner. Current research is also narrowed down in search criteria's to more specific (prevalent) health effects, after analysing half of the material. Therefore the results are also reflecting the most common health effects and do not give all the way through equal attention to all health effects and issues. On the other hand, the results after analysing the first half of selected literature, when there was no specific health effect preferences, showed that decision to focus later on those more specific health effects/ issues (*mental stress, attention fatigue, restoration and physical activity*), were justified. They were the most covered health effects/ issues. Health effects and issues has treated during the narrative syntheses often under the same context and combined under the same results. It should be clear that therefore the positive effects of certain issues are considered or the effects themselves. For example, if there is side by side health effects *restoration* and *attention fatigue*, it shows that in selected studies the green space has had a restorative effect and it has offered positive effects against attention fatigue. The two can be even dependent to each other – restoration helps to cope with attention fatigue. Nevertheless, in the conceptual mapping part (Chapter 3.2.3) effects and issues and their interconnections are visualized very clearly, by using corresponding colours.

It is often considered common sense to acknowledge that “green is good”, but not often is it explained or recognized, how it exactly works. Therefore current study goes more into depth to investigate the mechanism behind those seemingly simple connections. Compared to the PHENOTYPE project, this study is narrowed down to urban green spaces and does not cover all outdoor natural environments and their salutogenic functions. While PHENOTYPE has a wider research range including management and policy implications, supported by conducted studies, then current research aims only to contribute to part which investigates mechanisms and does it without conducting any in-situ studies on its own. There is still international coverage, but most relevant studies included to narrative syntheses are mainly of European origin. Even so, the results are quite applicable at international level and do not change the essence of health effects and green space. There can be different geographical circumstances and cultural backgrounds, socio-economical levels, albeit through cofounder analyses those influence are still addressed.

As bases of this study, the essence of the green space is investigated more closely, by analysing the terminology and characteristics of natural environment, which is informative. On the other hand it can also be confusing, as the used terminology is so wide and often synonymous. Results show that green space is actually not always “green”, but can also be blue for example. As *beach, sea, lake* and *water bodies* are also grouped under natural outdoor environment (Figure 4). There is also many possible word combinations, which is regarded separately and therefore their usage do not rise up in numbers, i.e. *Green environment, natural environment; public space, open space* etc. At the same time it provides a good overview of popular terms used in scientific context.

Indicators and indexes part (Chapter 3.2.4) provides a good overview of related indicators and indexes used in literature, although they are not always explicitly explained. And it is not always clear if it is the main indicator or cofounder as in different studies they have been used under different contexts. Therefore in the index tables, the letter ‘c’ indicates if the indicator is also used as cofounder.

Coming back to health effects, there was often difficulty to find solid evidence for quite simple mechanisms, as the results in literature were often based on persons perceptions. Therefore, when analysing the effect size, not all health effects/issues were evidently improved and often only ‘possible effects’ were confirmed. There is always some degree of scientific uncertainty involved, especially when analysing people’s perceptions, emotions and self-rated health condition. There is no method or study involved in current literature review, where the scientific certainty is rated 100% certain or rigorously proven. Nevertheless the most methods and studies are graded as 7- “Very probable” and all the studies graded <4- “Medium likelihood”, were not included at first place.

One of the weak sides of this research is that it concentrates on positive effects and does not investigate more closely into the negative effects in connection with green space. They are only vaguely mentioned in context of indicators and cofounders (i.e.: criminality, allergy, accessibility).

During case studies it was often difficult to obtain straight answers to primed questions and often answered from different angles relative to the participant’s background. Sometimes there were answers and visions of a rather politically populist nature and often the discussion was biased by financial and responsibility disputes. One of the prepared questions was obviously not favoured –“(How will the municipality handle future expansion of the city?)Which areas will be exploited?”. The reason was probably its negative connotation, as nobody was willing to state that they are going to expand the city at the expense of nature.

The non-international nature of the work conference could be considered another weak side of the research, but on the other hand the background and range of local participants were impressive and highly representable on local level. The second case study (WHO Study tour) on the other hand did not involve participant observations by active participation, but all the results and reflections were derived from the report. Therefore the answers were also not always directly reflected. Nevertheless it offered a somewhat international approach as the participants in that study were from United Kingdom. And at the same time the setting was still the Netherlands, providing good ground for equivalent comparison.

#### 4.2. Relevance

Often questions are raised, why there is need for scientific research to prove that green is good for people's health, it seems so obvious. But when you go more into depth and start identifying specifics of urban green and human health and their interconnections, it is not that straightforward. First it is necessary to define and identify what is considered as urban green space and results of this study show that the perception and meaning varies from simple view from window to vast forest park. More important is to identify how this single tree or forest park etc. influences people's health- what is the mechanism behind it? The narrative syntheses of selected literature shows that the connections are not always that clear and it is not always evident if the green space is the only beneficial factor or what is the role of contributing cofounders. By conducting the narrative syntheses and finding the most prevalent trends, it is possible to map the basic connections and mechanisms that made them happen. As the case study shows, in the Netherlands the knowledge is available and there is an awareness and clear vision that urban green spaces are beneficial for citizens. The challenge is to integrate the idea of healthy green planning into urban development projects. There are on-going discussions, how exactly to achieve this. A variety of tools, knowledge platforms and action plans are available to determine the prerequisites of healthy urban planning and practical examples are available. Another challenge is to integrate more specific methods to an everyday planning practice. To succeed a holistic approach is needed to see the big picture and at the same time paying attention to the intrinsic values of the natural outdoor environment. As the results show, the mechanisms behind it are often very simple in nature, but can result in multiple health benefits. Therefore it is essential to determine the connections and environmental prerequisites of areas, while planning healthy living environment. The present study can offer a starting point to determine the basic functions, which should be incorporated in the healthy green space. At the same time the results also show that there is still a lot of scientific uncertainty around the indicators to determine the direct health effects of green areas. The evidence is often based on self-rated perception and medical statistics, and it is not always easy to control the cofounders. Therefore the present study could also offer a good starting base, when beginning to conduct topic related research, to have an overview of methods and characteristics and expected outcomes.

## 5. Conclusions

This study aimed to answer the main research question:

*To what extent do natural outdoor environments in the cities and nearby green spaces have positive effects on human health and wellbeing and how can this knowledge be used in urban planning?*

The results of research based on literature review and case study, show that natural outdoor environments in the cities and nearby green spaces can have positive effects on human health and wellbeing. When the prerequisites of healthy green space are determined, this knowledge can be used in urban planning, to create a healthy living environment. As starting point, the

types of urban natural outdoor environments are defined. Literature indicates that the most commonly used green space descriptions are: **Green space, park, forest, natural environment, green area and beach**. Narrative syntheses based on evidence derived from selected literature, showed that the most common health effects of green spaces are: **Stress mitigation, Increase of physical activity, Restorative experiences, Attention fatigue amelioration and Mental health improvement**. The most common mechanisms to achieve those salutogenic benefits are: **Exposure to nature and closer contact with nature, Positive perception of the area, Thermal comfort, Physical activity stimulation and Improving environmental health**. Their interconnections with green space are visualized by conceptual mapping (p32, Figure 8).

The most applied health indicators were related to *Physical- and Psychological health, Wellbeing and General health*, followed by *Stress and Physical activity* related indicators. Furthermore *Cause-specific mortality, BMI(Body Mass Index) and Lifestyle*, were popular applied indicators. The majority of the most applied environment and mechanism related indicators were the *green space size in percentages* (in most cases) or *coverage* counted by available parks, green spaces etc. Next to them very common indicators to be considered are: the *distance to nearest green space*, the *frequency of the visits* and *duration of the stay*. In various studies *duration* and *frequency* are also handled as *cofounders* and not as direct indicators. *Urbanity* could be more clearly considered as *cofounder*. *Temperature* could be also considered as *cofounder*, but within this literature study it is prevalent as indicator. *Environment Walkability Scale* is considered as an interesting indicator to assess the quality of green space. Demographic and socioeconomic cofounders like *age, gender, education level, employment status, income* etc. are most commonly used within researches. Alike to environment related indicators, among cofounders also *frequency* of the green space visits and *duration* of the stay comes up. Therefore one can argue whether they can be used as indicators to describe the effect of the environment or as cofounder influencing the outcome. Rest of the cofounders vary from wall-to-wall and are taking into consideration e.g. the ethnic differences of respondents as well their lifestyle preferences and habits. Even seasonality and living conditions and childhood experiences are considered. The variety of cofounders also shows how many factors can influence the effect of the green space to health.

Results of literature review showed that methods to investigate connections between green space and human health varied. According to adapted scientific certainty scale grading, the best 3 researches about green space and human health come from Europe (The Netherlands, Denmark and Finland), have relatively high amount of participants and have conducted sending and filling in questionnaires. The biggest share of the studies received score 7, which indicated the probability between 80-90% and “very probable”.

Case study showed that benefits of green space to human health are well known in the Netherlands and there are various methods and tools to receive extra knowledge and practical examples. Also a study tours are organised to introduce their approaches and practical examples as the Dutch are forerunners in integrated city planning in Europe. For example, at Dutch knowledge platform Gezond Ontwerpen, they determine **10 important city characteristics: Clean city, safe city, climate adaptive city, mobile city, green city, energy- and waste-rich city, food-rich city, physically active city, economical city, social participation city**. The biggest challenge is to integrate that knowledge into everyday planning practice. Therefore current study could add to the

knowledge and offer an overview of the mechanism behind the health effects of green space, which could be integrated into everyday urban planning methods. The extent of the possible positive effects can be wide and taking the local health issues and environmental characteristics into consideration, the maximum salutogenic effect of green space could be achieved through relatively simple mechanisms, supported by awareness how those connections are working and how this knowledge could be integrated into special planning.

### 5.1. Recommendations

Current study aims to contribute to scientific knowledge as well as to spatial planning practices. It could be used as source for research related to environment and health connections and it could also be informative and inspirational to urban planners and other concerned practitioners. Practice recommendations for urban planners and for future research are presented in figure 11.

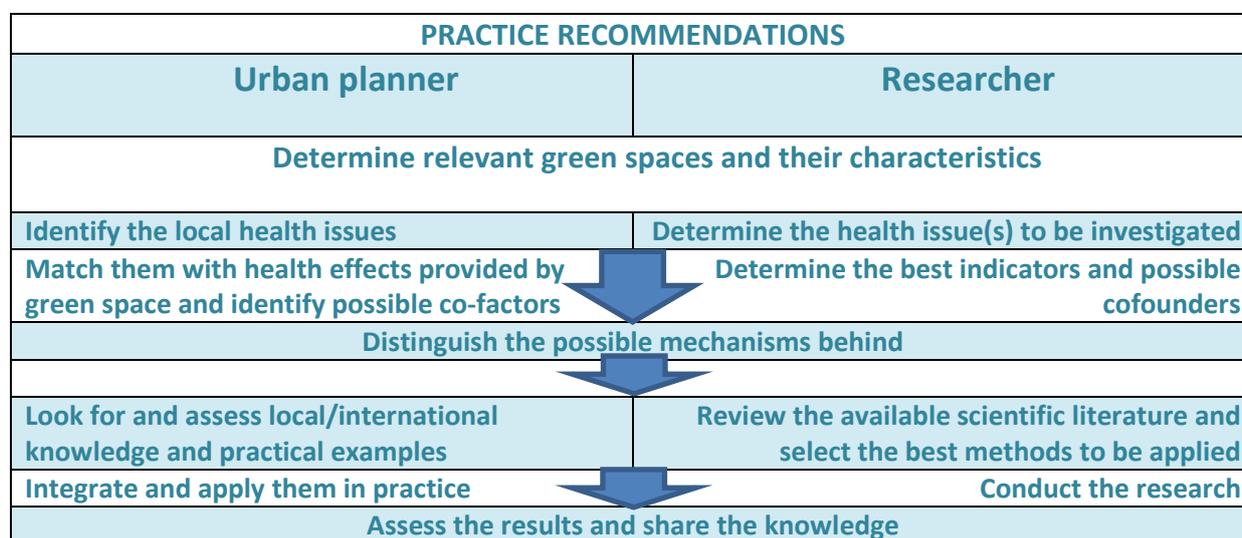


Figure 11: Practice recommendations.

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Front page picture from freepic.com, 2012 [online].

## Appendices

### Appendix I: Questions for literature search suggested by Hanneke Kruize (RIVM), 16.12. 2012

- What is the size of observed effect? Are those effects statistically significant? (matching with research question 3)
- Which indicators are used to characterize green and how are they determined?( q 4)
- Which method is used to investigate the relation between green and movement / social contacts/ stress/ environmental quality/ heat stress?(q 5)
- Which is the target group / examined population group? (q 5)
- What kind of area is being investigated? (q 5)
- Which confounders were included? (q 5)
- How is contact/ exposure mapped? How is it described? (q 5)
- Which mechanisms it focuses on? (q 6)

## Appendix IIA: Narrative syntheses table (cut in two: A and B parts)

Study, Abstract store, Setting, Participants, Study design and Findings

N R	Study	Abstract score	Setting	Participants	Study design	Findings
1	van den Berg A.E., Maas J., Verheij R.A., Groenewegen P.P., "Green space as a buffer between stressful life events and health", 2010	13	Various settings (urban, mixed urban-rural and rural) in the Netherlands	4529 Dutch respondents 18 years and older who had been registered as a resident in their current municipality for at least 12 months.	Dutch National Survey of General Practice (DNSGP-2), conducted in 2000–2002. Questionnaires were administered by trained interviewers in face-to-face interviews. To avoid seasonal patterns in morbidity, all interviews were carried out within 1 year (2001) and were distributed equally across all four seasons. Data were analysed using multilevel regression analysis, with GP practices as the group-level units. Environmental data were derived from the National Land Cover Classification database (LGN4) in 2001, which contains the dominant type of land use of each 25 x 25 m grid cell in the Netherlands.	The results show that the relationships of stressful life events with number of health complaints and perceived general health were significantly moderated by amount of green space in a 3-km radius. Respondents with a high amount of green space in a 3-km radius were less affected by experiencing a stressful life event than respondents with a low amount of green space in this radius. The same pattern was observed for perceived mental health, although it was marginally significant. The moderating effects of green space were found only for green space within 3 km, and not for green space within 1 km of residents' homes, presumably because the 3-km indicator is more affected by the presence of larger areas of green space, that are supposed to sustain deeper forms of restoration.
2	Papangelis G., Tombrou M., Dandou A., Kontos T., "An urban "green planning" approach utilizing the Weather Research and Forecasting (WRF) modeling system. A case study of Athens, Greece", 2012	18	diverse urban landscape of the coastal city of Athens, Greece	not stated	The Weather Research and Forecasting (WRF) model, coupled to a single layer urban canopy model, is utilized to carry out high resolution (0.5 km) land use scenarios, focusing on proposed urban parks (sized 8 and 4 km <sup>2</sup> )	Results during night-time of a typical warm-period day, depict a large cooling (on average greater than 5°C) over the park's vegetated surface compared to current conditions, and a park cool island effect of 9.5 °C when comparing park and surrounding urban fabric air temperatures. Additionally, a significant cooling of the neighboring built-up areas is indicated at a radius proportional to the park's dimensions, related to the nocturnal advection of cool air beyond its borders (park breeze)

3	Nordh H., Hartig T., Hagerhall C.M., Fry G., "Components of small urban parks that predict the possibility for restoration", 2009	15	small (>3000m2) public green spaces (pocket parks) in 72 parks, sampled from the capital cities Oslo, Stockholm, and Copenhagen, as well as a few other Scandinavian cities	Undergraduate and graduate students at the Swedish University of Agricultural Sciences N=52. The mean age among the participants was 26 years; 75% were women and 92% were Swedish.	quantitative analysis of the park photos, the psychological variables were measured by having groups of observers rate the parks. Following a pilot study in which a small group of students rated the photos on multiple items for each psychological variable related to restoration (ART)	The results of this study illustrate that the restorative quality of small urban parks does not depend only on size. results do support the claim that the bigger a park is, the more likely it is that a person will find a possibility for restoration there. findings are in line with the claim that the greener or more "natural" the outdoor environment, the better it is likely to be for restoration.
4	Pinder R., Kessel A., Green J., Grundy C., "Exploring perceptions of health and the environment: A qualitative study of Thames Chase Community Forest", 2009	14	Thames Chase Community Forest (TCCF), which is located in east London and south-west Essex, UK	Research was based on aesthetic and value judgements by both experts and non-experts. Involved both professionals and user groups of TCCF.	Ethnography embedded in a multi-disciplinary study. The main data drawn on for this paper come from the participant observations of the lead author (R.P.) over 1 year (over 2004 and 2005) of several sites associated with TCCF. Data drawn from policy documents; informal interviews with those responsible for managing TCCF and its various projects; interviews and informal conversations with a range of users of the forest and THERAPI projects; interviews with the local population; and participant observation of meetings, events, and everyday life within TCCF.	The concepts of interest to the study (environment, health, wellbeing) and the idea of relationships between them, were treated as unproblematic in everyday discourse, but only unravelled when attempted to pin them down precisely, in fixed and measurable ways. The idea of green environments as being intrinsically 'good for us' was part of a stock of common sense knowledge that both professionals and people from most communities subscribed to, and to some extent saw as a social right. The 'meaning' of concepts such as the impact of green space on wellbeing was immanent in people's engagement with that environment. 'Nature' was not understood as a hermetically sealed externality, but had shifting meanings resulting from people's mode of acting in the world.
5	van Dillen S.M.E., de Vries S., Groenewegen P.P., Spreeuwenberg P., "Greenspace in urban neighbourhoods and residents' health: Adding quality to quantity", 2012	14	Four large Dutch cities were selected, having comparable levels of urbanity and at least 125 000 inhabitants. Within each city 20 neighbourhoods were selected.	Neighbourhood residents N=1641	Cross-sectional survey. Neighbourhoods were selected, varying in the amount of nearby green area per dwelling, as determined by GIS. The quality of green areas, as well as the quantity and quality of streetscape greenery, was assessed by observers using an audit tool. Residents of each neighbourhood were asked to complete a questionnaire on their own health. Then multilevel regression analyses to examine the relationship between greenspace indicators and three health indicators, controlling for socio-demographic and socioeconomic characteristics.	Both indicators for the quantity of greenspace were positively related to all three health indicators (perceived general health, acute health-related complaints, mental health status). Quantity and quality indicators were substantially correlated in the case of streetscape greenery. The quantity and also the quality of greenspace in one's neighbourhood seem relevant with regard to health. Furthermore, streetscape greenery is at least as strongly related to self-reported health as green areas. The quality of the streetscape greenery was related to all three health indicators, whereas the quality of green areas was not related to mental health.

6	Hartig T., "Green space, psychological restoration, and health inequality", 2008	15	comments about conducted researches	Not applicable	Not applicable	Populations with the most access to green space had the weakest associations between income-related deprivation and both all-cause and circulatory disease mortality; the evidence for stress amelioration seems more consistent than that for promotion of physical activity. ; the extent to which green spaces attract people for physical activity could have much to do with the availability of restorative experiences. The relative attractiveness of green spaces for walking varies as a function of the need for restoration, and the expectation of restoration in a given environment is positively associated with its attractiveness as a place for walking. physical activity yields more beneficial emotional, cognitive, and physiological effects in natural environments compared with commonplace urban outdoor spaces
7	Maas J., Verheij R.A., De Vries S., Spreeuwenberg P., Schellevis F.G., Groenewegen P.P., "Morbidity is related to a green living environment", 2009	14	Morbidity data were derived from electronic medical records of 195 general practitioners in 96 Dutch practices.	Dutch data over population of N=345 143	Morbidity was classified by the general practitioners according to the International Classification of Primary Care. The percentage of green space within a 1 km and 3 km radius around the postal code coordinates was derived from an existing database and was calculated for each household. Multilevel logistic regression analyses were performed, controlling for demographic and socio- economic characteristics.	The annual prevalence rate of 15 of the 24 disease clusters was lower in living environments with more green space in a 1 km radius. The relation was strongest for anxiety disorder and depression. The relation was stronger for children and people with a lower socioeconomic status. Furthermore, the relation was strongest in slightly urban areas and not apparent in very strongly urban areas.

8	<p>Fan Y., Das K.V., Chen Q., "Neighborhood green, social support, physical activity, and stress: Assessing the cumulative impact",2011</p>	16	<p>Data for this study comes from the Sinai Improving Community Health Survey conducted by the Sinai Health System in Chicago from September 2002 to April 2003. The survey is a cross-sectional study of six of Chicago's 77 officially designated community areas, including West Town, Norwood Park, North Lawndale, South Lawndale, Roseland, and Humboldt Park.</p>	<p>This research includes a study sample of 1544 respondents.</p>	<p>The cross-sectional study used a three-stage probability sample design; the first stage of sampling was to select fifteen census blocks in each community using the Probability Proportionate to Size (PPS) sampling method. The second stage involved using PPS to randomly select 37 households per block from the blocks identified in the first stage.1 The third stage consisted of randomly selecting an individual between the ages of 18 and 75 from each household. In-person interviews were conducted to collect data from each of the sampled adults.</p>	<p>Different components of neighbourhood green play distinct roles in influencing stress. Park spaces are found to indirectly mitigate stress by fostering social support. Overall neighbourhood vegetation is found to have direct stress mitigation impact, yet the impact is counteracted by its negative effect on social support. When comparing the effect size, park spaces show a more positive impact on health and well-being than the overall neighbourhood vegetation level.</p>
9	<p>Lee A.C.K., Maheswaran R., "The health benefits of urban green spaces: A review of the evidence",2011</p>	14	<p>literature review</p>	<p>electronic database search from 1990-</p>	<p>A literature search of academic and grey literature was conducted for studies and reviews of the health effects of green space. Articles found were appraised for their relevance, critically reviewed and graded accordingly. Their findings were then thematically categorized</p>	<p>Most studies reported findings that generally supported the view that green space have a beneficial health effect. There is weak evidence for the links between physical, mental health and well-being, and urban green space. Environmental factors such as the quality and accessibility of green space affects its use for physical activity. User determinants, such as age, gender, ethnicity and the perception of safety, are also important.</p>

10	<p>Mitchell R., Astell-Burt T., Richardson E.A., "A comparison of green space indicators for epidemiological research", 2011</p>	14	<p>268 small areas in four cities within Britain (York, Exeter, Edinburgh and Glasgow)</p>		<p>Three different indicators of green space coverage were derived for a set of 268 small areas in four cities within Britain. The indicators had different origins and provided a spectrum of sensitivity from larger spaces only, through to ambient greenery. Two indicators reproducible for anywhere in Europe were included. Agreement between the indicators on the quantity of green space in a small area, and their independent association with measures of mortality and self-reported morbidity, were compared.</p>	<p>Overall, the indicators showed relatively close overall agreement. The indicator that detected larger spaces only found less green space in areas of socioeconomic deprivation than the other two. Despite this difference, all indicators showed similar protective associations with the risk of mortality and self-reported morbidity suggesting that larger green spaces may be more important for health effects than smaller spaces. Associations between green space indicator and health were not sensitive to indicator origin and type.</p>
11	<p>Lafortezza R., Carrus G., Sanesi G., Davies C., "Benefits and well-being perceived by people visiting green spaces in periods of heat stress", 2009</p>	14	<p>6 selected green spaces in Italy and the North-East UK</p>	<p>users of green spaces n=800 (50/50 from both countries)</p>	<p>In the two countries, data were gathered during the July 2006. The survey was carried out by interviewers who were instructed to visit each green space at least three times during the whole month, but only in days that were forecasted to be hot and sunny. Investigation used environmental psychology assessments to learn if there exists a relationship between the use of green spaces and the benefits – physical and psychological – and the well-being perceived by users when heat stress episodes are more likely to occur. The results were compared coming from the two countries: Italy and the UK, seeking for significant differences in the use of green spaces and perception of benefits between the two groups.</p>	<p>Longer and frequent visits of green spaces generate significant improvements of the perceived benefits and well-being among users. These results are consistent with the idea that the use of green spaces could alleviate the perception of thermal discomfort during periods of heat stress.</p>

1 2	Nielsen T.S., Hansen K.B., "Do green areas affect health? Results from a Danish survey on the use of green areas and health indicators", 2007	16	Denmark	2000 adult Danes age 18–80 in 2004 The sample was drawn randomly from the central register of persons.	Data from mailed questionnaires, based on the respondents answering on closed categorical or ordinal scales. A large part of the questionnaire focussed on types of activities undertaken in public green areas, as well as evaluations and preferences towards these areas. This was combined with questions on the distance from the home to different types of green and recreational areas such as parks, forests, beaches, green sports facilities, green residential areas and the like. The frequency of visits to these areas, as well as health indicators and background variables were also included. The health section of the questionnaire consisted of a number of questions indicating mental stress as well as the respondent's height and weight in order to allow the calculation of BMI as an indicator of overweight and obesity.	The statistical results indicate that access to a garden or short distances to green areas from the dwelling are associated with less stress and a lower likelihood of obesity. The number of visits cannot explain the effects of green areas on the health indicators. It is suggested that the significance of distance to green areas is mainly derived from its correlation with the character of the neighbourhood and its conduciveness to outdoor activities and "healthy" modes of travel.
1 3	Mitchell R., Popham F., "Effect of exposure to natural environment on health inequalities: an observational population study", 2008	14	England 2001-2005. Study was undertaken in July–August, 2008. Data describing the quantity of green space in an area was obtained from the generalised land use database (GLUD) 2001.	population of England at younger than retirement age (n=40 813 236)	The population of England at younger than retirement age was classified into groups on the basis of income deprivation and exposure to green space. Individual mortality records (n=366 348) were obtained to establish whether the association between income deprivation, all-cause mortality, and cause-specific mortality (circulatory disease, lung cancer, and intentional self-harm) in 2001–05, varied by exposure to green space measured in 2001, with control for potential confounding factors. stratified models were used to identify the nature of this variation.	The association between income deprivation and mortality differed significantly across the groups of exposure to green space for mortality from all causes and circulatory disease, but not from lung cancer or intentional self-harm. Health inequalities related to income deprivation in all-cause mortality and mortality from circulatory diseases were lower in populations living in the greenest areas. The incidence rate ratio (IRR) for all-cause mortality for the most income deprived quartile compared with the least deprived was 1.93 in the least green areas, whereas it was 1.43 in the most green. For circulatory diseases, the IRR was 2.19 in the least green areas and 1.54 in the most green. There was no effect for causes of death unlikely to be affected by green space, such as lung cancer and intentional self-harm.

14	Korpela K.M., Ylen M., Tyrvaainen L., Silvennoinen H., "Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland",2010	17	two major Finland cities - Helsinki and Tampere	random sample of 1273 inhabitants, aged between 15 and 75 years	Postal questionnaire. Respondents were asked to rate 16 types of urban and natural places and areas with regard to their personal importance (5-point Likert scale).A subsample of the answers from inhabitants with a self- reported distance from home to a favorite place of 15 km or less (n=1089) was analysed. To statistically model in an exploratory effort the connections between the use of favorite places, restorative experiences, their determinants and aspects of self-rated health.	Restorative experiences in favorite exercise and activity outdoor areas, waterside environments and extensively managed natural settings (mainly urban woodlands) were stronger than in favorite places in built urban settings or green spaces in urban settings (mostly parks). The results revealed a link between the need for restoration (worries and stress), the use of environmental self-regulation strategies (favorite places) and restorative outcomes.
15	Richardson E.A., Mitchell R.,"Gender differences in relationships between urban green space and health in the United Kingdom",2010	15	The United Kingdom, 6432 urban wards	total population of 28.6 million adults aged 16-64 years in 2001	UK-wide study of the relationship between urban green space and health, and the first such study to investigate gender differences in this relationship. An ecological approach was used. Two land use datasets were used to create a proportional green space measure (% by area) at the UK Census Area Statistic ward scale. Selected were health outcomes that were plausibly related to green space and another that was expected to be unrelated. Negative binomial regression models examined associations between urban green space and these health outcomes, after controlling for relevant confounders. Gender differences in these associations were observed and tested.	There were no significant differences between men and women in terms of their green space exposure. Male cardiovascular disease and respiratory disease mortality rates decreased with increasing green space, but no significant associations were found for women. No protective associations were observed between green space and lung cancer mortality or self-reported limiting long-term illness for either men or women. Possible explanations for the observed gender differences in the green space and health relationship are gender differences in perceptions and usage of urban green spaces.

1 6	Smith K.R., Roebber P.J., "Green roof mitigation potential for a proxy future climate scenario in Chicago, Illinois", 2011	15	Chicago, Illinois, US		Using the Advanced Research version of the Weather Research and Forecasting(WRF)Model coupled with the Urban Canopy Model (UCM), the effects of the urban environment are modelled to gain insight into the effectiveness of mitigation strategies that can be used to counter late-twenty- first-century business-as-usual climate-warming scenarios as well as the effects of continued urban sprawl.	Vegetative rooftops, or green roofs, offer a potentially attractive mitigation strategy by increasing equivalent albedo and thereby reducing temperatures in the urban environment. Results indicate as much as a 0.88 C reduction in average surface temperatures could be achieved with 50% green roof coverage across the city. This level of cooling could help to minimize the negative effects of the urban heat island, including heat stress and increased heat-related mortality, and could lead to improved air quality and reduced energy consumption for air conditioning.
1 7	Stigsdotter U.K., Ekholm O., Schipperijn J., Toftager M., Kamper-Jorgensen F., Randrup T.B., "Health promoting outdoor environments-- associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey.", 2010	14	Denmark	11, 238 adults	Data were derived from the 2005 Danish Health Interview Survey and are based on a region-stratified random sample of 21,832 adults. Data were collected via face-to-face interviews followed by a self-administered questionnaire, including the SF-36, which measures eight dimensions of health and the Perceived Stress Scale, which measures self-reported stress. A total of 11,238 respondents completed the interview and returned the questionnaire. Multiple logistic regression analyses were performed to investigate the association between distance to green space and self-perceived stress.	Danes living more than 1km away from the nearest green space report poorer health and health-related quality of life, i.e. lower mean scores on all eight SF-36 dimensions of health than respondents living closer. Respondents living more than 1km away from a green space have 1.42 higher odds of experiencing stress than do respondents living less than 300m from a green space. Respondents not reporting stress are more likely to visit a green space than are respondents reporting stress. Reasons for visiting green spaces differ significantly depending on whether or not respondents experience stress. Respondents reporting stress are likely to use green spaces to reduce stress.

18	<p>Pena-Salmon C.A., Rojas-Caldelas R., "Methodology for planning urban green areas: The case of Mexicali, Baja California, Mexico", 2009</p>	19	<p>Mexicali, Baja California, Mexico</p>	<p>Three kinds of participants: the permanent technical team; a temporary team composed by external specialists and; a consultative advice team, integrated by representatives of diverse sectors of the community, they can assess with autonomy the proposals made by the technical team.</p>	<p>Methodological proposal for planning urban green areas and its application in Mexicali. The methodological proposal is composed of five phases: organization, inventory, assessment, strategy and management and the development of six groups of components: the physical-urban, technological, environmental, financial-economical, legal-regulatory, and public participation. The green area inventory and its assessment were done according to a classification in twelve subsystems using a Quickbird satellite image with a 2.6 m resolution and data was integrated in a geographical information system (Mapinfo).</p>	<p>The total cover of existing green areas in urban area was of 2,894.32 ha. From the total subsystems, those of smaller percentage are public green areas: recreational (1.54%) and sports (1.07%), while those of greater percentage are the private green areas like residential ones (22.04%). The subsystems of farming and derelict land should not be considered, since these land uses will be incorporated to urban development in the middle or long term, therefore the existing network of urban green areas are 1480.67 ha, which represent the 7.10% from the total of urban area (20,848.39 ha). the vegetation cover necessary to remove CO<sub>2</sub> produced in a year was estimated in 12,017.13 ha of green area, considering an average of CO<sub>2</sub> removal of 212 ton/ha/year</p>
19	<p>Rosenzweig C., Solecki W., Parshall L., Gaffin S., Lynn B., Goldberg R., Cox J., Hodges S., "Mitigating New York City's heat island with urban forestry, living roofs, and light surfaces", 2006</p>	17	<p>6 areas in New York, US</p>	<p>modelling</p>	<p>This study uses a regional climate model (MM5) in combination with observed meteorological, satellite, and GIS data to determine the impact of each of the mitigation strategies on surface and near-surface air temperature in the New York Metropolitan Region over space and time. The effects of localized changes in land-surface cover in six case study areas are evaluated in the context of regional atmospheric mixing.</p>	<p>Vegetation cools surfaces more effectively than increases in albedo, and the most effective mitigation strategy per unit area redeveloped is curb side planting. However, the greatest absolute temperature reductions are possible with light surfaces because 64% of New York City's surface area could be redeveloped from dark, impervious surfaces to lighter high-albedo surfaces. New street trees could be planted in 17% of the city's surface area. Living roofs offer greater cooling per unit area than light surfaces, but less cooling per unit area than curb side planting.</p>

20	de Vries S., Verheij R.A., Groenewegen P.P., Spreeuwenberg P., "Natural environments - Healthy environments? An exploratory analysis of the relationship between greenspace and health", 2003	14	the Netherlands, 1155 different neighbourhoods	Health data come from a study conducted by the Netherlands Institute for Health Services Research (NIVEL)- Dutch National Survey of Morbidity and Interventions in General Practice N=10197 respondents	Hypothesis was empirically tested by combining Dutch data on the self-reported health of over 10 000 people with land-use data on the amount of greenspace in their living environment. In the multilevel analysis socioeconomic and demographic characteristics, as well as urbanity were controlled for.	Living in a green environment was positively related to all three available health indicators, even stronger than urbanity at the municipal level. Analyses on subgroups showed that the relationship between greenspace and one of the health indicators was somewhat stronger for housewives and the elderly, two groups that are assumed to be more dependent on, and therefore exposed to, the local environment. Furthermore, for all three health indicators the relationship with greenspace was somewhat stronger for lower educated people. At least three types of mechanisms can be discerned: 1. more greenspace leads to a less polluted environment; 2. more greenspace leads to more frequent or longer contact with, and therefore experience of, this greenspace; 3. more greenspace leads to more physical activity, such as walking and cycling.
21	Jim C.Y., Shan X., "Socioeconomic effect on perception of urban green spaces in Guangzhou, China", 2012	15	Guangzhou, China, 24 green sites (December 2005)	595 green area visitors	Face to face interviews in 24 green sites. A questionnaire survey solicited responses to positive and negative UGS attributes from selected respondents by stratified sampling from visitors in the study area. The first part presented 12 key UGS attributes (seven positive and five negative). The five-point Likert scale was employed, from "strongly agree" (coded as 1) to "strongly disagree" (as 5) to assess opinions. The second part evaluated the socioeconomic profile and perception of respondents	The results showed good knowledge, positive perception and limited concern about safety. Benefits directly related to individual and family interests were emphasized, such as health enhancement, promotion of children development, and stress reduction. The social role of community development (social interaction) received less support. Significant differences in perception were found across most socioeconomic variables, including gender, age, marital status, education, occupation, and district of residence. The distance-reinforced negative perception of UGS called for the generous provision of proximal sites near homes to satisfy local demands.

2 2	Richardson E., Pearce J., Mitchell R., Day P., Kingham S., "The association between green space and cause-specific mortality in urban New Zealand: An ecological analysis of green space utility", 2010	16	1009 small urban areas in New Zealand	Population of 1,546 405 . Individual-level mortality data (including information on age, sex and domicile of residence at death) for every registered death between 1996 and 2005 from the New Zealand Ministry of Health.	Observational study on a population of 1,546,405 living in 1009 small urban areas in New Zealand. A neighbourhood-level classification was developed to distinguish between usable (i.e., visitable) and non-usable green space (i.e., visible but not visitable) in the urban areas. Negative binomial regression models were fitted to examine the association between quartiles of area-level green space availability and risk of mortality from cardiovascular disease and from lung cancer, after control for age, sex, socio-economic deprivation, smoking, air pollution and population density.	Deprived neighbourhoods were relatively disadvantaged in total green space availability (11% less total green space for a one standard deviation increase in NZDep2001 deprivation score, $p < 0.001$ ), but had marginally more usable green space (2% more for a one standard deviation increase in deprivation score, $p = 0.002$ ). No significant associations between usable or total green space and mortality were observed after adjustment for confounders.
2 3	Makhelouf A., "The effect of green spaces on urban climate and pollution", 2009	14	Boulogne (wood, 855 hectares in the west of Paris) and the Bois de Vincennes (wood, 955 hectares in the east of Paris), France	Measurements of physical environment	A part of a study on "An example of the changing climate by the constructions in the Paris region". The study required an intensive measurement campaign over a period of four years, and it was tried to see the influence of local amenities on the different climatic factors (temperature, humidity and wind) and the distribution of air pollution. Measurements of temperature and relative humidity were taken at height of about 1.80 m with a very powerful probe. The measures of the climatic factors and the pollutants have been taken in diverse locations.	The influence of different types of gardens on temperature, humidity, wind, precipitation and the distribution of air pollution are presented. The results clearly showed the important role of parklands in urban areas. The parklands decreasing temperatures promote the reduction of urban heat island.

2 4	Aldous D.E., "The people-plant-place paradigm", 2011	14	general discussion	general discussion	The objective of this paper was to explore the concept of a people-plant-place paradigm, the benefits and outcomes that can accrue from such a relationship, and discuss the issues that could influence a paradigm shift towards sustainable green space.	In a people-plant-place paradigm, plants form the basis for improving food production as well as our quality of life and lifestyle. Because the human race is bound to the plants and places of the earth a special bond of dependence needs to be accepted—a bond that not only nourishes and enhances our physical bodies but one that also soothes and replenishes the mind and spirit. The paradigm put forward is a dynamic entity, and provides strong evidence that horticulturists, economists, ecologists, planners, social and health scientists need to retain closer linkages among their disciplines to secure longer term sustainable food production, and improvements in biodiversity, behaviour, health and well-being for mankind.
2 5	Sandstrom U.G., Angelstam P., Khaakee A., "Urban comprehensive planning - Identifying barriers for the maintenance of functional habitat networks", 2006	15	6 large cities in Sweden (Stockholm, Göteborg, Malmö, Uppsala, Linköping, Örebro)	18 urban planners	Normative model was defined for planning urban biodiversity and operationalised this concept by using landscape ecological principles. Structured in-depth interviews were then carried out with three planners in each city. The respondents were asked about their interest, ability, and knowledge concerning planning for functional networks of green spaces in relation to the normative model.	The in-depth interviews with urban planners indicated that legislation was an important driver for green space planning, that they paid attention to new knowledge concerning recreation values and public health, but that biodiversity maintenance was not a high priority. There was a general agreement that local governments lack necessary resources to plan for biodiversity. A majority of the respondents mentioned geographical information systems (GIS) as an important tool to integrate knowledge about biodiversity in the planning process and to evaluate likely consequences caused by deviations from current structure plans related to an efficient use of urban green spaces to maintain biodiversity.
2 6	Bowler D.E., Buyung-Ali L., Knight T.M., Pullin A.S., "Urban greening to cool towns and cities: A systematic review of the empirical evidence", 2010	14	literature review	databases of different disciplines (environmental and public health), internet search engines and websites of environmental and health organisations	Systematic review methodology was used to evaluate available evidence on whether greening interventions, such as tree planting or the creation of parks or green roofs, affect the air temperature of an urban area. Meta-analysis was used to synthesize data on the cooling effect of parks.	Most studies investigated the air temperature within parks and beneath trees and are broadly supportive that green sites can be cooler than non-green sites. Results show that, on average, a park was 0.94 °C cooler in the day. Studies on multiple parks suggest that larger parks and those with trees could be cooler during the day.

27	<p>Groenewegen P.P., Van Den Berg A.E., De Vries S., Verheij R.A., "Vitamin G: Effects of green space on health, well-being, and social safety", 2006</p>	15	the Netherlands	<p>datasets that were collected in 2001. 3 sets : n=300 000, n=13 000, n=90 000</p>	<p>Article discusses the design of a research program on the effects of green space in the living environment on health, well-being and social safety. The program consists of three projects at three different scales: at a macro scale using data on the Netherlands as a whole, at an intermediate scale looking into the specific effect of green space in the urban environment, and at micro scale investigating the effects of allotment gardens. The projects are observational studies, combining existing data on land use and health interview survey data, and collecting new data through questionnaires and interviews. Multilevel analysis and GIS techniques are used to analyze the data.</p>	<p>The program has three aims. First, to document the relationship between the amount and type of green space in people's living environment and their health, well-being, and feelings of safety. Second, to investigate the mechanisms behind this relationship. Mechanisms relate to exposure (leading to stress reduction and attention restoration), healthy behaviour and social integration, and selection. Third, to translate the results into policy on the crossroads of spatial planning, public health, and safety. Strong points of our program are: we study several interrelated dependent variables, in different ordinary settings (as opposed to experimental or extreme settings), focusing on different target groups, using appropriate multilevel methods.</p>
<p><b>Selected complementing literature related to physiological wellbeing/ mental stress and physical activity / obesity</b></p>						
28	<p>Grahn P., Stigsdotter U.A., "Landscape planning and stress", 2003</p>	13	<p>9 cities in Sweden (Enköping, Halmstad, Kristianstad, Lund, Trelleborg, Trollhättan, Uppsala, Varberg and Västerås)</p>	<p>953 respondents of 2200 randomly selected town-dwellers aged 3 months to 105 years</p>	<p>This paper focuses on the relationship between the use of outdoor environments and people's stress-related depression and burnout syndromes. A questionnaire about individual health and their use of different urban open green spaces in and close to the city. A quantitative survey in the form of a mailed questionnaire with pre-coded questions. Altogether 2,200 questionnaires were sent out to the nine towns, addressed to individuals chosen at random.</p>	<p>The results indicate that city landscape planning may affect the health of town-dwellers. Statistically significant relationships were found between the use of urban open green spaces and self-reported experiences of stress – regardless of the informant's age, sex and socio-economic status. The results suggest that the more often a person visits urban open green spaces, the less often he or she will report stress-related illnesses. The same pattern is shown when time spent per week in urban open green spaces is measured. The distance to public urban open green spaces seems to be of decisive importance, as is access to a garden, in the form of a private garden or a green yard immediately adjacent to, for instance, an apartment building. People do not usually compensate for lack of green environments in their own residential area with more visits to public parks or urban forests.</p>

29	<p>Volker S., Kistemann T., "I'm always entirely happy when I'm here!" Urban blue enhancing human health and well-being in Cologne and Düsseldorf, Germany", 2013</p>	13	<p>two promenades on the river Rhine in the centres of two German cities (Cologne and Düsseldorf)</p>	<p>A total number of n=42 participants (female n=22; male n=20), provided analysable questionnaires in the two cities (Cologne n = 22; Düsseldorf n = 20). The age ranges spanned 16-80 years.</p>	<p>An extended concept of therapeutic landscapes is used to analyse two promenades on the river Rhine in the centres of two German cities (Cologne and Düsseldorf). A complex of qualitative and quantitative methods from diverse disciplines is applied to obtain a multi-dimensional image of salutogenic health processes. I.e. A spatial analysis (geographical approach) was conducted, comprising field mapping, aerial photo analysis, and pedestrian-counting. Finally, qualitative, written questionnaires with standardised questions and open answers were completed on 12 different dates, 6 at each promenade, on working days and weekends (socio-psychological approach). The participants were recruited directly in the search field by the authors and were asked to fill out the questionnaires themselves while walking along the promenade.</p>	<p>The results show that the promenades are favourite places to spend leisure time and to engage in recreational activities, in addition to providing restoration from everyday stresses. Water is a strong predictor of preference and positive perceptive experiences in urban environments. Users of the promenades also report strong emotional attachments to the place. Urban blue space may be interpreted as a therapeutic landscape in various ways. The</p>
30	<p>Bowler D.E., Buyung-Ali L.M., Knight T.M., Pullin A.S., "A systematic review of evidence for the added benefits to health of exposure to natural environments", 2010</p>	12	<p>data for this study comes from the Sinai Improving Community Health Survey conducted by the Sinai Health System in Chicago from September 2002 to April 2003. The survey is a cross-sectional study of six of Chicago's 77 officially designated community area</p>	<p>Twenty-five studies met the review inclusion criteria.</p>	<p>Systematic review to collate and synthesise the findings of studies that compare measurements of health or well-being in natural and synthetic environments. Effect sizes of the differences between environments were calculated and meta-analysis used to synthesise data from studies measuring similar outcomes.</p>	<p>The most common outcome measures were scores of different self-reported emotions. Based on these data, a meta-analysis provided some evidence of a positive benefit of a walk or run in a natural environment in comparison to a synthetic environment. There was also some support for greater attention after exposure to a natural environment but not after adjusting effect sizes for protest differences. Meta-analysis of data on blood pressure and cortisol concentrations found less evidence of a consistent difference between environments across studies.</p>

3 1	<p>Lottrup L., Stigsdotter U.K., Meilby H., Corazon S.S., "Associations between use, activities and characteristics of the outdoor environment at workplaces", 2012</p>	10	Danish companies	402 office workers	<p>A quantitative survey in the form of a questionnaire with primary pre-coded questions with the opportunity to add personal comments was conducted (web-based). The questions addressed the use of the outdoor environments; the outdoor activities; encouragement and impediments for going outdoors; characteristics of the outdoor environment, and the impact of work- place outdoor environments on employees' health, job satisfaction and work performance.</p>	<p>The results show that 37.8% of the respondents spent time outdoors during their working day, and that the proportion of men spending time outdoors was higher than the proportion of women. Eight outdoor activities were identified, and significant relationships between the outdoor activities and perceived sensory dimensions (PSD) of the outdoor environment were found, indicating that the presence of the dimension 'serene' increased the odds for respondents going outdoors and that five of the eight activities would be performed. Only few significant relationships between outdoor environment use and employee health, job satisfaction and work performance were identified.</p>
3 2	<p>Sugiyama T., Leslie E., Giles-Corti B., Owen N., "Associations of neighbourhood greenness with physical and mental health: do walking, social coherence and local social interaction explain the relationships?", 2008</p>	13	Urban areas in Adelaide, Australia (2003-2004)	<p>adults (n = 1895), eligibility criteria: living in private dwellings, aged between 20 and 65 years, able to walk without assistance and able to take part in surveys in English</p>	<p>A mailed survey collected the following data from adults in Adelaide, Australia: physical and mental health scores (12-item short-form health survey); perceived neighbourhood greenness; walking for recreation and for transport; social coherence; local social interaction and socio-demographic variables.</p>	<p>After adjusting for socio-demographic variables, those who perceived their neighbourhood as highly green had 1.37 and 1.60 times higher odds of better physical and mental health, respectively, compared with those who perceived the lowest greenness. Perceived greenness was also correlated with recreational walking and social factors. When walking for recreation and social factors were added to the regression models, recreational walking was a significant predictor of physical health; however, the association between greenness and physical health became non-significant. Recreational walking and social coherence were associated with mental health and the relationship between greenness and mental health remained significant.</p>
3 3	<p>Hartig T., Catalano R., Ong M., "Cold summer weather, constrained restoration, and the use of antidepressants in Sweden", 2007</p>	13	Sweden	<p>nationally aggregated data on defined daily doses of SSRIs dispensed monthly from 1991 through 1998</p>	<p>the relationship between cold summer temperatures and the dispensation of selective serotonin reuptake inhibitors (SSRIs) in Sweden was investigated. The data using autoregressive, integrated, moving average time-series modelling methods were analyzed.</p>	<p>Dispensation of SSRIs correlated negatively with monthly mean temperature for July, the peak vacation period. The association held for both men and women, net of trends, seasonality, and other statistical controls. The constrained restoration hypothesis augments response style, restricted activity and seasonality explanations for depression.</p>

3 4	Largo-Wight E., "Cultivating healthy places and communities: Evidenced-based nature contact recommendations", 2011	11	this review of literature focused on nature contact, a specific component of healthy places and communities	several fields of study	A multi- disciplinary review was conducted in several fields of study and findings were organized into public health recommendations	Formed public health recommendations: (1) cultivate grounds for viewing, (2) maintain healing gardens, (3) incorporate wooded parks and green space in communities, (4) advocate for preservation of pristine wilderness, (5) welcome animals indoors, (6) provide a plethora of indoor potted plants within view, (7) light rooms with bright natural light, (8) provide a clear view of nature outside, (9) allow outside air and sounds in, (10) display nature photography and realistic nature art, (11) watch nature on TV or videos, and (12) listen to recorded sounds of nature.
3 5	Korpela K.M., Ylen M., Tyrvaïnen L., Silvennoinen H., "Determinants of restorative experiences in everyday favorite places", 2008	13	(Helsinki, Tampere) in Finland	Finnish-speaking inhabitants aged between 15 and 75 years n=1089 (of 3000)	The study was based on the answers to a mailed questionnaire of a simple random sample of respondents from two cities. The questionnaire included 74 major questions or measures (some of them including several items) grouped in the themes of residential area preferences, the meaning of nature, the use of and experiences in the green spaces in the residential area, the feelings of security and community, well- being and perceived health, health habits, and background data. Purpose of this study was to investigate the determinants of restorative experiences using favorite place as a window or unit of analysis.	Different variables were associated with restorative experiences in different favorite settings (extensively managed nature areas, built-up green spaces, waterside environments, exercise and activity/hobby areas, and indoor and outdoor urban areas).
3 6	Dean J., van Dooren K., Weinstein P., "Does biodiversity improve mental health in urban settings?", 2011	13	Literature review, seven online databases		A systematic review of the extant literature to identify empirical, narrative and review papers that investigated the relationship between biodiversity and mental health in urban settings.	Systematic review resulted finding only one empirical paper that employed indicators measuring both biodiversity and mental health outcomes. Nonetheless there is a well-developed body of evidence supporting the premise that contact with 'nature' provides a range of health benefits for humans. This literature draws particular attention to the 'culturally enriching' services of ecosystems such as psychological restoration, settings for physical activity and aesthetic preferences.

37	<p>Cummins S., Fagg J., "Does greener mean thinner Associations between neighbourhood greenspace and weight status among adults in England",2012</p>	11	<p>England 2000-2003 and 2004-2007</p>	<p>adults (aged 18 years) in from a nationally representative sample of the English population for the time periods 2000--2003 (n=42 177) and 2004--2007 (n=36 959)</p>	<p>Cross-sectional observational study over two time-periods. Neighbourhood greenspace was measured using the Generalised Land use Database for England. Multinomial logistic regression models were used to estimate associations between neighbourhood greenspace and BMI and, in eligible sub-samples, to investigate the contribution of total physical activity to these. Data used in this study were drawn from the publically available Health Survey for England (HSE), an annual nationally representative cross- sectional survey of individuals in England.</p>	<p>In 2000--2003 there was a counterintuitive association between greenspace and BMI. Residence in the greenest areas was significantly associated with increases in overweight (12%) and obesity (23%). In 2004--2007, there was a small protective effect of greenspace for those living in the greenest areas, but this was not statistically significant. Markers of total physical activity did not attenuate associations. Tests for interactions with urban/rural status confirmed that significant associations between neighbourhood greenspace and obesity were only present in urban areas in 2000--2003.</p>
38	<p>Thompson Coon J., Boddy K., Stein K., Whear R., Barton J., Depledge M.H., "Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review",2011</p>	10	<p>A systematic review</p>	<p>11 Papers-Eleven trials (833 adults) were included. Most participants (6 trials; 523 adults) were young students.</p>	<p>A systematic review using different databases. Controlled trials (randomized and nonrandomized) were included. To be eligible trials had to compare the effects of outdoor exercise initiatives with those conducted indoors and report on at least one physical or mental wellbeing outcome in adults or children. Screening of articles for inclusion, data extraction, and quality appraisal were performed by one reviewer and checked by a second with discrepancies resolved by discussion with a third if necessary. Due to the heterogeneity of identified studies a narrative synthesis was performed. Eleven</p>	<p>Most trials showed some improvement in mental wellbeing on one or other of the outcome measures. Compared with exercising indoors, exercising in natural environments was associated with greater feelings of revitalization and positive engagement, decreases in tension, confusion, anger, and depression, and increased energy. However, the results suggested that feelings of calmness may be decreased following outdoor exercise. Participants reported greater enjoyment and satisfaction with outdoor activity and declared a greater intent to repeat the activity at a later date. None of the identified studies measured the effects of physical activity on physical wellbeing or the effect of natural environments on exercise adherence.</p>

39	Bodin M., Hartig T., "Does the outdoor environment matter for psychological restoration gained through running?",2003	11	park and an urban environment in Sweden.	Twelve local regular runners (6 female, 6 male; mean age = 39.7 years)	A field experiment with environment (park, urban), occasion (first run, second run), and time (pre-run, post-run) as within-subjects factors, and gender as a between-subjects factor. Methods: Twelve regular runners provided self-reports of emotions and behavioural measures of attention before and after each of two 1-hour runs in each of the two environments. The routes differed in amount of greenery, proximity to water, and presence of traffic, buildings, and other people. Background measures of stress and evaluations of the running environments were also obtained.	Characteristic of restoration, running reduced anxiety/depression and anger. It had inconsistent effects on attention. No Time x Environment interactions reached statistical significance. However, those for tranquillity and anxiety/depression had medium-sized effects ) and were consistent with the hypothesis that the park would promote restoration while running to a greater degree than the urban environment. The runners preferred the park over the urban environment and perceived it as more psychologically restorative.
40	Pretty J., Peacock J., Hine R., Sellens M., South N., Griffin M., "Green exercise in the UK countryside: Effects on health and psychological well-being, and implications for policy and planning",2007	13	four regions of the UK	10 green exercise case studies, 263 participants	This study measured the effects of 10 green exercise case studies (including walking, cycling, horse-riding, fishing, canal-boating and conservation activities). Data were obtained in the field by means of a composite questionnaire.	Even though these participants were generally an active and healthy group, it was found that green exercise led to a significant improvement in self-esteem and total mood disturbance (with anger-hostility, confusion-bewilderment, depression-dejection and tension-anxiety all improving post-activity). Self-esteem and mood were found not to be affected by the type, intensity or duration of the green exercise, as the results were similar for all 10 case studies. Thus all these activities generated mental health benefits, indicating the potential for a wider health and well-being dividend from green exercise.

4 1	Annerstedt M., Ostergren P.-O., Bjork J., Grahn P., Skarback E., Wahrborg P., "Green qualities in the neighbourhood and mental health - Results from a longitudinal cohort study in Southern Sweden", 2012	10	Southern Sweden	population from Southern Sweden aged 18–80 years (n=24945)	Data on person factors were extracted from a longitudinal (years 1999/2000 and 2005) population health survey. The participants were geocoded and linked to data on green qualities from landscape assessments, and stored in the Geographical Information System (GIS). Crude odds ratios (OR) and 95% confidence intervals (CI) were calculated, and multivariate logistic analyses were performed. The survey contained in total 106 questions on varied aspects of health.	Mental health was not affected by access to the chosen green qualities, neither in terms of amount nor in terms of any specific quality. However, a reduced risk for poor mental health was found at follow-up among women, through a significant interaction effect between physical activity and access to the qualities Serene or Space. For men the tendencies were similar, though not significant. Regarding the other three green qualities, as well as amount of qualities, no statistically certain synergistic effects were found. Likewise, no significant synergies were detected between green qualities and the other person-factors. Only advanced exercise significantly reduced the risk for poor mental health among women, but not for men, compared to physical inactivity.
4 2	Woo J., Tang N., Suen E., Leung J., Wong M., "Green space, psychological restoration, and telomere length", 2009	13	Various regions in Hong Kong (Kowloon, Shatin)	976 men aged 65 years and over from various regions in Hong Kong	In a cohort study of the health status of 976 men aged 65 years and over from various regions in Hong Kong, telomere length was measured and its variation, adjusting for confounding actors, examined. Telomere length was divided into quartiles, and logistic regression was used to compare four densely populated regions in the old part of Kowloon with a region built from reclaimed land in the New Territories (Shatin), where many buildings were built on either side of a river and next to the Tolo Harbour, with many parks and markets and a transport terminus situated in the housing complexes.	Telomeres in participants living in older regions in Kowloon were shorter than in those living in Shatin. The results show that the presence of green spaces could have health benefits in terms of biological ageing, which is mediated by a mechanism other than age, lifestyle, or socioeconomic status. They therefore agree that the psychological benefit arising from a restorative environment could be a real one.

4 3	Mitchell R., "Is physical activity in natural environments better for mental health than physical activity in other environments?", 2012	12	Scotland, all environments in which respondents were physically active.	all respondents aged 16+ years, with required items.	Observational study. It used data from the Scottish Health Survey 2008, describing all environments in which respondents were physically active. Associations were sought between use of each environment, and then use of environments grouped as natural or non-natural, and the risk of poor mental health and level of wellbeing.	Results showed an independent association between regular use of natural environments and a lower risk of poor mental health, but not for activity in other types of environment. However, regular use of natural environments was not clearly associated with greater wellbeing, whilst regular use of non-natural environments was. The study concludes that physical activity in natural environments is associated with a reduction in the risk of poor mental health to a greater extent than physical activity in other environments, but also that activity in different types of environment may promote different kinds of positive psychological response.
4 4	Potestio M.L., Patel A.B., Powell C.D., McNeil D.A., Jacobson R.D., McLaren L., "Is there an association between spatial access to parks/green space and childhood overweight/obesity in Calgary, Canada?", 2009	10	Calgary, Canada	6,772 children (mean age = 4.95 years) attending public health clinics for pre-school vaccinations.	Multivariate multilevel analysis to examine associations between parks/green space and childhood overweight/obesity across communities in Calgary	In general, parks/green space at the community level was not associated with overweight/ obesity in Calgary, with the exception of a marginally significant effect whereby a moderate number of parks/green spaces per 10,000 residents was associated with lower odds of overweight/obesity. This effect was non-significant in adjusted analyses.
4 5	Abraham A., Sommerhalder K., Abel T., "Landscape and well-being: A scoping study on the health-promoting impact of outdoor environments", 2010	10	Literature review	electronic databases, key journals, reference lists	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. By focusing on the links between landscape and physical, mental and social well-being, all literature presenting theoretical or empirical approaches on a health-promoting impact of landscape was included.	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.

4 6	Lebel L., Krittasudthacheewa C., Salamanca A., Sriyasak P., "Lifestyles and consumption in cities and the links with health and well-being: The case of obesity", 2012	11	paper reviews	not stated	not stated, but it is an overview of topic ralted papers and their findings	It finds that there is modest, but far from universal, support for an emerging set of propositions that a sustainable and healthy urban environment is one which has: well connected, walkable and cyclable streets; public green spaces; compact and modular organization with mixed land- uses; and a healthy food environment.
4 7	Ward Thompson C., Roe J., Aspinall P., Mitchell R., Clow A., Miller D., "More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns", 2012	8	Dundee, UK. Dundee had a population of 153,226 in 2001 and contains a number of highly deprived neighborhoods with varying levels of green space.	n=25( 12 males and 13 females). participants not in work for any reason (unemployed, on invalidity benefit, carers, etc.). target sample was men and women aged 35–55 years.	An exploratory study (n=25) to establish whether salivary cortisol can act as a biomarker for variation in stress levels which may be associated with varying levels of exposure to green spaces. Self-reported measures of stress and general wellbeing were also captured, allowing exploration of relationships between cortisol, wellbeing and exposure to green space close to home. participants were asked to complete a short paper-based questionnaire and were briefed on the protocol for taking cortisol samples.	Results indicate significant relationships between self-reported stress (P<0.01), diurnal patterns of cortisol secretion (P<0.05), and quantity of green space in the living environment. Regression analysis indicates percentage of green space in the living environment is a significant (P<0.05) and independent predictor of the circadian cortisol cycle, in addition to self-reported physical activity (P<0.02).
4 8	de Jong K., Albin M., Skarback E., Grahn P., Bjork J., "Perceived green qualities were associated with neighborhood satisfaction, physical activity, and general health: Results from a cross-sectional study in suburban and rural Scania, southern Sweden", 2012	13	suburban and rural Scania, southern Sweden	N=24,847 (age 18 to 80), public health survey data from 2008	cross-sectional survey data from suburban and rural Scania, Sweden, we assessed how the recently validated index score of area-aggregated perceived green neighborhood qualities (Scania Green Score; SGS), and the five distinct qualities within this index were associated with three self-reported indicators of well-being: neighborhood satisfaction, physical activity and general health. Effect sizes were compared with objective (GIS-based) assessments of the same five qualities.	Area-aggregated SGS was positively associated with neighborhood satisfaction, physical activity and general health. The association with general health was mediated by physical activity and neighborhood satisfaction. Three perceived qualities had salutogenic potential: historical remains (culture), silence such that sounds of nature can be heard (serene) and species richness (lush). Spacious and wild were not appreciated. Some independent positive effects of the GIS-based index were noted, but could not be consistently attributed to specific qualities. Perceived qualities within green areas, not merely quantity, are related to aspects of well-being in suburban and rural areas.

49	<p>Maas J., Verheij R.A., Spreeuwenberg P., Groenewegen P.P., "Physical activity as a possible mechanism behind the relationship between green space and health: A multilevel analysis", 2008</p>	13	The Netherlands	<p>n=4899 Dutch residents. the Second Dutch National Survey of General Practice (DNSGP-2). Data for the DNSGP-2 were gathered in 2001 via 104 general practices.</p>	<p>The study includes 4.899 Dutch people who were interviewed about physical activity, self-perceived health and demographic and socioeconomic background. The amount of green space within a one-kilometre and a three-kilometre radius around the postal code coordinates was calculated for each individual. Multivariate multilevel analyses and multilevel logistic regression analyses were performed at two levels and with controls for socio-demographic characteristics and urbanity.</p>	<p>No relationship was found between the amount of green space in the living environment and whether or not people meet the Dutch public health recommendations for physical activity, sports and walking for commuting purposes. People with more green space in their living environment walked and cycled less often and fewer minutes during leisure time; people with more green space garden more often and spend more time on gardening. Furthermore, if people cycle for commuting purposes they spend more time on this if they live in a greener living environment. Whether or not people garden, the time spent on gardening and time spent on cycling for commuting purposes did not explain the relationship between green space and health.</p>
50	<p>Amorim T.C., Azevedo M.R., Hallal P.C., "Physical activity levels according to physical and social environmental factors in a sample of adults living in South Brazil", 2010</p>	10	urban area of Pelotas, South Brazil	<p>urban residents n=972 adults (20–69 years)</p>	<p>Cross-sectional study including 972 adults (20–69 years) living in the urban area of Pelotas, Brazil. Physical activity was measured using the long International Physical Activity Questionnaire. Environmental variables were assessed using a modified version of the Neighborhood Environment Walkability Scale.</p>	<p>Subjects living near green areas were more likely to be active in leisure-time, as well as those who reported to live in safe neighborhoods. Transport-related physical activity was higher among individuals living in areas with garbage accumulation, and was lower among those living in neighborhoods which are difficult to walk or cycle due to traffic. Social support was strongly associated with leisure-time physical activity.</p>

5 1	Hansmann R., Hug S.-M., Seeland K., "Restoration and stress relief through physical activities in forests and parks", 2007	13	Zurich, Switzerland. April 2005 in Zurichberg Forest and Irchelpark. Zurichberg Forest, the city's largest urban forest, is close to the city centre. spacious park of 32ha with a pond at its centre	164 forest visitors, 71 males and 93 females	A field survey assessed the restorative effects of visiting an urban forest and a city park in Zurich, Switzerland. Respondents rated their headaches, level of stress, and how balanced they felt both prior to visiting the outdoor location and at the time of being interviewed.	Suffering from headaches and stress decreased significantly, and feeling well-balanced increased significantly. The recovery ratio for stress was 87%, and the reduction in headaches was 52%, in terms of the possible improvements on five-point rating scales. With respect to feeling well-balanced, the observed changes amounted to 40% of the possible enhancement. Positive effects increased with length of visit, and individuals practising sports (e.g., jogging, biking, playing ball) showed significantly higher improvements than those engaged in less strenuous activities (e.g., taking a walk or relaxing). These
5 2	Stigsdotter U.K., Grahn P., "Stressed individuals' preferences for activities and environmental characteristics in green spaces", 2011	12	Sweden	953 randomly selected informants, representative of the Swedish population	postal questionnaire with pre-coded items. The questionnaire consisted of three parts: personal data, preferences for PSD(perceived sensory dimensions) and for outdoor activities, and self-estimations of health. The study focuses on ill health in relation to Level of Stress (LS). The data was analysed using factor and regression analysis.	The results show that individuals reporting high LS (level of stress) are more likely to: be younger adults, women, be on sick-leave, have small children, be dissatisfied with their home environment, experience poorer access to green spaces and, foremost, want to use public green spaces more often. Seventeen different outdoor activity types are identified. The most preferred activity type among the most stressed informants was 'rest activities' followed by 'animal activities' and 'walking activities'. All pairs of these three activity types and PSDs showing a significant association were transformed into 'activity-sensory dimension types'. A regression analysis shows that the most preferred activity-sensory dimension types for informants reporting high LS are 'animal activities' in the PSD 'rich in species', 'animal activities' in the PSD 'refuge', and 'rest activities' in the PSD 'nature'.
5 3	Grahn P., Stigsdotter U.A. "The relation between perceived sensory dimensions of urban green space and stress restoration", 2010	14	Sweden	953 randomly selected informants, representative of the Swedish population	A total of 953 randomly selected informants from nine Swedish cities answered a postal questionnaire with pre-coded questions. The questionnaire consisted of three parts: personal data, preferences for natural qualities and self-estimations of health status. The data were analyzed using factor analysis and regression analyses.	The results identify and describe eight perceived sensory dimensions. People in general prefer the dimension Serene, followed by Space, Nature, Rich in Species, Refuge, Culture, Prospect and Social. The dimensions Refuge and Nature are most strongly correlated with stress, indicating a need to find the most restorative environments. A combination of Refuge, Nature and Rich in Species, and a low or no presence of Social, could be interpreted as the most restorative environment for stressed individuals.

5 4	Martens D., Gutscher H., Bauer N., "Walking in ""wild"" and ""tended"" urban forests: The impact on psychological well-being",2011	11	urban forest in Zürich. between June and early September in sunny weather conditions, with sessions undertaken during daylight between 8 am and 7 pm	52 participants in the wild forest condition and 44 participants in the tended forest condition.	In an experimental field setting, participants were randomly assigned to either a walk through wild or tended forests for 30 min. Multidimensional scales in a pre e post-treatment- setting measured well-being.	Results indicate a stronger change in "positive affect" and "negative affect" in the tended forest condition. Well-being factors "activation" and "arousal" changed after solitary walks, too. However, there were no differences between the treatment conditions, indicating a stronger influence of physical activity than the forest condition wild and tended on these well-being factors. Perceived attractiveness of the natural area did not effect the change in well-being, thus questioning the close relation between perceived attractiveness and the effect on well-being suggested in prior research. Furthermore, more and less fatigued persons did not profit differently concerning well-being changes.
5 5	Barton J., Pretty J., "What is the best dose of nature and green exercise for improving mental health- A multi-study analysis",2010	12	10 UK studies	n=1252	A Multi-Study Analysis. The research used meta-analysis methodology to analyze 10 UK studies involving 1252 participants. Outcomes were identified through a priori subgroup analyses, and dose-responses were assessed for exercise intensity and exposure duration.	Dose responses for both intensity and duration showed large benefits from short engagements in green exercise, and then diminishing but still positive returns. Every green environment improved both self- esteem and mood; the presence of water generated greater effects. Both men and women had similar improvements in self- esteem after green exercise, though men showed a difference for mood. Age groups: for self-esteem, the greatest change was in the youngest, with diminishing effects with age; for mood, the least change was in the young and old. The mentally ill had one of the greatest self-esteem improvements. This

## Appendix IIB: Narrative syntheses table (cut in two: A and B parts)

Study, Urban environments involved, Health effects described, Indicators/Indexes, cofounders, Weiss level of evidence scale

N R	Study	Urban environments involved	Health effects described	Indicators/indexes	cofounders	Adapt. Weiss evidence score
1	van den Berg A.E., Maas J., Verheij R.A., Groenewegen P.P., "Green space as a buffer between stressful life events and health", 2010	Green space in a 1-km and 3-km radius around the respondents home; green environment; public areas, parks; nature; green areas "close to your dwelling";	Respondents with higher levels of green space reported being less affected by stressful life events, and better perceived mental health ; Contact with green space can provide restoration from stress and mental fatigue.; When nature captures people's attention, executive systems that regulate directed attention get to rest, pessimistic thoughts are blocked, and negative emotions are replaced by positive ones (Parsons, 1991).; this research has shown more positive affective, cognitive, and physiological responses to natural settings as compared to built settings.	Percentages of green space in a 1-km and 3-km radius around the home; self- reported physical, mental, and general health: (1) the number of health complaints in the last 14 days; (2) perceived mental health (measured by the GHQ-12); and (3) a single item measure of perceived general health ranging from 'excellent' to 'poor'; Stressful life events were assessed using the List of Threatening Experiences (LTE- Q);	age, gender, income, education level, and level of urbanity	8
2	Papangelis G., Tombrou M., Dandou A., Kontos T., "An urban ""green planning"" approach utilizing the Weather Research and Forecasting (WRF) modeling system. A case study of Athens,	urban park, industrial/commercial area, urban canopy, coastal area, thermally polluted area, green spaces, small number residential houses	No health effects directly described. Indirectly related with thermal comfort.	UHI- Urban Heat Island; PCI- Park Cool Island(also used as an index); Positive park effect -cooling more than half degree		5

	Greece",2012					
3	Nordh H., Hartig T., Hagerhall C.M., Fry G.,"Components of small urban parks that predict the possibility for restoration",2009	small green spaces (pocket parks) incl: hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water	Restoration	ART- Attention Restoration Theory		4
4	Pinder R., Kessel A., Green J., Grundy C.,"Exploring perceptions of health and the environment: A qualitative study of Thames Chase Community Forest",2009	community forest incl. woodlands and parks; urban settlements; green area; green belt; fishing grounds	Abstract description from participants, difficult to specify precisely. Physical and Mental health mentioned in discussions			4

5	<p>van Dillen S.M.E., de Vries S., Groenewegen P.P., Spreeuwenberg P., "Greenspace in urban neighbourhoods and residents' health: Adding quality to quantity", 2012</p>	<p>Green area, streetscape greenery, good quality greenspace. Green areas were defined as parks, forests, nature and recreation areas.</p>	<p>Greenspace offers restorative experiences, leading to stress reduction and/or recovering from attentional fatigue. Greenspace stimulates physical activity, either by way of promoting more active modes of transport (walking, cycling) or by way of seducing people to be more active during leisure, in the form of outdoor recreational activity. It stimulates social contact between neighbourhood members and social cohesion in the neighbourhood.</p>	<p>greenness of the area (Greenness based on median split at 45 m<sup>2</sup> of green area per dwelling within 500 m), green visible on the streetscape on a 5- point scale (not very green impression/very green impression). The quality of green areas was assessed with 10 items, each on a 5-point scale: accessibility, maintenance, variation, naturalness, colourfulness, clear arrangement, shelter, absence of litter, safety and general impression. Also socio-demographic characteristics and health indicators: perceived general health (5-point scale), acute health-related complaints, mental health status</p>	7	
6	<p>Hartig T., "Green space, psychological restoration, and health inequality", 2008</p>	<p>green space, natural environment</p>	<p>health inequality as moderated by the degree of access to parks and other green spaces near the home; Stress amelioration; promotion of physical activity; Restorative experiences.</p>	<p>health inequality (by the degree of access to parks and other green spaces near the home), psychological restoration and physical activity; mortality from circulatory disease, (chronic stress and physical inactivity have causal roles)</p>	<p>The natural environment affects human health through the provision of ecosystem services such as water purification, catastrophes such as tsunamis, and the harbouring of disease vectors, among other things</p>	5

7	<p>Maas J., Verheij R.A., De Vries S., Spreeuwenberg P., Schellevis F.G., Groenewegen P.P., "Morbidity is related to a green living environment", 2009</p>	<p>green space, living environment</p>	<p>Effect to morbidity rates: data included contact diagnoses and indications (diagnoses) for medication and referral to secondary care Prevalence rates are based on contacts that were classified by the GP according to the International Classification of Primary Care and subsequently clustered into episodes of disease. The 24 disease clusters have been distributed over seven disease categories, namely cardiovascular diseases, musculoskeletal diseases, mental diseases, respiratory diseases, neurological diseases, digestive diseases and miscellaneous.</p>	<p>physician- assessed morbidity; people with a lower socioeconomic status (SES); percentage of green space. Only green spaces that dominate the land use in the 25x25 m grid cell (more than 50% of the grid cell is green) have been classified as green space in the dataset. Small-scale green spaces, such as street trees and roadside vegetation were only included as green space if they were dominant in the grid cell. Urbanity. This variable consists of five categories, ranging from very strongly urban (1) to non-urban (5). The indicator is based on the number of households per square kilometre.</p>	<p>Demographic(gender and age) and socioeconomic (education, work status and healthcare insurance type) characteristics .</p>	7
8	<p>Fan Y., Das K.V., Chen Q., "Neighborhood green, social support, physical activity, and stress: Assessing the cumulative impact", 2011</p>	<p>neighborhood green ("neighborhood" as the half-mile buffer area surrounding each home.) including parks, boulevard trees, grassy verges, private gardens</p>	<p>greens impact on physical activity, stress mitigation</p>	<p>Park acreage(The total acreage of parks that can be accessed within a 0.5 mile walk), distance to nearest park, perceived social support indicators (feeling alone, feeling disliked, and people being unfriendly), perceived stress scale (0-16), physical activity per week (moderate and vigorous:)-the total number of times during a typical week that the respondent was engaged in vigorous activities for at least 20min at a time and in moderate activities for at least 30 min at a time.; Normalized Difference Vegetation Index (NDVI);</p>	<p>Social and demographic characteristics (gender, age, marital status, household income, race, employment , education); Indicators:Importance of getting exercise, Try to lose weight, Health limiting moderate activity, Exposure to violence, Years living in the current house, Health interfering with socializing, Threatened or harassed because of race/ethnicity</p>	7

9	Lee A.C.K., Maheswaran R., "The health benefits of urban green spaces: A review of the evidence", 2011	green space, public open space, park	green spaces effect on physical health, mental health and well-being by attracting people, providing scope for physical activity to occur or having restorative effect. Green exercise i.e. walking. Availability of green space has been reported to be independently associated with increased survival in elderly populations. Positive association between lower stroke mortality and higher levels of greenness in the environment.		Green spaces may also influence social capital by providing a meeting place for users to develop and maintain neighbourhood social ties. Exposure to green spaces may have an impact on urban socioeconomic health inequalities. Presence of barriers such as major roads was an influencing factor. Studies of park use also note that ethnic minorities and people with disabilities were less likely to use green spaces. personal barriers also exist such as being overweight, not enjoying exercise, being too old, a lack of time due to other commitments, ill health, injury or disability or concerns about the environment or unpredictable weather conditions, quality of pavements.	5
10	Mitchell R., Astell-Burt T., Richardson E.A., "A comparison of green space indicators for epidemiological research", 2011	green space-22 CORINE land cover categories pertaining to natural, land-based (ie, excluding water bodies) environment	A significantly lower risk of all-cause mortality (excluding external causes) was observed in areas with more than 60% green space. There was also a significantly lower risk of self-reported morbidity associated with green space at levels greater than 80%.	green space coverage, self-reported morbidity and all-cause mortality (excluding external causes). First indicator was derived from CORINE land use coverage categories. The second indicator was derived from the British Ordnance Survey's master map (OSMM). Third was based on generalised land use database (GLUD)- Hybrid dataset	population density, influence of settlement density not related to green space, age and sex and air pollution. socioeconomic deprivation	7

11	Laforteza R., Carrus G., Sanesi G., Davies C., "Benefits and well-being perceived by people visiting green spaces in periods of heat stress", 2009	city parks, urban woodlands, street trees, rooftop gardens, and vertical greening on buildings (mentioned), but survey took place in parks	green spaces offering shaded locations and accessible water could benefit people and, at some extent, alleviate symptoms of thermal discomfort under heat stress conditions. people using green spaces to perform physical activities reported higher benefits and well-being compared with those walking and relaxing.	well-being perceived before and after the visit. Amount of physical activity performed during the visit. Preference for the shade. Effort required to reach the green space. Psychological benefits, physical benefits, well-being before the visit and well-being after the visit and during the visit, importance of accessibility to water during the visit, frequency of the visit.	socio- demographic characteristics (e.g., age, gender, family status, working status.), environmental factors (e.g., travelled distance from home) and individual factors (e.g., type and amount of physical activity performed during the visit, individual preferences)	6
12	Nielsen T.S., Hansen K.B., "Do green areas affect health? Results from a Danish survey on the use of green areas and health indicators", 2007	Public green areas, parks, forests, beaches, green sports facilities, green residential areas; garden and shared green areas at the dwelling; Small urban park, Larger urban park. forest or nature area, Urban square or similar—with old trees, Historical monument with green space, Location suitable for bading in lake/ocean, locations with ocean-view	Stress, obesity . the more visits to green areas the less stress. The ones that have access to a garden or green area are less likely to be overweight/obese.	BMI as an indicator of overweight and obesity. visiting frequency. experienced stress ("Have you in the last 12 months felt: irritated, hunted, stressed, full of energy in the morning—or—concentrated and in a good mood on your job?" The respondents would answer with the frequency of the feeling/experience mentioned on an ordinal scale with seven grades: almost every day, maximum once a week, maximum once every fourth night, maximum once per month, maximum once every quarter, single occurrences and finally—never. A stress-indicator was constructed as an additive stress index based on the responses given upon the 5 questions.; Distance to green areas.	Differences in lifestyles, and other environmental variables, noise, air quality and dust; Seasonality (summer, winter); Physical setting and the housing condition (type of dwelling), socio-economic status (employment, level of education, ownership to dwelling), demography (age, gender, household type) and lifestyle correlates (second home, bicycling for work). ; Factors affecting the possibility to visit green areas (work, family obligations etc) .	8

13	Mitchell R., Popham F., "Effect of exposure to natural environment on health inequalities: an observational population study", 2008	green space, are defined as "open, undeveloped land with natural vegetation" and include parks, forests, playing fields, and river corridors. : Green space defining in CLUD database: category includes parks, other open spaces, and agricultural land, but excludes domestic gardens.	all-cause mortality, and cause-specific mortality (circulatory disease, lung cancer, and intentional self-harm); green spaces promoting faster healing in patients after surgical intervention; green space might be associated with lower inequality involves the physiological responses to the stress of poverty, which are implicated in increased risk of various diseases, notably heart disease.	income deprivation, all-cause mortality, and cause-specific mortality (circulatory disease, lung cancer, and intentional self-harm); incidence rate ratio (IRR); accessibility to green spaces	socioeconomic position; age at death, sex, cause of death; Education, skills, training; living environment (incl air quality); population density, degree of urbanity;	7
14	Korpela K.M., Ylen M., Tyrvaïnen L., Silvennoinen H., "Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland", 2010	urban and natural places: extensively managed nature areas (large forest areas, small-scale wooded areas, scenery fields and meadows, small-scale natural state areas such as river valleys, wetlands, bushes and rocks), (ii) built-up green spaces (large green lots, green areas within housing blocks, decorative plantations and glorious flowers, traffic green areas such as wind-breaks, green lanes and tree avenues, parks including grass and plantations), (iii) waterside environments (beaches and harbour areas), (iv) exercise and activity/hobby areas (playgrounds, recreation trails, sports grounds, allotment gardens, dog parks) and (v) indoor and outdoor urban areas (street areas and indoor places within the city center).	The findings show that restorative experiences were the strongest, and of statistically similar strength, in everyday favorite places located in outdoor exercise and activity areas, waterside environments and extensively managed natural settings (mainly urban woodlands).	general health status, physical symptoms (pain in stomach, reported high blood pressure), negative affectivity (a diffuse sense of subjective distress and dissatisfaction and feelings of stress. Feelings of energy and keenness; restorative experiences (relaxation and calmness, attentiveness and clearing one's mind)	use of places (duration of stay and frequency of visiting), daily hassles (worries about work and money), personality characteristics (nature connectedness, nature hobbies, childhood nature experiences, satisfaction with life) and social relations (uplifts of social relations)	5

15	Richardson E.A., Mitchell R., "Gender differences in relationships between urban green space and health in the United Kingdom", 2010	green space, neighborhood environment; green urban areas, continuous urban fabric, pasture, water bodies	green space effects on health derive from a combination of physical activity promotion and stress reduction. The protective effects of physical activity against cardiovascular disease mortality, respiratory disease mortality and self-reported ill health.	green space measure (% by area) at the UK Census Area Statistic ward scale (GLUD); cardiovascular disease mortality, respiratory disease mortality and self-reported limiting long-term illness and lung cancer mortality.; PM10 concentration	Socioeconomic status. Population density. Individual-level mortality records (including age, sex, cause of death and area of residence at death); air pollution; smoking	6
16	Smith K.R., Roebber P.J., "Green roof mitigation potential for a proxy future climate scenario in Chicago, Illinois", 2011	vegetative surfaces, urban canopy; natural space; streetscape; green roofs; Barren land, scrub/ shrub, grasslands), pasture/hay, and cultivated crops.	cases of heat stress and stroke increase during periods of hot weather; heat waves increase mortality; natural space cools the air; a green roof provides cooling through evapotranspiration in the summer and insulation during the winter;	temperature, wind, and humidity within the canopy, skin temperature and fluxes from all surfaces, diurnal change of solar azimuth angles, and shadowing effects from buildings, moisture availability, heat capacity, albedo, emissivity, and building heights		5
17	Stigsdotter U.K., Ekholm O., Schipperijn J., Toftager M., Kamper-Jorgensen F., Randrup T.B., "Health promoting outdoor environments-- associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey.", 2010	nature environments (forest; park, green space; beach, sea, lake; and other green space)	obesity, diabetes II, osteoporosis and stress-related illnesses such as heart disease, depression and mental fatigue related to modern urban living. A positive association between how often people visit or how long they stay in urban green spaces and recovery from stress and mental fatigue.	distance to a green space, (self-reported) health-related quality of life, Perceived Stress Scale, frequency of visiting green space; The SF-36: a 36-item instrument that measures eight dimensions of health (bodily pain; general health; mental health; physical functioning; role limitations due to emotional problems; role limitations due to physical health; social functioning; and vitality), range 0-100.	health behaviour and habits, lifestyles, environmental and occupational health risks and health resources; reason to visit; Educational status; current socioeconomic position (employment status); type of accommodation; size of municipality, Ethnic background, cohabitation status, gender, age	7

18	<p>Pena-Salmon C.A., Rojas-Caldelas R., "Methodology for planning urban green areas: The case of Mexicali, Baja California, Mexico", 2009</p>	<p>urban green area( Urban green areas were considered as all soils made mainly by permeable surfaces and covered for any kind of vegetation as lawns, shrubs and trees, from public or private property and to meet environmental, recreational or productive functions). Different types of green areas were classified into two main groups (public and private), subdivided into five systems (public services, roads, natural, productive and private) and 12 subsystems related to land use (recreational, sports, education, streets, heritage natural areas, farming, industrial, commercial, tourist, residential, mixed land uses and derelict land).</p>	<p>urban green areas can modify the microclimatic conditions in open spaces and help to restore physical comfort. They improve air quality, adding oxygen and removing carbon dioxide. urban green areas constitute spaces where population develop recreational activities and outdoor sports, they support the physical and mental health of the population contributing to stress reduction.</p>	<p>surface of green area by typology, tons of emissions of carbon dioxide (CO2) and amount of CO2 absorbed by vegetation; surface and density of green areas per inhabitant and neighbourhood, and fuel consumption per inhabitant by use of automotive vehicles.</p>	<p>physical-urban, technological, environmental, financial-economical, legal-regulatory and public participation</p>	5
19	<p>Rosenzweig C., Solecki W., Parshall L., Gaffin S., Lynn B., Goldberg R., Cox J., Hodges S., "Mitigating New York City's heat island with urban forestry, living roofs, and light surfaces", 2006</p>	<p>living/green roofs, urban forest, Urban heat island</p>	<p>Thermal comfort</p>	<p>Heat wave days, near-surface air temperatures</p>	<p>surfce color</p>	5

20	de Vries S., Verheij R.A., Groenewegen P.P., Spreeuwenberg P., "Natural environments - Healthy environments? An exploratory analysis of the relationship between greenspace and health", 2003	living environment (The environment of a neighbourhood was defined as a circle with a radius of 3 km around the centre of the neighbourhood), green environment, green areas, natural environments, greenspace (urban green, agricultural green, forests and nature areas); 'blue' space (fresh and salt water surface)	green areas in one's living environment may lead people to spend a larger part of their spare time outdoors and/or be more physically active.; natural environments are more often used for recreational walking and cycling than urban environments and that these activities have a positive health effect.; people in a greener living environment may become more healthy just by being more exposed to natural elements.; People in highly urban areas tend to have more symptoms and a higher risk of mental illness; people living in a greener environment appear to be significantly more healthy than others; a greener environment appears to have a significant beneficial effect solely in the lower educated group, suggesting that this group is indeed more sensitive to local physical environmental characteristics;	Self-reported health indicators: Number of symptoms experienced in the last 14 days; Perceived general health (Measured on a five-point scale (very good- very bad)); Score on the Dutch version of the General Health Questionnaire (GHQ) (Goldberg, 1972), indicating one's propensity to psychiatric morbidity. Percentage of greenspace (urban green, agricultural green, forests and nature areas); percentage of 'blue' space (fresh and salt water surface); urbanity level 1-5 (based on the number of households per square km); the percentage of green within a 1 km radius around one's home, and the percentage of green in the 1 km to 3 km zone;	Demographic and socioeconomic characteristics: gender, age, number of life-events (such as birth, divorce, loss of job, burglary) in the past year.; type of health insurance; level of completed education of either the head of the household or his or her partner, whoever had the highest level of education; number of rooms in the house; household income; presence of a garden;	7
21	Jim C.Y., Shan X., "Socioeconomic effect on perception of urban green spaces in Guangzhou, China", 2012	urban green spaces (UGSS)	People perceive urban green sites as health promoting, stress reducing and good for children's development; Deterioration of environmental quality, especially air quality, has fostered strong awareness of and concern about health. UGS has the capability to abate air pollution and noise, albeit somewhat limited in dense cities.	Perception of positive and negative attributes of UGS: positive- Promote health, Promote children development, Reduce stress, Increase property value, Contact with nature, Importance to daily life Space for social interaction; Negative -Incivility and vandalism, Commercial encroachment, Bug attack, Unsafe place, Whiling away time;	gender, age, marital status, education level, household monthly income, occupation, place of residence, walking time to reach the nearest UGS, and childhood experience with nature	7

22	Richardson E., Pearce J., Mitchell R., Day P., Kingham S., "The association between green space and cause-specific mortality in urban New Zealand: An ecological analysis of green space utility", 2010	green space (definition of green space included natural areas (e.g., parks, beaches, and fields) but excluded aquatic areas (e.g., lakes and the sea), natural environment, green environment; usable green space (e.g., 'Scenic Reserve'), non-usable green space (e.g., 'Sanctuary Area') and other land (e.g., 'Administration Purpose'). Usable green space was defined as 'urban parkland/open space', 'beaches', and any non-commercial forestry ('indigenous forest', 'deciduous hardwoods', or 'other exotic forest') that was either adjacent to other usable green space or was within 10 m of a road (i.e., accessible). Non-usable green space was defined as all other natural areas, including agricultural land, salt marsh, and commercial forestry.	Green environments are associated with better self-perceived health, lower blood pressure, lower levels of overweight and obesity, lower levels of physician-assessed morbidity, as well as lower mortality risks.; Three key mechanisms have been proposed to explain how green space might influence health: 1. green space provides opportunities for physical activity (PA), and increased PA levels are associated with reduced risks of physical and mental illnesses. 2. green space may benefit health by facilitating social contacts, for example through providing opportunities to meet others or participate in group activities. 3. exposure to green space can promote recovery from attention fatigue, and stress, and stress has been implicated in the aetiology of common chronic physical and mental illnesses.	two causes of mortality with differing aetiologies: cardiovascular disease and lung cancer.; percentage coverage of green space types for each urban neighbourhood; green space availability (total and usable).	age, sex and domicile of residence at death; income, employment, communication, support, transport, qualifications, living space and home ownership; smoking; air pollution; population density (persons per hectare) as a measure of urbanity	4
23	Makhelouf A., "The effect of green spaces on urban climate and pollution", 2009	green space, urban parkland, gardens	Heat stress. In hot periods, parklands and gardens play an important role in reducing the temperature. Thus contributing to thermal comfort. ; .The significant number of trees, being the source of the breeze, tends to push back pollutants. Thus improving air quality.	role and influence of parklands on climatic factors (temperature, humidity, wind and precipitation) and on air pollution (CO and SO2)	surface material	4

24	Aldous D.E., "The people-plant-place paradigm", 2011	(sustainable) green space; neighbourhood park, a wilderness habitat, a botanic garden, confines of the family home.; Natural urban green spaces has been described as any open space, vegetated land or water located and managed within the urban environment and could include plant communities and assets that include public and private green space, grassed sporting facilities, residential lawns, golf courses, airfields, churches, colleges and university grounds (Aldous, 2009). Rural green spaces could involve amenity grasslands, wild lands, protected areas, forest plantations, cropland and rural settlements as well as each nation's national, wilderness and conservation parks. ; inner city parks: community gardens, green roof gardens, hydroponics, mini-farming and ranching; wildlife or biodiversity corridors, urban forest;	Plants not only nourish and enhance our physical bodies but also sooth and replenish our minds and spirits; Living green plants provide for leafy photosynthetic regeneration, for food and fibre, protect and conserve biodiversity, purify pollutants from urban and industrial areas, and sustain the physical and ecological environment of the wider community.; green spaces provide ecosystem benefits such as providing shade and releasing oxygen, stabilizing dust particles and reducing glare, noise and visual pollution, on what human health benefits.; Green spaces provide health benefits by reducing health care expenses by fostering healthy living and active lifestyle; nutrition, physical activity and obesity connection; recovery from stress and mental fatigue; improvements in wellbeing and self-esteem, and reductions in ailments and headaches, dementia, and anger control; spiritual health and preventative health.	not brought out	not brought out	4
25	Sandstrom U.G., Angelstam P., Khakee A., "Urban comprehensive planning - Identifying barriers for the maintenance of functional habitat networks", 2006	Urban landscape, green space, urban green space corridors, urban parks, natural ponds, urban woods, 'green infrastructure'; areas of unspoilt nature	Green spaces are offering recreation and healthy local climate.	no health related indexes brought out	paper concerns more urban biodiversity, what can be confounder itself	6

26	Bowler D.E., Buyung-Ali L., Knight T.M., Pullin A.S., "Urban greening to cool towns and cities: A systematic review of the empirical evidence", 2010	green roofs, parks, green space/area, urban trees and forests, ground(grass) and roof vegetation; green site	'Urban greening' has been proposed as one approach to mitigate the human health consequences of increased temperatures resulting from climate change. An increase in the intensity and frequency of heat waves have been linked with heat stroke, hyperthermia and increased mortality rates.	NDVI (normalized difference vegetation index), air temperature within green and non-green sites within an urban area; type of green site;	park size, seasonality, climate type, amount of tree and grass cover; shading coverage,	5
27	Groenewegen P.P., Van Den Berg A.E., De Vries S., Verheij R.A., "Vitamin G: Effects of green space on health, well-being, and social safety", 2006	(nearby )green space, living environment, urban neighborhoods, allotment garden	Mere exposure to views of nature can improve people's health and well-being by providing restoration from stress and mental fatigue.; relationship between the amount and type of green space in people's living environment and their health, well-being, and feelings of safety; Besides providing relief from stress, an aesthetically attractive living environment may also improve well-being by enhancing satisfaction, attachment, and a sense of responsibility.; Natural environments are perceived as more attractive than built environments. Because of this, green areas may stimulate residents to undertake healthy physical activities such as walking or cycling or to choose these activities as a mode of transport, and to spend more time in them.	perceived physical and mental health status; indicators of health and well-being (acute complaints, chronic illness, mental health, disabilities), health behaviour; land use in each 25 by 25 meter grid cell.	life style, combining structural aspects (socio economic status) and opportunities (availability, social integration) and choices people make (behaviour); population density or urbanicity; socio-demographic characteristics as age, income and education	7

Selected complementing literature related to physiological wellbeing/ mental stress and physical activity / obesity						
28	Grahn P., Stigsdotter U.A., "Landscape planning and stress", 2003	Open green space, urban forest, private garden, green yard; green area; inner city areas, suburban areas	Stress-related illnesses such as burnout syndrome, insomnia and fatigue, depression, feelings of panic; Stress may be deleterious to, for instance, the cardio-vascular system and central parts of the hormonal system, and depression due to exhaustion may occur (Maslach 2001). Environments in the city, such as parks, gardens and green open spaces, could diminish stress and provide opportunities for recovery; Feelings of stress, such as the feeling of being chased, harassed and of not being able to control a situation, have a direct effect on pulse, blood pressure, intestinal functions etc; "stress-triggered fatigue reactions" are a general feeling of being chased, harassed and stressed, fatigue, irritability, lack of ability to concentrate, insomnia, muscular tension, body ache, stomach trouble, hypersensitivity to sound and light, itches, dizziness, chest pains, impaired short- term memory and general anxiety and depression	Socio-economic index, SEI(takes into account an individual's profession, education and responsibility in the society); frequency of visiting public green spaces and duration of the visit; self-estimated health status (primarily concerned stress complaints), occurrence per year: Stress, Irritation, Fatigue, Cold(occurrence of common cold (viral infection)), Headache, Backache, Ache in the back of the head; obstacles visiting green space (time, distance)	Age, sex and socio-economic status; profession, home environment and access to garden.	5

29	Volker S., Kistemann T., "I'm always entirely happy when I'm here!" Urban blue enhancing human health and well-being in Cologne and Düsseldorf, Germany", 2013	Therapeutic landscapes, urban green, urban blue (covers all visible surface waters in urban areas), public place, waterscape, blue space, green space	Beneficial health outcomes and well-being created by urban blue; therapeutic value of urban blue; Urban blue places are favourite places to spend leisure time and for recreational activities, restoring people from everyday stress and sharing activities, partly developed into rituals, which help to enhance physical and mental well-being.	Information was collected about the experienced space, activity space, social space and the symbolic space, in addition to demographic data,	The social and symbolic space dimensions, demographic data including age, sex, frequency of visits and the length of residency in each city.	4
30	Bowler D.E., Buyung-Ali L.M., Knight T.M., Pullin A.S., "A systematic review of evidence for the added benefits to health of exposure to natural environments", 2010	natural environments; park, gardens, woodland, forest, nature reserve/wildlife preserve, wilderness, university campus; outdoor 'green' environment; urban/city street, urban residential area; green paths	A natural environment may provide an environmental setting for an activity or exercise programme, thus promoting increased physical activity. Physical activity can have positive benefits for mental health, for instance, lowering depression; Restoration	measure of a particular emotion (e.g. revitalisation, anger, anxiety), psychological score (e.g. Zuckerman's Inventory of Personal Reactions, Profile of Mood States); effects on attention/concentration; cardiovascular outcomes (e.g. blood pressure or pulse), hormone levels, salivary or urinary cortisol, amylase and adrenaline; effects on immune function (e.g. immune globulin A concentration; natural kill cell activity); levels of physical activity; motor performance; cerebral brain activity (measured as absolute haemoglobin concentration); engagement, memory recall and sleeping hours;	age, sex, and health condition and/or amount of previous physical activity	7

31	<p>Lottrup L., Stigsdotter U.K., Meilby H., Corazon S.S., "Associations between use, activities and characteristics of the outdoor environment at workplaces", 2012</p>	<p>Workplace outdoor environment; Green outdoor environments, 'high quality' environments; Forest-like, Park-like, Green courtyards, Roof terrace with view to forest and sea; green environment, 'balcony or terrace', 'common court-yard', 'private garden &lt;600 m2', and 'private garden ≥600 m2; The possible response categories about characteristics of outdoor env. were: 'wild, free growing nature (Nature)', 'the experience of culture/a lost time (Culture)', 'a large, open room with vast vistas (Prospect)', 'organised for amusement, outdoor seating or similar (Social)', 'an experience of entering a different world where the parts of the environment are perceived as a whole (Space)', 'view of a large area, e.g. the sea, a lake or the roofs of the city (Space view)', 'vast variety of both animals and plants (Rich in species)', 'an experience of safety and shelter in an enclosed room (Refuge)', 'a silent and calm room where one can retire and be undisturbed (Serene)'</p>	<p>Access to green outdoor environments may contribute to improved work performance by increasing attention and lowering stress, which could off-set the time lost by spending time outside. The obvious danger is the opposite; that spending time outside, away from work tasks, might lead to more stress due to time loss; The workplace outside environment can support range of different activities, including social well-being and physical and mental restoration.</p>	<p>(1) background data, (2) health status, (3) working life situation, (4) physical working environment (incl. characteristics of the outdoor environment), and (5) psychological working environment.</p>	<p>age, gender and educational level, managerial position, 'green outdoor environment at home, frequency of time spent outdoors, encouragement to go outdoors, self-reported perceived sensory dimensions</p>	5
32	<p>Sugiyama T., Leslie E., Giles-Corti B., Owen N., "Associations of neighbourhood greenness with physical and mental health: do walking, social coherence and local social interaction explain the relationships?", 2008</p>	<p>Natural environments, green environments, vegetated areas such as parks, open spaces and playgrounds; neighbourhood green spaces; green space;</p>	<p>the availability of green or natural environments is associated with adults' perceptions of better health.;recreational walking was a significant predictor of participants' physical health; the relationship between greenness and physical health may be mediated by recreational walking; those who reported the highest degree of greenness had almost twice the odds of being in the better mental health category, compared with those who perceived little greenness in their</p>	<p>physical and mental health scores (12-item short-form health survey); perceived neighbourhood greenness; walking for recreation and for transport; social coherence; local social interaction and socio-demographic variables ; Neighborhood Environment Walkability Scale (access to a park or nature reserve; access to bicycle or walking paths; presence of greenery; presence of tree cover or canopy along footpaths and presence of pleasant natural features);</p>	<p>social coherence; local social interaction and socio-demographic variables: Age in years, Gender, Education, Work status, Household income, Marital status,; time spent in walking and social factor scores(Social coherence score, Local social interaction)</p>	6

			neighbourhood; the importance of the quality of natural environments, as well as the quantity and access, for promoting walking and health.			
33	Hartig T., Catalano R., Ong M., "Cold summer weather, constrained restoration, and the use of antidepressants in Sweden", 2007	green spaces, urban and national parks	Constraint of restorative activities (i.e. bad weather) prolongs chronic stress and may exacerbate depressive symptoms; depression may in some cases depend on climatic conditions; relatively cold summer weather would restrict access to outdoor settings for restorative activities and in turn constrain psychological restoration. Without the restoration of adaptive resources needed to cope with heavy role obligations and other demands, stress would persist. Persistence of chronic stress into relatively cold summer months would in turn be reflected in increases in outcomes in which chronic stress plays an etiologic role, such as depression.	mean temperature and the dispensation of antidepressant medication (selective serotonin reuptake inhibitors; SSRIs); seasonal affective disorder (SAD); depression and depressive symptoms recorded.	gender, seasonality	7

<p>34</p>	<p>Largo-Wight E., "Cultivating healthy places and communities: Evidenced-based nature contact recommendations", 2011</p>	<p>Unhealthy physical environments are places typified by toxins, pollutants, environmental demands, low environmental control, crime, poverty, urban sprawl, reliance on automobiles, and over or unwise consumption of natural resources.; healthy places or "health-promoting environments" .healthy built environments are characterized with health- promoting factors that promote behavioral, social, psychological, and biological health.Availability of healthy choices, safety, mixed designed land-use, environmental sustainability and stewardship, and the opportunity for nature contact are characteristics of healthy places and communities.; wooded parks and urban green space; wilderness; Parks and green spaces; healing gardens</p>	<p>built environments can harm health in many ways.Unhealthy physical environments are places typified by toxins, pollutants, environmental demands, low environmental control, crime, poverty, urban sprawl, reliance on automobiles, and over or unwise consumption of natural resources.; healthy places or "health-promoting environments" (Frank and Engelke 2001) may enhance health. Healthy places provide the opportunity for nature contact.; Vacationing in beautiful natural places and taking an outdoor work break for a fresh air are intuitively restorative practices.; (Louv 2005) coined the term "nature deficit disorder" to describe the dangerous divide between children and nature and the subsequent health problems associated with that disconnect. Horticulture therapy is a healthcare intervention that involves planting or gardening.; even brief exposure to unknown animals such as fish in an aquarium or an unfamiliar dog appear to promote health, some of the health benefits of animal contact are likely due to the innate relaxing and restorative properties of nature contact.</p>	<p>nature contact was organized into categories of potential contact: outdoor nature contact, indoor nature contact, and indirect nature contact.</p>	<p>Safety, urban sprawl, reliance on automobiles (mentioned)</p>	<p>7</p>
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35	<p>Korpela K.M., Ylen M., Tyrvaïnen L., Silvennoinen H., "Determinants of restorative experiences in everyday favorite places", 2008</p>	<p>extensively managed nature areas, built-up green spaces, waterside environments, exercise and activity/hobby areas, and indoor and outdoor urban areas; parks, woods; green space; green nature, water environments, nature-dominated areas; beaches (lakeshores), forest; green area; 16 types of urban and green/natural places and areas (based on the classification of green areas developed for mapping the social values of green areas in Helsinki): (1) extensively managed nature areas (large forest areas, small-scale wooded areas, scenery fields and meadows, small-scale natural state areas such as river valleys, wetlands, bushes, and rocks), (2) built-up green spaces (large green lots, green areas within housing blocks, decorative plantations and glorious flowers, traffic green areas such as wind-breaks, green lanes, and tree avenues, parks including grass, and plantations), (3) water-side environments (beaches, and harbor areas), (4) exercise and activity/hobby areas (playgrounds, recreation trails, sports grounds, allotment gardens, dog parks), and (5) indoor and outdoor urban areas (street areas and indoor places within the city center; the city center in general, pedestrian streets, squares, cafe's, restaurants, and shops or malls);</p>	<p>The strongest determinant positively related to restorative experiences was the length of stay in the favorite place followed by nature orientedness and frequency of visiting the favorite place. The results indicate that the more worries a person has about money or work the more restoration s/he experiences while in the favorite place. The more satisfied s/he is with life the more restoration s/he experiences while in the favorite place. Nature hobbies, childhood nature experiences, and being alone in green areas all correlate positively with restorative experiences.</p>	<p>restorative experiences in favorite places ≤15km from home; "immediate" use of the favorite place (duration and frequency); distance to a favorite place; (1) stress- and health- related variables and measures. (perceived stress, reported health problems, Feelings of energy, Feelings of distress), (2) personality traits related to place experiences in urban and natural areas (noise sensitivity-Weinstein's (1978) noise sensitivity scale.); (3) personality traits relevant to stress and health. (4) social context of restorative experiences. (5) use of the favorite place and experiences of residential natural areas. ;</p>	<p>personal background of nature experiences (nature orientedness, nature hobbies, childhood nature experiences), and situational factors in life, which were related to stress (hassles at work and with money, satisfaction with life) and to social relations (uplifts of social relations, visiting alone vs. in company).; gender as a determinant of restorative experiences; number of working hours per week as an indication of the amount of workload.; liking of nature holidays; Sensitivity to noise; sense of security, and sense of community; Level of education; Illness or handicap restricting movement; existence of a pet which requires walking outdoors;</p>	8
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36	Dean J., van Dooren K., Weinstein P., "Does biodiversity improve mental health in urban settings?", 2011	decorative plantations, natural environments such as forests and vegetation	environmental issues such as climate change and biodiversity loss impact on human health. Recent studies have demonstrated the negative effect of environment degradation and environmental disasters on mental health outcomes. However, nature can also impact positively on mental health and wellbeing, and the contact with natural environments such as forests and vegetation can improve outcomes across a broad range of human health indicators; The impacts from diminished 'regulating services' is clearly seen in the link between post traumatic stress and natural disasters such as major flooding or bushfires, and the psychological consequences of environmental stressors such as drought and heat exposure. Physical health problems linked to loss of biodiversity and associated environmental degradation are also associated with mental health problems through causal and reciprocal relationships	disability adjusted life years (DALYs)	Biodiversity richness	5
37	Cummins S., Fagg J., "Does greener mean thinner Associations between neighbourhood greenspace and weight status among adults in England", 2012	Generalised Land use Database for England defines greenspace as parks, open spaces and agricultural land, excluding domestic gardens; neighborhood greenspace; natural environments; woodland, playing fields; 'formal' greenspaces (areas characterised by an organised layout and structured path network, which are generally well maintained);	there was a counterintuitive association between greenspace and BMI, with residence in the greenest areas associated with a 12% increase in risk for overweight, and a 23% increase in risk for obesity. In 2004--2007, a small protective effect of greenspace was observed for those living in the greenest areas, with a (non-statistically significant at the 95% level) reduction in the risk of overweight (5%), and obesity (8%).	body mass index (BMI) category according to WHO classification; access to greenspace; Physical activity was assessed as total self-reported physical activity undertaken as part of work, domestic labour, sport and leisure in the last 4 weeks. ; quantity of local greenspace (GLUD database) in%; IMD -English Index for Multiple Deprivation	age, sex, social class(as measured by head of household occupational social class:Professional Managerial, Skilled non-manual, Skilled manual, Semi-skilled manual Unskilled manual', Army or full-time education, Never worked), economic activity(employed,	5

					<p>unemployed, retired or other inactive), neighbourhood income deprivation and urban/rural status; gender</p>	
<p>38</p>	<p>Thompson Coon J., Boddy K., Stein K., Whear R., Barton J., Depledge M.H., "Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review", 2011</p>	<p>(outdoor) natural environments( includes many different types of green space such as wilderness areas, allotments, urban parks, open countryside, country parks, woodlands, and wildlife reserves), green space, nature; outdoor space; forest, county park, university campus</p>	<p>promising effects on self-reported mental wellbeing immediately following exercise in nature which are not seen following the same exercise indoors.; Insufficient physical activity creates additional vulnerabilities to cancers, heart disease, stroke, diabetes, and mental and physical disability; measures of revitalization, self-esteem, positive engagement, and subjective vitality were all greater following outdoor walking as were feelings of energy, pleasure, and delight, and there were decreases in feelings of frustration, worry, confusion, depression, tension, and tiredness. a greater degree of mental restoration following outdoor activity than indoor activity and a more positive attitude to exercising outdoors.</p>	<p>influence of location (indoors vs outdoors) to physical activity (walking, running)</p>	<p>age, gender;</p>	<p>5</p>

39	Bodin M., Hartig T., "Does the outdoor environment matter for psychological restoration gained through running?", 2003	urban park; nature reserve; pine-birch forest and open field; shore of the lake, large lawn; natural environment	exercise environment would moderate changes in emotion and attention that might occur while running outdoors. Although running did produce beneficial emotional changes as expected, the results do not indicate that greater emotional (or attentional) benefits came from running in the park versus the urban environment.	environmental preferences and perceptions of environmental restorativeness; Exercise-Induced Feeling Inventory (EFI; Gauvin & Rejeski, 1993) to measure positive emotions on 5p scale (e.g., calm, relaxed, revived, refreshed); Anxiety/depression and anger subscales from the Negative Mood Scale (NMS) to measure negative emotions on 5p scale (e.g., worried, anxious, angry, irritated); Digit Span Forward (DSF) and Digit Span Backward (DSB)- neurocognitive measures; Perceived Restorativeness Scale (PRS)	Need for restoration (Daily hassles refer to minor annoyances of everyday life, such as frustration resulting from rush-hour traffic. The participant indicates whether each of 94 possible hassles has occurred during the preceding week);	6
40	Pretty J., Peacock J., Hine R., Sellens M., South N., Griffin M., "Green exercise in the UK countryside: Effects on health and psychological well-being, and implications for policy and planning", 2007	natural environment and green space; parks and open spaces, street trees, vacant lots and backyard gardens, fields and forests; open countryside, fells, woodland, shoreline, community garden, community farm, managed lake;	'green exercise' will improve health and psychological well-being; all these 10 green exercise activities, regardless of their type or level of intensity and duration, yield mental health benefits, despite their varying duration and intensity.	General physical health information) and General psychological health; changes to psychological health brought on by participating in green exercise; duration of each activity; Rosenberg Self- Esteem Scale (pre and pro activity); Mood status; The level of physical fitness and lifestyle; effects of green exercise (measured by calorie consumption); self-reported body mass.	gender Self-esteem before activity	7

41	Annerstedt M., Ostergren P.-O., Bjork J., Grahn P., Skarback E., Wahrborg P., "Green qualities in the neighbourhood and mental health - Results from a longitudinal cohort study in Southern Sweden", 2012	nature settings (e.g. parks, community gardens, urban greenways, forests, playing fields, and river corridors); nearby green areas; green space; nature; pastures, water courses, lakes and ponds; wild nature, beaches, dunes, sand plains, bare rock.; national parks, sparsely vegetated areas, coastal zone preservation;	Moderate or even more regular physical activity significantly decreased the risk for poor mental health at follow-up. Moderate to severe financial stress had significant impact on the risk for poor mental health for both genders.	level of physical activity; reported mental health; presence/absence of green area;	gender, age, and education level, Employment status; weight and height, 'number of persons in the household, economy, marital status, ethnicity; Financial stress and living conditions (person factors)	6
42	Woo J., Tang N., Suen E., Leung J., Wong M., "Green space, psychological restoration, and telomere length", 2009	natural environment; green space; restorative environment	the presence of green spaces could have health benefits in terms of biological ageing; psychological benefit can arise from a restorative environment	telomere length	age, smoking, socioeconomic status, and physical activity level	6

43	<p>Mitchell R., "Is physical activity in natural environments better for mental health than physical activity in other environments?", 2012</p>	<p>natural environment, non-natural environment; green space(including for example, parks, forests and grass, but excluding domestic gardens); a woodland, forest or tree covered park; an open space or park; country paths (not on tarmac); a beach/sea shore/loch/river or canal (NB, loch is a Scottish term for lake); sports fields or outdoor courts; a swimming pool; a gym or sports centre; pavements or streets in your local area; your home or garden;</p>	<p>physical activity in natural environments is associated with a reduction in the risk of poor mental health to a greater extent than physical activity in other environments, but also that activity in different types of environment may promote different kinds of positive psychological response.; Regular users of Woods/forest for physical activity were at about half the risk of poor mental health of non-users. Each additional use of any natural environment per week was associated with about a 6% lower risk of poor mental health. Regular use of non-natural, and in particular sporting, environments was positively and significantly associated with greater wellbeing.</p>	<p>poor mental health (measured by the General Health Questionnaire (GHQ)) and level of wellbeing (measured by the Warwick Edinburgh Mental health and Wellbeing Score (WEMWBS)); green space value for respondents CASward(Census Area Statistics ward), of residence; frequency of use(reported for each environment);</p>	<p>age, sex, equalised household income, average hours of physical activity per week, urban/rural status and green space in a respondent's neighbourhood.</p>	7
44	<p>Costello M.L., Patel A.B., Powell C.D., McNeil D.A., Jacobson R.D., McLaren L., "Is there an association between spatial access to parks/green space and childhood overweight/obesity in Calgary, Canada?", 2009</p>	<p>parks, green space(refers to all public parks, schools (i.e., school fields) and recreation areas (e.g., public riverfront) within the city-&gt;1 km<sup>2</sup>), playgrounds;</p>	<p>children living in communities with a moderate number of parks/green space per 10,000 people had lower odds of being overweight/obese compared to those living in communities with a low number of parks/green space per 10,000 people.</p>	<p>Body Mass Index (based on height and weight); 1) the number of parks/green spaces per 10,000 residents, 2) the area of parks/green space as a proportion of the total area within a community, 3) average distance to a park/green space, and 4) the proportion of parks/green space service area as a proportion of the total area within a community.</p>	<p>family income (as a proxy for an individual child's family income) community-level education, and community-level proportion of visible minorities; Age and sex</p>	5

45	Abraham A., Sommerhalder K., Abel T., "Landscape and well-being: A scoping study on the health-promoting impact of outdoor environments", 2010	walkable environments; Landscape - (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'; Also, 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; Soundscape, Smellscape; natural landscape such as beaches, waters, forests, parks, and mountains;	Mental well-being: landscape as a restorative; natural landscape is more restorative than an urban one; 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 have a low restorative potential (Herzog et al. 1997); Landscapes promote physical well-being through promotion of physical activity in cities and promotion of physical activity outside cities; Attention restoration, Stress recovery, •Evocation of positive emotions.	Mental well-being, Physical well-being, Social well-being	7
46	Lebel L., Krittasudthacheewa C., Salamanca A., Sriyasa P., "Lifestyles and consumption in cities and the links with health and well-being: The case of obesity", 2012	(public) green spaces; parks; well connected, walkable and cyclable streets;	Physical activity reduces obesity. Parks and urban green spaces help people to be physically more active.	Obesity	age, sex;

47	<p>Ward Thompson C., Roe J., Aspinall P., Mitchell R., Clow A., Miller D., "More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns", 2012</p>	<p>green space; green and natural environment; forest; parks, woodlands, scrub; residential environment;</p>	<p>Higher mean levels of cortisol were associated with a steeper cortisol slope and with greater wellbeing. A steeper cortisol slope (the decline 3–12h post awakening) was positively associated with wellbeing, physical activity and percentage of green space, and negatively associated with levels of stress.; Green space exposure is associated with steeper cortisol slope- for every 1% increase of green space the cortisol level will increase 0,07; for every 1% increase in green space, self-reported stress decreased by 0.14 units.</p>	<p>A stress as measured by levels and/or patterns of salivary cortisol secretion over the day; and/or                  b. stress and more general wellbeing as measured by self-report scales.; self-reported indicator of stress, the Perceived Stress Scale, comprising 10 items (e.g. feeling nervous and stressed; feeling on top of things; being angered because of things outside your control) measured on a 5-item response from 'never' to 'very often'.; Mental wellbeing(Warwick and Edinburgh Mental Wellbeing Scale) and physical activity( the number of days on which physical activity (of sufficient exertion to raise breathing rate) reached or exceeded 30min, recalled over the past 4 weeks.; The percentage of a participant's residential environment that was green space.</p>	<p>current income on a scale of 1 (living comfortably on current income) to 4 (finding it very difficult to live on current income). Participants' age and sex; Socio-economic deprivation based on the Carstairs Index(based on prevalence of household overcrowding, unemployment among men, low social class, and not having a car.);</p>	6
48	<p>de Jong K., Albin M., Skarback E., Grahn P., Bjork J., "Perceived green qualities were associated with neighborhood satisfaction, physical activity, and general health: Results from a cross-sectional study in suburban and rural Scania, southern Sweden", 2012</p>	<p>green open space or forest area; green neighborhood environment</p>	<p>neighborhoods rich in historical remains (culture) and in animal and plant species (lush) were positively associated with physical activity. The association with general health was mediated by physical activity and neighborhood satisfaction.</p>	<p>area-aggregated perceived green neighborhood qualities (Scania Green Score; SGS); three self- reported indicators of well-being: neighborhood satisfaction, physical activity level and general health. ; walking distance; qualities (dimensions) that humans appreciate in park environments (culture, serene, lush, spacious and wild);</p>	<p>sex, age, highest level of education, economic difficulties, country of origin and type of residence</p>	6

49	<p>Maas J., Verheij R.A., Spreeuwenberg P., Groenewegen P.P., "Physical activity as a possible mechanism behind the relationship between green space and health: A multilevel analysis", 2008</p>	<p>nature, built-up environments; green space; parks and beaches; streetscape (includes trees, wide grassy verges, parks, private gardens, diverse and interesting natural sights); recreational space, sports grounds; green environment; forest, water, agricultural green space and nature conservation areas; woods and grassy areas, peat grassland; living environment;</p>	<p>study indicates that the amount of green space in the living environment is scarcely related to the level of physical activity; in the more rural areas the relationship between green space and physical activity is stronger than in the more urban areas. The relationship between green space and physical activity is strongest in slightly urban areas.; People who garden feel healthier.</p>	<p>self-reported health status, level of physical activity (type and duration); The percentage of green space within a 1-km radius as well as within a 3-km radius (Environmental data from the National Land Cover Classification database (LGN4), which contains the dominant type of land use of each 25 x 25 meter grid cell);</p>	<p>demographic and socio-economic background characteristics (age, gender, income and education); level of urbanicity</p>	6
50	<p>Amorim T.C., Azevedo M.R., Hallal P.C., "Physical activity levels according to physical and social environmental factors in a sample of adults living in South Brazil", 2010</p>	<p>green areas (parks or squares), neighborhood environment,</p>	<p>those who live close to green areas were more likely to be active; being encouraged to exercise by relatives, friends or neighbors is a protective factor against sedentary lifestyle</p>	<p>Leisure-time physical activity, Transport-related physical activity, data derived from NEWS (Neighborhood Environment Walkability Scale) (Existence of sidewalks, Existence of green areas, Garbage accumulation, Existence of crime etc); Social environment (a) Do your friends and neighbors invite or stimulate you to walk, cycle or practice sports? and b) Do your relatives invite or stimulate you to walk, cycle or practice sports?; Self-reported health status;</p>	<p>demographic (sex, age, skin color) and socioeconomic (economic level) variables</p>	5

51	Hansmann R., Hug S.-M., Seeland K., "Restoration and stress relief through physical activities in forests and parks", 2007	Green space(nature reserves, woodlands, and urban parks), forest, city park; natural spaces; unthreatening natural environment; green environments; green paths; Peri-urban forests;	exercise in green spaces promotes well-being and recovery from stress; Of forest visitors, 98.4% stated that visiting forests had a positive effect on their well-being.; In terms of the average improvements over pre-visit levels, the overall recovery rate for stress was 87% and the reduction in headache was 52% after visiting the park; vigorous exercise was associated with greater decreases in stress and increases in feeling balanced, whereas taking a walk, relaxing, or observing nature produced average restorative effects.	psychological distress (stress, headaches), subjective measure of well-being (feeling well-balanced); activities in the location and the duration of their visit; sources of stress;	age and sex, employment status	6
52	Stigsdotter U.K., Grahn P., "Stressed individuals' preferences for activities and environmental characteristics in green spaces", 2011	green space(is defined as all accessible open spaces with a high degree of vegetation in urban or peri-urban (in the immediate vicinity of a town or a city) areas.);	Nature environments and performing activities closely related to outdoor life, such as being close to animals, seems to be most preferred by people with high LS; individuals' Level of Stress is related to an interaction between preferences for certain PSDs(perceived sensory dimensions) of the outdoor environment and certain types of outdoor activities; individuals reporting high LS want to use green spaces more often.	habits regarding visiting green spaces, preferences for performing certain activities in green spaces, preferences for certain PSDs(Perceived Sensory Dimensions) of green spaces and prevalence of stress symptoms; The eight PSDs ('serene', 'space', 'nature', 'rich in species', 'refuge', 'culture', 'prospect', and 'social') were used here as a method for analysing the informants' preferences for certain environmental characteristics.	background (Having children, Access to green spaces, Use of public green space,s Sick-leave, Want to use public green spaces more often, Studies, Work nights, Work shift, Comfort and enjoyment at work),gender, age, educational level and profession.	7

53	<p>Grahn P., Stigsdotter U.A. "The relation between perceived sensory dimensions of urban green space and stress restoration", 2010</p>	<p>green space; green environments; nature and urban parks; urban open space; forest</p>	<p>A combination of the dimensions Refuge, Nature and Rich in Species, where the dimension Social is toned down, could be interpreted as being most preferred by people reporting the highest levels of stress, and thereby such a combination may offer the optimal place for recovery.. A person who is affected by stress finds it increasingly difficult to understand, sympathize with and tolerate other people (Währborg, 2002); Individuals who report stress are most sensitive to the environment;</p>	<p>habits of visiting urban green spaces; preferences for certain qualities in urban open green spaces; prevalence of symptoms of stress; Self-estimations of their health status; 'Level of Stress' (LS)</p>	<p>sex, age and socio-economic status(profession);</p>	7
54	<p>Martens D., Gutscher H., Bauer N., "Walking in ""wild"" and ""tended"" urban forests: The impact on psychological well-being", 2011</p>	<p>urban natural areas,(wild and tended) forest;</p>	<p>positive influence of natural environments overall on human well-being; The stronger increase of "positive affect", consisting of good mood and calmness items, in the tended forest supports results of Herzog et al. (2003), showing well-kept natural scenes to be especially restorative and tranquilizing.; tended forests have a more positive impact than wild forests in a daily context on affective well-being.</p>	<p>forest-maintenance - wild versus tended;(Self-rated)Psychological well-being is represented by eight subscales ("activation", "arousal", "good mood", "reflection", "calmness", "lethargy", "anger", "depression"), each measured by five items, Scale 0-8; perceived attractiveness;</p>	<p>Demographic data, such as age, gender and education level; frequency of visits in nature, current residency, ancestry, perceived physical effort and time to get to the experimental area; perceived threat, safety and fear with one item each, scales ranging from 0 (not at all) to 6 (very much); influence of temperature;</p>	6

55	Barton J., Pretty J., "What is the best dose of nature and green exercise for improving mental health- A multi-study analysis", 2010	natural ecosystems; greenspace; green place; forest and woodland, urban green, waterside (beach or river), wild habitats;	The results show acute short-term exposures to facilitated green exercise improves both self-esteem and mood irrespective of duration, intensity, location, gender, age, and health status.; Exposure duration: both self-esteem and mood showed greatest changes for the least duration (5min), both showed smaller positive improvements for <1 and half-day activities, and both increased for whole-day activities. This suggests that there is an immediate effect obtained from the start of green exercise. Exercise intensity: self-esteem improvements declined with growing intensity of activity, and mood improvements were greatest for light and vigorous activity. This suggests that there is a health benefit from any short engagement in green exercise. All green environments improved both self-esteem and mood; the presence of water generated greater improvements. The mentally ill had one of the greatest changes for self-esteem improvements. This suggests that the mentally ill should be encouraged to undertake green exercise	Descriptive Data on the Green Exercise Interventions (cycling, gardening, walking, fishing, boating, horse-riding), duration and intensity of nature-based activities; health status; The Rosenberg Self-Esteem Scale (RSE) (self-esteem was measured immediately pre- and post-activity or intervention using the one-page 10-item RSE scale), Profile of Mood States (POMS)	age, sex,	7
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## Appendix III: Work conference GEZONDRONDOM program



### Programma Werkconferentie GEZONDRONDOM

09.00 – 10.00 uur	<b>Ontvangst met koffie en thee</b>
10.00 – 10.30 uur	<b>Opening</b>
10.45 - 12.00 uur	<b>Workshops, ronde 1</b>

Tijdens deze workshopronde, maakt u een keuze voor één workshop.

#### Workshop 1: Samenwerken aan frisse scholen: een bron van inspiratie?

U hoort, aan de hand van inspirerende voorbeelden, hoe professionals samenwerken met als doel: frisse basisscholen. GGD Gelre IJssel licht het initiatief in de provincie Gelderland toe. Daarbij nemen verschillende partijen (provincie, scholen, gemeenten en GGD'en) deel in het [Netwerk Luchtkwaliteit Scholen Gelderland](#). U hoort tijdens deze workshop de eerste resultaten van de pilot 2013: Duurzame & Gezonde scholen in Gelderland.

Daarnaast vertelt VIBA-Expo over de samenwerking van de provincie Noord-Brabant, Longfonds, GGD, en HAS met gemeenten en scholen. Ze zochten naar manieren om vijf (pilot)scholen gezonder, duurzamer en leerzamer te maken. Dat leidde tot het [Brabants Frisse Scholen Concept](#). Vanaf 2012 is de uitbouw en de implementatie van het Concept overgedragen aan VIBA-Expo. In deze workshop hoort u over de resultaten van dit concept.

[Klik hier](#) voor meer informatie.

#### Workshop 2: Nieuwsgierig naar uw leefomgeving? Kom kijken op de Atlas!

Moet u een ruimtelijk plan maken of beoordelen? Wilt u weten hoe het zit met de kwaliteit van de leefomgeving in uw buurt of gemeente? Hoe krijgt u snel een beeld van mogelijke bronnen van milieu-overlast in uw gemeente? Waar liggen kansen voor een gezonde inrichting? In de Atlas Leefomgeving vindt u informatie en instrumenten die kunnen helpen bij het beantwoorden van deze en andere beleidsvragen. In deze sessie gaat u zelf aan de slag met de Atlas. U krijgt tips hoe u kaarten en informatie kunt vinden, bekijken, bewerken, combineren en delen met uw collega's of bewoners. De sessie wordt afgesloten met twee keuzemodules die een beeld geven hoe u atlas kunt gebruiken bij planvorming of bij het inventariseren van knelpunten. U kunt ter plekke kiezen tussen een bezoekje aan een ontwerptafel, meer horen over lichtkaarten of zien hoe de aanwezigheid van natte koeltorens eenvoudig in kaart gebracht kan worden.

En als u 's ochtends niet kunt, komt u gewoon 's middags want dan doen we de workshop nog een keer!

**Workshop 3: Vraag en aanbod voor een duurzaam en gezond binnenmilieu**

De gemeente Almere heeft hoge ambities, ook waar het gaat om energiezuinig en gezond bouwen. Door die energiebesparingsambities is een gezond binnenmilieu niet meer vanzelfsprekend. Zelfs het voldoen aan het Bouwbesluit is geen garantie voor een gezond binnenmilieu. Dit wordt bevestigd door het onderzoek van VACPunt naar bewonerservaringen bij energiebesparing, waarbij ook expliciet aandacht is besteed aan binnenmilieu en ventilatie. Tegelijk hebben aanbiedende partijen en consumentenorganisaties, rond het 'Lente Akkoord' en het 'Actieplan Kwaliteitsverbetering Ventilatievoorzieningen', initiatieven genomen om problemen de wereld uit te helpen.

Daarom in deze sessie een drieluik:

1. Ambitieuze beleid: de gemeente Almere die in het kader van Duurzame Stad en Almere 2.0, haar ambities rond energiebesparing en een gezond binnenmilieu toelicht;
2. Bewoners vinden er ook wat van: het onderzoek van VACPunt Wonen en andere bronnen met ervaringen van bewoners;
3. Aanbiedende partijen die de bewoners goed willen voorlichten (Informatiepunt Ventilatie), die de kwaliteit van technische oplossingen willen borgen, prestaties willen garanderen (KopStaart aanpak en VPK) en die willen leren van de situaties waarin het toch nog fout lijkt te gaan.

Na de presentaties vindt er een discussie plaats met vertegenwoordigers van betrokken sectoren en de deelnemers in de zaal over de vraag of we het onderwerp 'binnenmilieu in woningen' nu onder controle denken te hebben.

**Workshop 4: Asbestcommunicatie via Atlas Leefomgeving**

Transparant zijn over asbest. Nu eens niet communiceren naar aanleiding van een calamiteit, maar communiceren over asbestbronnen op een locatie en over de maatregelen die zijn genomen. Een aantal ontwikkelingen bieden nieuwe mogelijkheden. Het Landelijk Asbestvolgsysteem biedt gestructureerde informatie over asbestbronnen in gebouwen (bij wooncorporaties). Via onder andere de Atlas Leefomgeving kunnen verschillende deskundigen (GGD, rijksoverheid) informatie geven en een handelingsperspectief bieden.

Na een kijkje op Atlas laten we tijdens deze workshop voorbeelden zien van recente asbestcommunicatie door een wooncorporatie, GGD-en en de overheid. We bediscussiëren met u als belanghebbende de do's en don'ts voor internetcommunicatie over asbest. We gaan in op wat de burger wil weten en hoe we bewoners en gebruikers van een pand het beste kunnen informeren.

[Klik hier](#) voor meer informatie.

**Workshop 5: Gezond ontwerpen: zoektocht naar een stad die (ver)leidt tot gezond leven**

De urgentie om meer aandacht te besteden aan 'gezond ontwerpen' is groot. Mensen worden dikker, kinderen spelen minder buiten en vanwege de vergrijzing neemt dementie toe. Bewegen draagt bij aan de gezondheid van de mens. Deze maatschappelijke opgaven hangen samen met de ordening, de inrichting en het gebruik van onze leef- en woonomgeving. We gaan samen op zoek naar de stad die bijdraagt aan het welzijn en de gezondheid van haar bewoners. Een stad die gezond leven mogelijk maakt en gezond gedrag stimuleert. De relatie tussen de inrichting van de stad en gezondheid staat centraal.

In deze workshop delen planologen, stedenbouwkundigen, volksgezondheids-, milieu- en andere professionals hun kennis en ervaring. We kijken samen terug op bestaande ervaringen en kennis rondom de gezonde stad uit verschillende domeinen, en gaan samen op zoek naar de 'best-practices'. We richten ons daarbij op de thema's actieve mobiliteit, bewegen en groen in de stad, en maken een schouwlijst die 's middags tijdens de excursie gebruikt wordt.

12.00 - 13.00 uur

**Lunch**

13.00 – 13.30 uur

**Bazen, burgers en buitenlui**

Annemarie Jorritsma (VNG), Johan Remkes (IPO), Jan Hendrik Dronkers (Directeur Generaal Rijkswaterstaat) en Paul Huijts (Directeur Generaal Volksgezondheid) verkennen met elkaar de uitdagingen voor een gezonde leefomgeving en discussiëren daarover met mensen uit de praktijk. Dagvoorzitter Betty de Kelzer leidt de discussie.<sup>1</sup>

13.45 – 15.30 uur

**Excursies en workshops, ronde 2**

Tijdens deze ronde, maakt u een keuze uit één excursie of één workshop.

*LET OP! Wanneer u de keuze maakt voor het volgen van een excursie, houdt u er dan rekening mee dat u goede wandelschoenen aantrekt en indien nodig een paraplu meeneemt.*

**Excursie 1: Asbest in mijn school, wat nu?**

U brengt een bezoek aan een Haagse school waar onlangs een asbestinventarisatie/sanering heeft plaatsgevonden. Op de locatie zijn verschillende partijen (gemeente, GGD, schoolbestuur, etc.) aanwezig om hun verhaal te vertellen. Ook beantwoorden zij al uw brandende vragen. Deze excursie is een inspirerend voorbeeld voor andere scholen: hoe om te gaan met asbest in de school?

**Excursie 2: Verbeteren van het binnenmilieu: de praktijk**

Excursie naar het complex Bezuidenhout-West van Woningcorporatie Haag Wonen te Den Haag.

Het complex bestaat uit ruim 800 portiekwoningen, vier bouwlagen, geen lift en uit het bouwjaar 1981. Een bijzondere locatie, achter Den Haag CS en ingeklemd tussen de Utrechtse baan en de spoorlijnen naar Den Haag CS. Door zijn ligging een complex met potenties, ook voor de lange termijn. Maar ook een geluidbelaste locatie met in de woningen geisers en ventilatieproblemen, waarvoor Haag Wonen, binnen de beperkte financiële ruimte die eigen is aan deze tijd, oplossingen heeft gezocht.

**Excursie 3: Gezond Ontwerpen**

Om de mogelijkheden voor gezond ontwerpen in de praktijk te bekijken, gaan we in groepen een aantal Haagse wijken in. We schouwen deze wijken op de thema's mobiliteit, bewegen en groen, en gaan met elkaar het gesprek aan: zijn er veilige mogelijkheden om te wandelen en te fietsen? Hoe aantrekkelijk en toegankelijk is het groen in de buurt? Zijn er mogelijkheden voor waterberging? En hoe zouden deze wijken nog 'gezonder' en aantrekkelijker gemaakt kunnen worden voor de bewoners? Wat kunnen bewoners daarbij zelf doen?

We verzamelen verhalen en beelden, en maken foto's. Bij terugkomst delen we onze impressies, en maken afspraken hoe we in de toekomst elkaar weten te vinden om kennis & ervaringen te blijven delen.

15.45 – 16.15 uur

Een **spetterende countdown** naar de toekomst

16.15 – 17.15 uur

**Borrel**

## Appendix IV: Current research introduction for work conference



***Stedelijke Groene gebieden en  
volksgezondheid: Verkennen van  
de verbindingen***

**Master thesis project van Mari Murel**

**Utrecht Universiteit, Sustainable Development**

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**2013**

Groene gebieden in de stad zijn in groeiende mate belangrijk voor de inwoners en hun gezondheid. Het **contact met de natuur is vooral belangrijk in stedelijke gebieden waar groene en blauwe gebieden veelal het enige contact met de natuur is voor de inwoners. Levens tempo en ritme zijn toegenomen waar tijd voor ontspanning en reflectie vooral afneemt. Daarom is de toegang tot groene gebieden en herstellende waarde van het gebied op de voorgrond komen te staan teneinde mensen te helpen omgaan met dagelijkse stress, terwijl het aanbieden ervan ook ruimte voor lichaamsbeweging en sociale interactie oplevert. Groene gebieden zijn ook buffers tegen stedelijke verontreiniging (bv. geluidsoverlast, luchtverontreiniging) en de gevolgen van klimaatverandering, zoals stedelijke hittestress. Het is een belangrijk gebied om te onderzoeken tijdens het creëren van een duurzame stedelijke omgeving. Kwaliteit van de groene gebieden binnen een stad is een belangrijk element in het verhogen van de leefbaarheid, en helpt om de stedelijke klimaatbestendigheid in het algemeen te verhogen. Zo is het noodzakelijk om er achter te komen wat de kwaliteitscriteria zijn voor een hoogwaardige groenvoorziening en wat de mechanismen zijn, die bijdragen aan de kwaliteit van de groene gebieden, om aanbevelingen te kunnen doen en richtlijnen te kunnen bieden aan beleidsmakers, stedenbouwkundigen, landschapsarchitecten en andere aanverwante beroepsbeoefenaren. Daarom is een van de belangrijkste doelen van dit onderzoek om de verbanden tussen de positieve effecten op de menselijke gezondheid en de groene gebieden te vinden. De belangrijkste onderzoeksvraag is in deze:**

Hebben de groene gebieden in de steden positieve effecten op de volksgezondheid en het welzijn, en hoe kan deze kennis worden gebruikt in de stedelijke planning?

Met behulp van literatuuronderzoek en het raadplegen van ervaringsdeskundigen, zijn de antwoorden gevonden.

Samenvattend kunnen groen gebieden 5 belangrijke gezondheid effecten van groene gebieden worden gedefinieerd:

Stress mitigation, Increase of physical activity, Restaurative experiences, Attention fatigue amelioration, Mental health improvement

De 5 meest voorkomende mechanismen waarmee de groene gebieden de gezondheid bevorderen zijn:

Exposure and closer contact with nature, Positive perception of the area, Thermal comfort, Improving environmental health, Physical activity stimulation.

## ***Stedelijke Groene gebieden en volksgezondheid: Verkennen van de verbindingen***

Wilt u meehelpen met uw ervaring?

Dit zijn de vragen waarop ik antwoorden zoek:

Het belang van groene planning en groene ruimten:

- Heeft uw gemeente een zichtbare behoefte aan of zelfs een planning voor een stedelijke groen planning? Zo ja welke redenen heeft men hiervoor? Geef a.u.b. voorbeelden.
  - **Hoe belangrijk zal het stedelijke groen in de toekomst volgens U zijn.**
  - **Hoe zal de gemeente omgaan met toekomstige uitbreiding van de stad? Welke gebieden zullen worden benut?**
  - **Is er voldoende groen in uw gemeente? Zijn die ontwikkelde groene ruimtes belangrijk voor de kwaliteit van leven en de duurzaamheid? Worden ze op grote schaal gebruikt en voor wat?**
- Ervaringen en nieuwe kennis:
    - **Bij het werken met groen planning-welke gegevens zijn opgenomen met betrekking tot gezondheidseffecten van groene ruimte?**
    - **Is er een bepaalde gezondheid gerelateerde gebied randvoorwaarden beschouwd / geteld, bij de planning van nieuwe groene ruimte?**
    - **Hoe zijn deze strategieën en doelstellingen uitgedrukt in planvorming?**
    - **Welke planning tools / richtlijnen gebruikt u -bijvoorbeeld GES, eigen databases of andere tools? Geef a.u.b. voorbeelden.**

Alvast bedankt,

Mari Murel

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**2013**

## Appendix V: Recording's transcripts from work conference GEZONDRONDOM

### 1. Presentation Chris Kuijpers (DWA1138)

*Drs. C.B.F. (Chris) Kuijpers is sinds 2011 directeur-generaal Ruimte en Water bij het ministerie van Infrastructuur en Milieu. Daarvoor was hij onder andere directeur-generaal Ruimte en directeur Realisatie en Ontwikkeling bij het toenmalig ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu. Chris Kuijpers studeerde geografie/planologie aan de Universiteit Utrecht.*

Healthy living environment is important topic. From the discussions you can see that health and environment is smth we do not want to talk about hole day along, which is strange. It is driven by the fact that basic is Environmental policy (Milieu beleid).

He tells what is his connection with health and environment, beginning with the story where he comes from (Rotterdam-overschie) . Beautiful place, but there was often brown air as it was very polluted there. But it is a lot changed since then. If you look what under the Env. Policy have been done, it is impressive. Of course, there should always more and more happen. We do not have anymore acid soils, dead fishes, brow air etc. Now we have one of the cleanest drinking water in the world. And we should be very proud. And what it all means for public health, it has been huge stimulant.

(Presents graphs with improved indicators incl economical. ). Nice pictures, but does it mean that there is nothing wrong anymore..and we can leave the topic –no, of course not. There is still lot going on – it is a worldwide problems with climate, energy and CO2 . Climate change. Between those problems are also issues we deal with – peoples health, peoples safety etc what needs attention. We are going toward good direction with air quality, but according to WHO the norms are still not fulfilled on the levels where we should end up. We still dealing to get there and new problems are coming, like nanotechnology – what effects do that have? Micro plastics, is also smth we lot of trouble have. Pharmaceuticals in drink water – also causing problems, but what are not visible for eyes, but which are still there . So there is still lot of challenges in our work field , what have connection with health and environment policy, what we are busy implementing and therefore we cannot relax concerning those topics.

From the presentation slide: During last decades we have known how to improve our environment. And therefore is it also healthier. To care for people's health is now and in the future the motor of the environmental policy. **Clean air, clean water, clean soil and noise restraint: that were and are the major environmental issues.**

Information over environment: Atlas leefomgeving platform. GezondOntwerpWijzer

Health will continue to be an important perspective of environmental policy. We shall, therefore, for the coming years as closely as possible to search for connections with the National Prevention Program of the VWS (Ministry of Health).

This work conference is one of the important national event, where health and living environment gets more attention . It is important that there is bond, connection made between knowledge and policymakers within different governmental organisations like GGDs (Health services) , to go further with that topic. There is also lot of interesting topics worked out. Like ruimtelijke ontwerpen (special planning's, development) with health aspects. We have ATLAS Leefomgeving developed, so that people would get much more information, also in digital. Apps – few months ago I was by the introduction of RIVM's air-quality app, with what u can measure on spot air-quality. This all spreads to social media as people want to be informed in a better way, over the actual situation to be able to take precautions if necessary.

## **2. Riens Dijkstra (Rijksadviseur voor Infrastructuur en Stad) DW-A1139 +DW-A1141**

*is principal architect of the Rotterdam-based Maxwan Architects and Urbanists. Dijkstra has worked with de ArchitectenCie and OMA. In 1993 an invitation to design a master plan for Leidsche Rijn, a new town of 30,000 houses, kick started Dijkstra's own practice, Maxwan.*

*Dijkstra has been appointed as a member of Ken Livingstone's Design for London Advisory Group, as a member of the Barking Riverside Design Advisory Panel, and as Supervising Master Planner for the Rotterdam Central Station surroundings master plan.*

I have been half year State advisor of city and infrastructure. There is lot of talk about integrated planning. People use that word often, everybody wants that to happen, but few people understand what it means. And that is smth we have to practice as we do not apply integrated planning we cannot do healthy planning.

We are all agreed that healthy city development new important topic of our area is and that means that there is also search for responsibility. Who is responsible- I am or somebody else? I think that this is not the way to deal with it and that you carefully have to ask from state officials, local officials, society, which part of healthy planning is state responsibility. And state officials have questions which part are they responsible and which part not. And I encourage them not to give up this responsibility to developers and markets, that they would make use of the tools and support platforms, what are developed from their budgets. And use to develop their laws and guidelines.

There is lot of mention of integrated planning. Lot of people use that word, but only few understand what it means. In integrated planning you have to learn that all related areas are bond in the planning process. There is lot of discussions.

**3.Josine van den Bogaard** (senior advisor healthy urban planning at GGD Rotterdam-Rijnmond), senior beleidsmedewerker GGD Rotterdam Rijnmond and for Brabantse GGD and she deals with relations between living environment and health.

Everybody feels that green is important for your living environment, for your health and that nobody feels that they need any scientific evidence. It is important that we do not have to wait for scientific reports or researches and till health insurance companies and city leaders get those results.

Most people want lot of green and there is lot of possibilities how you can make people happy by bringing more green in the city. Everybody feels that green is important for your health and for your living environment. It is important to realize it in the densely build cities and neighbourhoods Rotterdam for example. The people want to add more street green and places to sit, other wants routes to walk their dogs and other places where to play ball with kids. So you have to look how you can use the green and bring people to use it. You have to be creative with planning- think of vertical greening, garden green, rooftop green

**4.Henk aalderink.** We have lot of kids in the classes, who are hyperactive and who are hard to handle by teachers, so the parents are taking them to their GP (huisarts) and they describe Vitalin and say – now have we ADHD problem solved. My opinion is that it is not correct, that we have to offer children areas to play, to sport, to relax and then u can see that they themselves calm down.

We have lost lot of green around Randsdad and other areas. Children do not know anymore what outside playing is, parents bring them to beach with cars, even if the beach is 2 bus stops distance. This is related how we have equipped our city area, close to each other, intensive land use, few palces to play and if you consider that kids have computers and iPods, then they barely spend time outside. I find it is urgent need to direct people, not to back in time, but to bring them to value of nature. But it starts with those who offer it and they are planners. If you do not take into planning the integrated green aspect, then you also fail to involve health. Green cares for relaxation, for space to discover nature and for fun way to play and not only between 4 walls. Beside that it leads us to place where we can once and a while to calm down and have peace. This solves also children's ADHD problems and not medicaments.

**5. Hanke Kruize,RIVM (DWA1140),** thema gezond onderwerpen leefomgeving bij NAMG and developing gezond ontwerpwijsjer within lot of practical knowledge is gathered.

Presentatie.

NAMG to get attention to the topic (healthy living env.) It is different topics what get attention, like safety and also economical value of the area. And next to it is public health, what you can improve. If you think of the heat stress, then there is lot of ways how you can improve public health via living environment. Aims:

That state knowledge would be available for practitioners who want that information and who can improve with that knowledge public health and health problems like overweight, heat stress. The group of people who would like that information is quite wide group – you can think of people from GGD, municipalities, housing associations, city planners (ruimetlijke planners) . All those people are part to create healthy neighbourhoods.

Question from **Annelies Acda, (trekker exp Gezonde wijk, GGD Amsterdam)** It looks like it is very much municipality and state related, is that true? What professionals have you in mind, who will co-work with those professionals?

**HK:** This is true that during last years, there is lot of different departments combined VWS, BZK, RIVM of course... AZ is with green and health ... you also see that some GGDs are very active . But what you see is that other practices who are less involved and who should do more, but there are some good examples.

Products: Digitally accessible products like Gezond Ontwerp Wijzer , where lot of information is incorporated. This is meant for people, to find information and inspiration how to do it. There is also examples and pilot projects, where you can learn how it works in the practice and how can you do even better. I.e. how green space for low income neighbourhood is developed with cooperation among different parties. This is not always easy and you can learn from it what you can next time in a better way do.

**6. Pieter van Wesemael** (TU/e professor of urbanism and urban architecture) worked with RIVM with project Gezonde wijken , Docent. And lot of practical experience in private business. I always think how you can bring people from area green and health together who are involved with developing and research etc. There are lot of pilots and researches and practical examples and the question is how to bring all that together. Second, how to you determine and learn those very specifics, when working with projects, which factors etc will influence healthy living environment. How do you have to change the area to make it more healthier and to improve and stimulate the lifestyles..

**AA** Question: do you learn from already developed projects or those which are still going on.

Answer **PvW:** Of course we learn from already made projects, also from international, where lot of attention is set on healthy developments. But I think it is very very important that we also approach the new projects . If you look local or international projects, you can see that they are often very limited and there is only few projects where proper research have been made – what is the problem, what are possible solutions etc.

Such knowledge platform would help to combine the information and knowledge to help planners and developers.

Question (..): How are that platform meant for developers? Those are made/used either by municipalities or professionals or citizens ... this divides people from eachother

Ans: In my experience (12 year) there is very few medical field people involved with development.

**AA:** Is it not lot of related with the spirit or enthusiasm of new students..?

Ans **PvW:** Yes, there is lot to do with new students spirit. There is lot to do that people who come from development field, have different historical background – they are more knowledgeable with modern city building and its connection with overweight problems, hygiene, social problems, but I have feeling that since 70ties that knowledge has decreased. Now the city development is more object bases. Environmental issues are dealt by environment officials, traffic issues by traffic officials... this not proper developing anymore.. They are also very sensitive about trends, like how city landscape is connected with health, what is very hype now . But if you look more further what is

developers concept for what is healthy, then there are lot of issues about obesities, dementia, stress and burnout.. You can read from newspaper that more younger people have those problems.

It is very important, that we developers would realize that health is wider concept than we think and what should be taken into consideration. That it is clear from scientific research and practical experience, that living environment is very important and influential factor. That city is meant for people and not for cars and lifts and escalators. That you have to create neighbourhood centres, where community is central and not only that it is healthy, but that it also beautiful is and fun and exciting and that you learn to know all the people etc etc . But the specifics of the neighbourhood development is very complicated, especially in a modern lifestyle, where auto is a standard and lift and escalator is a standard.. Try to find a building, where still stairs are used. We know what should happen with the community, but how to you achieve that now?

#### **7. Ad de Bont (TU/e) docent, adviseur, De Bont voor de ruimte.**

It is very important that people with different backgrounds come together and have a discussion and share knowledge and experiences.. Developers have to meet with medical people, environment people, social people etc

Urgent problems are well known – Obesities, overweight. It is growing trend. T is related with physical activity .There is problem among children, but even more with adults. Less we walk and cycle, more we weight...

This is not only problem, there is more like depression, heart and vascular disease, dementia ..

People are less physically active. If you do not want to put on physical effort, you do not have to- you can do everything with auto, even work in it... you can use escalators etc. it is recommended to sport at least 5 times 30 minutes per week. Also the youth, who are using scooters, escalators and come together online and sit behind computer to play instead sportclub or park. It is also important for elders to prevent dementia to be more outside and physically active. The developers have to think how to make streets more usable and safe, so that people would come outside to walk beside children playgrounds and bicycle routes.

Social economical issues are also important if you look how big is the connection with low income and overweight- lower the income, bigger the overweight %, but there is also problems in other income groups. Also education plays role. There is also relation with lifestyle. Social-cultural factors- We think about auto and allathone, but it is of course more- do people cycle gladly or do they use car - how to you go to city. Is the schools, municipality and doctors close by if not, then often you have to take a car. The important question is do the city make people or do people make city? Do people have possibilities/ do they like to cycle or walk together etc. You can discuss over those topics a lot and make good research, but it is clear that there is relation and people make city and city makes people. There is example, where in one city the usage of bike have been raised up to 40%, when it is usually 25% and the question is it smth to do with the city or if it is because people have changed their lifestyle and prefer bikes or is there some other reasons related to city planning, traffic...

There are lot of cities like Amsterdam, Rotterdam, Almere etc busy with physical activity, there is infrastructure people busy with it, there is safety people (police) busy with it .there is- woning wet combined with gezondheid wet. Already long time ago hygiene was a topic, also if there is place to cycle to play, for green, social contacts, sustainability. Nowadays are newer task: An attractive living environment that (far) leads to healthy living and more exercise. We are busy finding out what we already know and what we still do not know. And for that there is such a knowledge platform. For that there is involved health experts, environment and sustainability experts, traffic engineers and should be also planners and city developers. It is also that health and space good co-operates. We have green, but we need more knowledge how this works in medical and health promoting way. So researches have a task to study how the connections work i.e. with green and overweight etc. There is already studies, but not very many. Example of Bike, green and city. That in smaller cities the % is smaller than in bigger cities .

**Diane Houweling ,(RIVM)** – I think that is related with paring problems.

**AdB** – that is also correct it is related with several things (closeness to city, accessibility to bike paths and routes, Closeness of services, diversity, lifestyle?, parking load)

More green leads to more playing, more health and more experiences

(?) – It think it is lot to do how close people work. In big cities are work places more compact.

**AdB** - This plays sure a role – the diversity.

We have tried to bring together 10 important city characteristics: Clean city, safe city, climate adaptive city. Mobile city, green city, energy- and waste-rich city, food-rich city, physically active city, economical city, social participation city.

In central are physical activity, active mobility and green in the city. That we more exercise, use more mobile transport methods ( bike) and green to adapt with the climate change.

Example Grouwplein Rotterdam, Transvaal Wijkpark Den Haag, Kopenhagen Hauserplads:

Not too small, more functions, open parks without fences, mix between park and plain, park area not in the edge of the area, but in the busiest place of the neighbourhood, well accessible functions, supervision and guidance, designed carefully with sustainable and beautiful materials, developed with or by habitants.

Green is good (from presentation slide):

- Sport, playing, experiences
- Saves money
- If,

○ *Functional*

- Accessible
- Right place
- Safe
- Smart place and development, not on expense of bicycle and walking

**8. Diana van Loenen**, adviseur

For physical activity promotion it is important, that if you are going to city, that you instead car, take a bicycle to be faster there. That there is public sport parks in the neighbourhood, school plains what are still open after the school. So that there would be much more possibilities to play in the neighbourhood. How to make it happen? There is lot of attention and activity, but still often people are not physically active and do not come together.. so to make it happen is the attention point. For example in Nieuwe West- Amsterdam is neighbourhood were are lot of green spaces , sports places etc, but in the other hand also highest population density is and where most people do not exercise. So there is misconnection between offer and demand. So we are very interested how we can people, vulnerable groups to direct and guide to be physically active in that beautiful living environment.

Workshop: 9 routes in 3 areas

My group: DW-A1144 Answers to more specific questions and about case study

**9. Goriska van Cooten** ,Strategische Adviseur Bestuur RWS at Rijkswaterstaat

Bringing together the management and knowledge

**10. Wim Ovaa, Gemeente Utrecht.** We advise also GGD with spatial planning projects and health, health protection and how to develop healthier areas.

**Aad de Bont:** half week as docent by TU and half time researcher with the same topic as advisor, i. e. municipality Hoorn to create more child friendly environment.

**11. Hanneke Zoest, RIVM Centrum Gezond Leven,** beleidsmedewerker.

If the area around workplace would not be attractive and are neglected, I would prefer to go there with car and would not like to come out during lunch pauses.

**AdB:** People who live or work close by highways, walk less than people who work in the inner city and there is quite big difference in minutes.

**HZ:** Therefore you have to make the area more attractive, so the people would come out during lunch pauses etc and u can start with small things.

**GvC:** I cycle to work every morning and one part of the route is horrible- it do not feel safe, no proper lightning, no stoplights in some places to regulate traffic, so the cars and bikes can easily collide. Nothing nice to see, ugly old houses, no parks, air filled with combustion gases.

**AdB:** In Utrecht we have done research of the attractiveness of routes and if people walk or cycle alongs nice area, they have feeling that they have spent less time to get from A-to B. So the attractiveness of routes is important.

**HZ:** You rather choose longer route where less traffic is and where more green is. You also do not want to live close to busy streets and you should not plan routes next to it. Safety is important, that you at evenings can safely walk and see easily around etc.

**AdB:** So important are safety, traffic safety and also diversity of the living area, that areas where people live, feel also more safe, oversight..

**HZ:** What services are around – shops, restaurants, that u i.e. during lunch are going to walk to shop or.. Access to water, routes along are very attractive. If u can combine closed areas along water so, that there no fences are and that you have nice view.

**AdB:** Green roofs are way to add green space and also cemetery's to use as quiet areas.

## Appendix VI: Urban environments terming's and characteristics described in selected literature.

Lit. Nr. refers to literature in the narrative synthesis table, presented in Annex II. The characterisation was not always available, so only specifically described characterisations are included as well the indication to literature, wherein it is done. Last boxes in the table is coloured in blue as they are non-natural urban environments described.

Terms used	number of studies where it occurs	characterisation	Lit. Nr.
<b>(sustainable)(natural)(Urban) Green space (greenspace), (UGS)</b>	38	space in a 1-km and 3-km radius around the respondents home	1
		22 CORINE land cover categories pertaining to natural, land-based (i.e., excluding water bodies) environment	10
		Defined as "open, undeveloped land with natural vegetation" and include parks, forests, playing fields, and river corridors.	13
		Green space defining in CLUD database: category includes parks, other open spaces, and agricultural land, but excludes domestic gardens.	13
		built-up green spaces (large green lots, green areas within housing blocks, decorative plantations and glorious flowers, traffic green areas such as wind-breaks, green lanes and tree avenues, parks including grass and plantations)	14
		urban green, agricultural green, forests and nature areas	20
		definition of green space included natural areas (e.g., parks, beaches, and fields) but excluded aquatic areas (e.g., lakes and the sea)	22
		Natural urban green spaces has been described as any open space, vegetated land or water located and managed within the urban environment and could include plant communities and assets that include public and private green space, grassed sporting facilities, residential lawns, golf courses, airfields, churches, colleges and university grounds (Aldous, 2009)	24
		Generalised Land use Database for England defines greenspace as parks, open spaces and agricultural land, excluding domestic gardens	37
		including for example, parks, forests and grass, but excluding domestic gardens	43
		refers to all public parks, schools (i.e., school fields) and recreation areas (e.g., public riverfront) within the city->1 km <sup>2</sup>	44
Is defined as all accessible open spaces with a high degree of vegetation in urban or peri-urban (in the immediate vicinity of a town or a city) areas.	52		
<b>Green area</b>	12	defined as parks, forests, nature and recreation areas	5

		Urban green areas were considered as all soils made mainly by permeable surfaces and covered for any kind of vegetation as lawns, shrubs and trees, from public or private property and to meet environmental, recreational or productive functions). Different types of green areas were classified into two main groups (public and private), subdivided into five systems (public services, roads, natural, productive and private) and 12 subsystems related to land use (recreational, sports, education, streets, heritage natural areas, farming, industrial, commercial, tourist, residential, mixed land uses and derelict land)	18
		parks or squares	50
<b>Green site</b>	1		
<b>(Urban/city) park</b>	33	Natural environments, larger contiguous green spaces	10,11
<b>Urban parkland</b>	1		
<b>Urban canopy</b>	2		
<b>Coastal area</b>	1		
<b>coastal zone preservation</b>	1		
<b>Pocket park</b>	1	small green spaces including: hardscape, grass, lower ground vegetation, flowering plants, bushes, trees, water	3
<b>Conservation parks</b>	1		
<b>Nature conservation areas</b>	1		
<b>Community Forest</b>	1	Includes woodlands and parks	4
<b>(Urban) Forest</b>	23	pine-birch forest	39
		wild and tended	54
<b>(Urban)Woodland</b>	9	Extensively managed natural settings	14
<b>Woods</b>	4		
<b>Wooded parks</b>	1		
<b>Wooded area</b>	1		
<b>Forest area</b>	1		
<b>(Public) open space</b>	10	Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	16
<b>Public green areas</b>	1		
<b>Public green space</b>	2		
<b>Private green space</b>	1		
<b>Open green space</b>	2		
<b>Built-up green spaces</b>	1	large green lots, green areas within housing blocks, decorative plantations and glorious flowers, traffic green areas such as wind-breaks, green lanes, and tree avenues, parks including grass, and plantations	35
<b>Built-up environments</b>	1		
<b>Public place</b>	1		
<b>Green place</b>	2		
<b>Urban green</b>	3		

	2	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'; Also , 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	45
<b>(Urban) landscape</b>			
<b>Natural landscape</b>	1	such as beaches, waters, forests, parks, and mountains	45
<b>Green belt</b>	1		
<b>Green lanes</b>	2		
<b>Green paths</b>	1		
<b>Tree avenues</b>	2		
<b>Fishing grounds</b>	1		
<b>Streetscape (greenery)</b>	3	includes trees, wide grassy verges, parks, private gardens, diverse and interesting natural sights	49
<b>Nature (area)</b>	7	large forest areas, small-scale wooded areas, scenery fields and meadows, small-scale natural state areas such as river valleys, wetlands, bushes and rocks)	14
<b>Recreation area</b>	2	e.g., public riverfront	44
<b>Recreational space</b>	1		
<b>Recreation trails</b>	2		
<b>Natural space</b>	1		
<b>Natural environment</b>	14	such as forest and vegetation	36
		includes many different types of green space such as wilderness areas, allotments, urban parks, open countryside, country parks, woodlands, and wildlife reserves	38
<b>Living environment</b>	4	The environment of a neighbourhood was defined as a circle with a radius of 3 km around the centre of the neighbourhood	20
<b>Restorative environment</b>	1		
<b>Neighbourhood green (space)</b>	3	"neighbourhood" as the half-mile buffer area surrounding each home, including parks, boulevard trees, grassy verges, private gardens	8
<b>Neighbourhood environment</b>	3	forest; park, green space; beach, sea, lake; and other green space	17
<b>Urban neighbourhood</b>	1		
<b>Neighbourhood area</b>	1		
<b>Green neighbourhood environment</b>	1		
<b>Green environment</b>	8	Natural environment	15
<b>Green outdoor environment</b>	2		
<b>Outdoor environment</b>	1	Characteristics of outdoor environments were: 'wild, free growing nature (Nature)', 'the experience of culture/a lost time (Culture)', 'a large, open room with vast vistas (Prospect)', 'organised for amusement, outdoor seating or similar (Social)', 'an experience of entering a different world where the parts of the environment are perceived as a whole (Space)', 'view of a large area, e.g. the sea, a lake or the roofs of the city (Space view)', 'vast variety of both animals and plants (Rich in species)', 'an experience of safety and	31

		shelter in an enclosed room (Refuge)', 'a silent and calm room where one can retire and be undisturbed (Serene)'	
<b>Outdoor space</b>	1		
<b>Boulevard (street) trees</b>	3		
<b>Urban trees</b>	2		
<b>Grassy verges</b>	2		
<b>Grassy areas</b>	1		
<b>Private gardens</b>	5	private garden <600 m <sup>2</sup> , and 'private garden ≥600 m <sup>2</sup>	31
<b>Rooftop gardens</b>	2		
<b>Roof terrace with view to forest and sea</b>	1		
<b>Allotment gardens</b>	4		
<b>Community gardens</b>	3		
<b>Healing gardens</b>	1		
<b>Common courtyard</b>	1		
<b>Gardens</b>	4		
<b>Green yard</b>	1		
<b>Backyard gardens</b>	1		
<b>Botanic gardens</b>	1		
<b>Vertical greening on buildings</b>	1		
<b>balcony or terrace</b>	1		
<b>Urban blue</b>	1	covers all visible surface waters in urban areas	29
<b>Beach</b>	11	Described as location suitable for bathing in lake/ocean	12
<b>Blue space</b>	2	fresh and salt water surface	20
<b>Waterside environment</b>	2	beaches, and harbour areas	14
		beaches and harbour areas	35
		beach or river	55
<b>Water environment</b>	1		
<b>Water (bodies)</b>	4		
<b>Waterscape</b>	1		
<b>Water courses</b>	1		
<b>hydroponics</b>	1		
<b>Aquatic areas</b>	1	e.g., lakes and the sea	22
<b>Sea, lake</b>	4	shore of the lake	39
<b>Managed lake</b>	1		
<b>Natural ponds</b>	2		
<b>Shoreline</b>	1		
<b>Sea shore</b>	1		
<b>River or canal</b>	2		
<b>Public riverfront</b>	1		
<b>Green sports facilities</b>	1		
<b>outdoor courts</b>	1		

Swimming pool	1		
grassed sporting facilities	1		
exercise and activity/hobby areas	2	playgrounds, recreation trails, sports grounds, allotment gardens, dog parks	14
		playgrounds, recreation trails, sports grounds, allotment gardens, dog parks	35
Sports grounds/fields	4		
Green residential areas	1		
Shared green areas at the dwelling	1		
Urban square with trees	1		
Historical monument with green space	1		
Playing field/playgrounds	6		
River corridor	1		
River valley	2		
Agricultural land	3		
Pasture/ hay	3		
Agricultural green (space)	2		
Natural place	2		
Natural area	2	e.g., parks, beaches, and fields	22
(Scenery) field	4		
Open field	1		
Meadow	2		
Wetland	2		
Dunes	1		
Green lots	2		
Vacant lots	1		
Harbour area	1		
Dog parks	2		
continuous urban fabric	1		
vegetative surfaces	1		
Vegetated land	1		
Vegetated area	2		
Roof vegetation	1		
Green roofs	3		
Barren land	1		
Scrub/ Shrub	2		
Grass(land)	5		
Ground (grass) vegetation	1		

<b>Urban Heat Island</b>	1		
<b>Usable green space</b>	1	e.g., 'Scenic Reserve', defined as 'urban parkland/open space', 'beaches', and any non-commercial forestry ('indigenous forest', 'deciduous hard- woods', or 'other exotic forest') that was either adjacent to other usable green space or was within 10 m of a road (i.e., accessible)	22
<b>non-usable green space</b>	1	e.g., 'Sanctuary Area', Non-usable green space was defined as all other natural areas, including agricultural land, salt marsh, and commercial forestry.	22
<b>non-commercial forestry</b>	1	('indigenous forest', 'deciduous hardwoods', or 'other exotic forest')	22
<b>commercial forestry</b>	1		
<b>salt marsh</b>	1		
<b>Wilderness( habitat)</b>	5		
<b>Wild nature</b>	2		
<b>Wild habitat</b>	1		
<b>residential lawns</b>	1		
<b>large lawn</b>	1		
<b>Golf course</b>	1		
<b>wildlife or biodiversity corridors</b>	1		
<b>Urban green space corridors</b>	1		
<b>Green Infrastructure</b>	1		
<b>areas of unspoilt nature</b>	1		
<b>Therapeutic landscapes</b>	1		
<b>nature reserve/wildlife preserve</b>	3		
<b>workplace outdoor environment</b>	1		
<b>'high quality' environments</b>	1		
<b>Forest-like</b>	1		
<b>Park-like</b>	1		
<b>Green courtyards</b>	1		
<b>National park</b>	2		
<b>healthy places or "health-promoting environments"</b>	1	Healthy built environments are characterized with health-promoting factors that promote behavioural, social, psychological, and biological health. Availability of healthy choices, safety, mixed designed land-use, environmental sustainability and stewardship, and the opportunity for nature contact are characteristics of healthy places and communities	34
<b>extensively managed nature areas</b>	1	Large forest areas, small-scale wooded areas, scenery fields and meadows, small-scale natural state areas such as river valleys, wetlands, bushes, and rocks	35
<b>Outdoor urban area</b>	1	street areas and indoor places within the city center; the city center in general, pedestrian streets, squares, cafe's, restaurants, and shops or malls	35

Nature-dominated areas	1		
Decorative plantations	2		
Traffic green areas	1	such as wind-brakes	35
'formal' greenspaces	1	areas characterised by an organised layout and structured path network, which are generally well maintained	37
Community farm	1		
Nature settings	1	e.g. parks, community gardens, urban greenways, forests, playing fields, and river corridors	41
Sand plains	1		
Bare rock	1		
tree covered park	1		
Walkable environments	1		
Designed environment	1		
Soundscape	1		
Smellscape	1		
Mountains	1		
Residential environment	1		
Peat grassland	1		
Natural ecosystems	1		
Inner city areas	1		
urban/city street	3	well connected, walkable and cyclable	46
Pedestrian street	1		
Pavements	1		
non-natural environment	1		
Suburban areas	1		
confines of the family home	1		
industrial/commercial area	1		
Unhealthy physical environments	1	are places typified by toxins, pollutants, environmental demands, low environmental control, crime, poverty, urban sprawl, reliance on automobiles, and over or unwise consumption of natural resources.	34
thermally polluted area	1		
area with small number residential houses	1		
urban residential area	1		
University campus	2		
Urban settlements	1		
Locations with ocean-view	1		

## Appendix VII: Table of health related indicators

Lit. Nr. refers to literature in the narrative synthesis table, presented in Annex II. The letter c at the end of the row indicates that in some studies this indicator is also used as cofounder. The specifics were not always available, so only specifically described specifics and sub criteria are included as well the indication to literature, wherein it is done.

Nr	Indicators/indexes Health related	Specifics	Sub criteria	Occurs in the study nr	C
1	Physical health	Self-reported physical health. The number of health complaints in the last 14 days		1, 27	
		Self-reported physical health scores(12-item short-form health survey)		32	
		General physical health information		40	
2	General Health	Self-reported general health. A single item measure of perceived general health ranging from 'excellent' to 'poor'		1	
		Self-reported general health.Number of symptoms experienced in the last 14 days	acute complaints, chronic illness, mental health, disabilities	20, 27	
		self-estimated health status (primarily concerned stress complaints), occurrence per year	:Stress,Irritation, Fatigue, Cold(occurrence of common cold (viral infection)), Headache, Backache, Ache in the back of the head;	28	
		(Self-reported health )condition, health problems		30, 35, 14, 31, 48, 49, 50, 53, 55	c
		5 point scale, running from 'bad' to 'excellent'		5, 20	
3	Psychological health	consists of five items to be score on a 6-point scale, with scores being transformed into a scale from 0 to 100. A score of 100 indicates perfect mental health		5	
		Perceived/Reported mental health status		27, 41	
		Perceived mental health measured by the GHQ-12 (Dutch 12-item version of the General Health Questionnaire)		1	
		Mental health sores(12-item short-form health survey)		32	
		General psychological health		40	
		Poor mental health measured by the General Health Questionnaire (GHQ)		43	
4	Well-being	Preceived well-being	before and after the visit of green space	11	
		level of wellbeing measured by the Warwick Edinburgh Mental health and Wellbeing Score (WEMWBS)		43, 47	
		Mental well-being		45, 48	
		Physical well-being			
		social well-being			

		subjective measure of well-being -feeling well-balanced		51	
		Self-rated)Psychological well-being	eight subscales (“activation”, “arousal”, “good mood”, “reflection”, “calmness”, “lethargy”, “anger”, “depression”), each measured by five items, Scale 0-8	54	
5	Stressful life events	Assessed using the List of Threatening Experiences(LTE-Q), a self-report questionnaire that examines the incidence of 25 stressful life events during someone’s life course	The 25 items fall in 12 categories, including serious illnesses or injuries to the subject or a close relative, death of a family member or close friend, separation or break-off of a steady relationship, interpersonal problems, unemployment or getting fired, financial crises, legal problems, and losses.	1	
6	Experienced stress	‘Have you in the last 12 months felt: irritated, hunted, stressed, full of energy in the morning—or—concentrated and in a good mood on your job?’ The respondents would answer with the frequency of the feeling/experience mentioned on an ordinal scale with seven grades: almost every day, maximum once a week, maximum once every fourth night, maximum once per month, maximum once every quarter, single occurrences and finally—never.		12	
		stress as measured by levels and/or patterns of salivary cortisol secretion over the day		47, 53	
		prevalence of symptoms of stress		53	
7	Perceived stress	Perceived stress scale (0-16)	Perceived Stress Scale, comprising 10 items (e.g. feeling nervous and stressed; feeling on top of things; being angered because of things outside your control) measured on a 5-item response from ‘never’ to ‘very often’	8, 17, 35, 47	
8	Sources of stress			51	
9	ART- Attention Restoration Theory	The theory characterizes restorative experiences in terms of being away, fascination, extent, and compatibility.	<b>Being away</b> refers to psychological distance from the demands and routines in which a person uses the directed attention capacity. <b>Fascination</b> refers to the way in which attention becomes captured by elements such as flora and fauna and by the process of exploration. <b>Extent</b> refers to both the degree of order or coherence and the scope for exploration and involvement in the environment. <b>Compatibility</b> refers to the match between what a person wants to do, can do, and must do at the site.	3	

10	Acute health-related complaints	it was asked whether one suffered from any out of a list of 37 acute health- related complaints in the last 14 days, such as headache, nausea, dizziness, listlessness, etc. (0-37 point scale)		5	
11	Health inequality	by the degree of access to parks and other green spaces near the home		6, 9	
12	Psychological restoration	distance from everyday demands, and possibilities for aesthetic appreciation and activity driven by interest.		6	
13	Restorative experiences	Relaxation and calmness, attentiveness and clearing one's mind		14	
		Restorative experiences in favorite places ≤15 km from home	social context of restorative experiences	35	
14	Environmental restorativeness	environmental preferences and perceptions of environmental restorativeness		39	
15	Perceived restorativeness Scale	PRS		39	
16	Physical activity	the extent to which green spaces attract people for physical activity		6, 30	
		assessed as total self-reported physical activity undertaken as part of work, domestic labour, sport and leisure in the last 4 weeks.		37	
		Level of physical activity	type and duration	41, 42, 48, 49	c
		the number of days on which physical activity (of sufficient exertion to raise breathing rate) reached or exceeded 30min, recalled over the past 4 weeks.		47	
		Leisure-time physical activity		50	
		Transport-related physical activity			
17	Amount of physical activity	amount of physical activity performed during the visit		11	
		amount of previous physical activity		30	c
		Physical activity per week	moderate and vigorous:-the total number of times during a typical week that the respondent was engaged in vigorous activities for at least 20min at a time and in moderate activities for at least 30 min at a time	8, 43	
18	Preferred physical activity	Individual preferences		11	
19	Activities	activities in the location	duration of the visit	51	
20	Preferred activities	preferences for performing certain activities in green spaces		52	
21	Influence of location to physical activity	Influence of location (indoors vs outdoors) to physical activity (walking, running)		38	
22	Walking	for recreation and for transport		32	
23	Motor performance			30	
24	Self-reported limiting long-term illness	self-reported limiting long-term illness		15	

25	<b>Cause-specific mortality</b>	(circulatory disease, lung cancer, cardiovascular disease, respiratory disease, and intentional self-harm)		6, 13, 15, 22	
26	<b>All-cause mortality</b>	excluding external causes(10)		10, 13	
27	<b>Physician assessed morbidity</b>	was classified by the general practitioners according to the International Classification of Primary Care.		7	
28	<b>Self-reported morbidity</b>			10	
29	<b>Propensity to psychiatric morbidity</b>	Score on the Dutch version of the General Health Questionnaire (GHQ) (Goldberg, 1972), indicating one's propensity to psychiatric morbidity.		20	
30	<b>Perceived social support indicators</b>	feeling alone, feeling disliked, and people being unfriendly		8	
31	<b>Perception of positive and negative attributes of UGS</b>	positive- Promote health, Promote children development, Reduce stress, Increase property value, Contact with nature, Importance to daily life Space for social interaction; Negative -Incivility and vandalism, Commercial encroachment, Bug attack, Unsafe place, Whiling away time.		21	
32	<b>Antidepressant use</b>	dispensation of antidepressant medication(SSRI- selective serotonin reuptake inhibitors)		33	
33	<b>Importance of getting exercise</b>	The extent to which the respondent considered getting exercise as important. This is an ordinal scale measure, including categories of not at all important, not too important, somewhat important, and very important.		8	c
34	<b>Try to lose weight</b>	Whether or not the respondent was trying to lose weight at the time of the survey.		8	c
35	<b>Health limiting moderate activity</b>	The degree to which the respondent's health limited moderate physical activity. This is an ordinal scale measure, including categories of not limited at all, limited a little, and limited a lot.		8	c
36	<b>Years living in the current house</b>	The number of years the respondent lived in their house.		8	c
37	<b>Health interfering with socializing</b>	The extent to which the respondent's health interfered with social activities such as visiting friends or relatives		8	c
38	<b>Physical benefits</b>	respondents were asked to estimate the level of physical benefits perceived during the visit and after the visit.		11	
39	<b>Physical fitness</b>	Level of physical fitness		40	
40	<b>Psychological benefits</b>	respondents were asked to estimate the level of psychological benefits perceived during the visit and after the visit.		11	
41	<b>Skin temperature</b>			16	
42	<b>Cerebral brain activity</b>	measured as absolute haemoglobin concentration		30	
43	<b>BMI</b>	Body Mass Index as indicator of overweight and obesity	category according to WHO classification	12, 37, 40, 44	
44	<b>IRR</b>	Incidence rate ratio		13	
45	<b>Obesity</b>	determined based on BMI		46	
46	<b>Cause of death</b>			13, 15	c

47	Physical symptoms	pain in stomach, reported high blood pressure		14	
48	Negative affectivity	a diffuse sense of subjective distress and dissatisfaction and feelings of stress.		14, 35	
49	Positive affectivity	Feelings of energy and keenness		14, 35	
50	NMS	Negative Mood Scale. Anxiety/depression and anger subscales from the NMS to measure negative emotions on 5p scale(e.g., worried, anxious, angry, irritated)		39	
51	Mood status	Profile of Mood States (POMS)		40, 55	
52	Psychological distress	stress, headaches		51	
53	Quality of life	Self-reported health-related quality of life		17	
54	DALYs	Disability adjusted life years		36	
55	SF-36 health	a 36-item instrument that measures eight dimensions of health (bodily pain; general health; mental health; physical functioning; role limitations due to emotional problems; role limitations due to physical health; social functioning; and vitality), range 0-100.		17	
56	Health behaviour			17, 27	c
57	Health risks	Occupational and environmental health risks		17	c
58	Health resources	not specified, data from national survey		17	c
59	Emotion	measure of a particular emotion(e.g. revitalisation, anger, anxiety)		30	
60	Self-esteem	Rosenberg Self- Esteem Scale (pre and post activity or intervention using the one-page 10-item RSE scale)		40, 54	
61	Engagement			30	
62	Psychological score	e.g. Zuckerman's Inventory of Personal Reactions, Profile of Mood States		30	
63	Attention/ Concentration	effects on attention/concentration		30	
64	Cardiovascular outcomes	e.g. blood pressure or pulse		30	
65	Hormone levels			30	
66	Cortisol level	Salivary or urinary		30, 47	
67	Amylase level			30	
68	Adrenaline level			30	
69	Telomere length	geographical variation in telomere length. Telomere length is affected by cumulative oxidative and inflammatory stress, having inverse associations with mortality, chronic diseases, and psychological stress and can be regarded as a marker of biological ageing.		42	
70	Immune function	effects on immune function(e.g. immune globin A concentration; natural kill cell activity)		30	
71	Memory recall			30	
72	Sleeping hours			30	
73	Psychological working environment			31	
74	Seasonal affective disorder	SAD		33	

75	<b>Depression</b>	depression and depressive symptoms recorded		33	
76	<b>Place experience</b>	Personality traits relevant to stress and health		35	
77	<b>Noise sensitivity</b>	Weinstein's (1978) noise sensitivity scale		35	c
78	<b>EFI</b>	Exercise-Induced Feeling Inventory (EFI; Gauvin & Rejeski, 1993) to measure positive emotions on 5p scale (e.g., calm, relaxed, revived, refreshed)		39	
79	<b>Neurocognitive measures</b>	Digit Span Forward (DSF) and Digit Span Backward (DSB)		39	
80	<b>Green exercise effect</b>	changes to psychological health brought on by participating in green exercise	Duration of each activity	40	
		measured by calorie consumption			
		Descriptive Data on the Green Exercise Interventions( cycling, gardening, walking, fishing, boating, horse-riding),	duration and intensity of nature-based activities	55	
81	<b>Lifestyle</b>	Lifestyle correlates (second home, bicycling for work etc), Vegetarian, sportive		12, 17, 27, 40	c
82	<b>Perceived Sensory Dimensions</b>	preferences for certain PSDs(Perceived Sensory Dimensions) of green spaces and prevalence of stress symptoms	The eight PSDs : 'serene', 'space', 'nature', 'rich in species', 'refuge', 'culture', 'prospect', and 'social'	52	

## Appendix VIII: Table of Environment and mechanisms related indicators

Lit. Nr. refers to literature in the narrative synthesis table, presented in Annex II. The letter c at the end of the row indicates that in some studies this indicator is also used as cofounder. The specifics were not always available, so only specifically described specifics and sub criteria are included as well the indication to literature, wherein it is done.

Nr	Indicators/indexes Environment or mechanism related	Specifics	Sub criteria	Occurs in the study nr	C
1	UHI-Urban Heat Island effect	degree Celsius		2	
2	Park Cool Island effect	degree Celsius		2	
3	Heat wave days	how many days heat in row		19	
4	UCM- Urban Canopy Model to measure coverage	grid based		2	
5	Positive park effect	Cooling more than half degree		2	
6	Percentages of green space	Only green spaces that dominate the land use in the 25x25 m grid cell (more than 50% of the grid cell is green) have been classified as green space in the dataset. Small-scale green spaces, such as street trees and roadside vegetation were only included as green space if they were dominant in the grid cell.		7, 49	
		% of urban green, agricultural green, forests and nature areas		20	
		Percentages of green space in a 1-km and 3-km radius around home		1, 20, 49	
7	Greenness of the area	Greenness based on median split at 45 m <sup>2</sup> of green area per dwelling within 500 m or percentage		5	
		the number of parks/green spaces per 10,000 residents		44	
		area of parks/green space as a proportion of the total area within a community		44	
		average distance to a park/green space		44	
		the proportion of parks/green space service area as a proportion of the total area within a community.		44, 47	
8	Greenspace coverage	1 indicator:22 CORINE land cover categories pertaining to natural, land-based (i.e., excluding water bodies) environment; 2: OSMM contains a topography layer, which is delimited into nine themes, two of which were used for defining green space: (1) the terrain 'natural' subset, representing all natural (non-synthetic) topography; and (2) water (to include small 'blue spaces' such as river corridors). The third indicator was a 'hybrid' designed to offer a middle ground between CORINE (sensitive to larger spaces only) and OSMM (sensitive to ambient greenery).		10	

		percentage coverage of green space types for each urban neighbourhood		22, 43	
9	Green space availability	total and usable		22	
		Presence/absence of green area		41	
10	Type of green site	Forest, park, beach etc		26	
11	Land use	land use in each 25 by 25 meter grid cell.		27	
12	Green visible on the streetscape	5- point scale (not very green impression-very green impression)		5	
13	quality of green area	Assessed with 10 items, each on a 5 point scale	Accessibility	5	
			Maintenance		
			Variation		
			Naturalness		
			colourfulness		
			clear arrangement		
			shelter		
			absence of litter		
		safety			
area-aggregated perceived green neighborhood qualities (Scania Green Score; SGS)	qualities (dimensions) that humans appreciate in park environments (culture, serene, lush, spacious and wild)	48			
14	Green space value	green space value for respondents CASward(Census Area Statistics ward), of residence		43	
15	Green space measure	% by area at the UK Census Area Statistic ward scale (GLUD)		15, 37	
16	Percentages of blue space	fresh and salt water surface		20	
17	Urbanity	This variable consists of five categories, ranging from very strongly urban (1) to non-urban (5). The indicator is based on the number of households per square kilometre.		1,7, 13, 20	c
18	Park acreage	The total acreage of parks that can be accessed within a 0.5 mile walk		8	
19	Park size			26	
20	Tree and grass cover	Amount of tree and grass cover		26	
21	Distance to nearest green space	travelled distance from home		8, 11, 12, 17, 35	
			walking distance	48	
22	Walking time	to reach the nearest green space		21	c
23	Accessibility to green spaces			13, 31, 37	
		perceived physical effort and time to get to the experimental area;		54	c

24	Normalized Difference Vegetation Index (NDVI)	The mean NDVI value calculated within the 0.5-mile buffer area		8, 26	
25	Air pollution levels			10, 15, 22	c
26	Air quality			12, 13	c
27	Accessibility to water	importance of accessibility to water during the visit to green space		11	
28	Noise			12	
29	Dust	PM10 concentration		12, 15	
30	Seasonality	summer, winter		12, 26, 33	c
31	Climate type	tropical, Mediterranean, boreal etc		26	
32	Physical setting	Where it locates (btw big roads, close to rural areas)		12	
33	Quality of pavements			9	c
34	Frequency of the visit	How often one visits the green area		11, 12, 14, 17, 28, 29, 31, 35, 43, 54	c
35	Duration of stay	How long one stays in the area		14, 28, 35, 51	c
36	Temperature	Air temperature within green and non-green sites within an urban area. degree Celsius. Role and influence of green areas on climatic factors; Mean temperature		16, 23, 26, 33, 54	
37	Wind	Role and influence of green areas on climatic factors.		16, 23	
38	Humidity	Within the canopy. Role and influence of green areas on climatic factors.		16, 23	
39	Temperature flux	from all surfaces		16	
40	Temperature near- surface	degree Celsius		19	
41	Diurnal change	of solar azimuth angles		16	
42	Shadowing effect	Shadowing effects from buildings		16	
43	Shading coverage	How much shade the green space elements offer		26	
44	Moisture availability			16	
45	Heat capacity			16	
46	Precipitation	Role and influence of green areas on climatic factors.		23	
47	albedo			16	
48	Emissivity			16	
49	Building heights			16	
50	Surface of green area	Surface of green area by typology		18	
51	Surface colour			19	c
52	Surface material			23	
53	CO2	Tons of emissions of carbon dioxide		18, 23	
54	CO2 absorbed	amount of CO2 absorbed by vegetation		18	
55	SO2			23	

56	Urban biodiversity	Biodiversity richness		25, 36	c
57	Experienced space			29	
58	Social space			29	
59	activity space			29	
60	symbolic space			29	
61	Physical working environment	incl. characteristics of the outdoor environment		31	
62	Perceived sensory dimensions	self-reported perceived sensory dimensions		32	
63	Perceived neighbourhood greenness			32	
64	Environment Walkability Scale	Access to a park or nature reserve		32	
		Access to bicycle or walking paths			
		Presence of greenery			
		presence of tree cover or canopy along footpaths			
		Presence of pleasant natural features			
		Existence of sidewalks, Existence of green areas, Garbage accumulation, Existence of crime etc		50	
65	Nature contact	categories of potential contact:	outdoor nature contact	34	
			indoor nature contact		
			indirect nature contact		
66	forest-maintenance	wild versus tended		54	
67	Perceived attractiveness			54	

## Appendix IX: Table of cofounders

Lit. Nr. refers to literature in the narrative synthesis table, presented in Annex II. The letter c at the end of the row indicates that in some studies this indicator is also used as cofounder. The specifics were not always available, so only specifically described specifics and sub criteria are included as well the indication to literature, wherein it is done.

Nr.	Co-founders	Specifics	Occurs in the study nr
1	Age	in years	1, 7, 8, 10, 11, 12, 15, 17, 20, 21, 22, 27, 28, 29, 30, 31, 32, 37, 38, 41, 43, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55
2	Age at death		13
3	Gender/ sex	female or male	1, 7, 8, 10, 11, 12, 13, 15, 17, 20, 21, 22, 28, 29, 30, 31, 32, 33, 35, 37, 38, 40, 41, 43, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55
4	Education level	Elementary school, basic school, high school, university etc	1, 7, 8, 12, 13, 17, 20, 21, 27, 31, 32, 35, 41, 48, 49, 52, 54
		community-level education	44
5	Urbanicity	Degree of urbanity, 5 scale-very strongly urban (1) to non-urban (5); based on the number of households per square km; Urban/rural status	1,7, 13, 20, 27, 49
6	Urban/rural status		37, 43
7	Urban sprawl		34
8	Socioeconomic status(SES)	was additionally implicitly measured by type of healthcare insurance (unknown, public or private). The type of healthcare insurance can be regarded as an indicator of SES in the Dutch context in 2001, as only people with a higher income had private health insurance, whereas people with a lower income had obligatory public health insurance. SES was operationalised as the level of education divided into three categories: higher education (university or higher vocational education), secondary education and primary or no education.	7
		or position	13, 15, 17, 27, 28, 42, 50, 53
		Social class as measured by head of household occupational social class: Professional Managerial, Skilled non-manual, Skilled manual, Semi-skilled manual Unskilled manual', Army or full-time education, Never worked	37

			10
9	Socioeconomic deprivation	Socio-economic deprivation based on the Carstairs Index(based on prevalence of household overcrowding, unemployment among men, low social class, and not having a car.)	47
10	Income deprivation	neighbourhood income deprivation	13, 37
11	IMD	English index for multiple deprivation	37
12	Social coherence		32
13	Social interaction	Local social interaction	32
14	Socio-economic index (SEI)	takes into account an individual's profession, education and responsibility in the society	28
15	Work status	situation	7, 11, 31, 32
		managerial position	31
16	Economic activity/employment status	Employed, unemployed, retired or other inactive	8, 12, 22, 37, 41, 51
17	Occupation	profession	21, 28, 52, 53
18	Marital status	married, single, divorced	8, 21, 32, 41
19	Family status	i.e. head of household, partner to her or he	11, 20
20	Cohabitation status		17
21	Household type	i.e. married couple with children and grandparents	12, 48
22	Household size	Number of persons in the household	41
23	Household income	households monthly income (21)	8, 20, 21, 32
		equalised household income	43
		family income as a proxy for an individual child's family income	44
24	Income		22, 27, 49
		current income on a scale of 1 (living comfortably on current income) to 4 (finding it very difficult to live on current income)	47
25	Ethnic background	ethnicity	8, 9, 17, 41
26	Skin colour		50
27	Country of origin		48
28	Communication	number of life-events (such as birth, divorce, loss of job, burglary) in the past year	20
29	Exposure to violence	Whether or not the respondent or any member of the respondent's household had been a victim of physical, verbal, or sexual violence	8
30	Safety	sense of security	34, 35
		perceived threat, safety and fear with one item each, scales ranging from 0 (not at all) to 6 (very much)	54
31	Threatened or harassed because of race/ethnicity	The extent to which the respondent had been threatened or harassed in day-to-day life because of race or ethnicity issues. This is an ordinal scale measure, including categories of never, less than once a year, a few times a year, a few times a month, at least once a week, and almost every day.	8
32	Proportion of minorities	community-level proportion of visible minorities	44
33	Presence of barriers	such as major roads	9
		obstacles visiting green space (time, distance)	28
34	Disability	Illness or handicap restricting movement	9, 35

35	<b>Personal barriers</b>	such as being overweight, not enjoying exercise, being too old, a lack of time due to other commitments, ill health, injury or disability or concerns about the environment or unpredictable weather conditions	9
36	<b>Reason to visit</b>	sport, lunch break, walking dog etc	17
37	<b>Population density</b>	persons per hectare as a measure of urbanity	10, 13, 15, 22, 27
38	<b>Preferences of green space qualities</b>	Preference for the shade	11
		preferences for certain qualities in urban open green spaces	53
39	<b>Required effort</b>	Effort required to reach the green space	11
40	<b>Lifestyle</b>	Lifestyle correlates (second home, bicycling for work etc)	12, 17, 27, 40
41	<b>Housing condition</b>	Type of dwelling, type of accommodation	12, 17
42	<b>Area residence</b>	place of residence	15, 21, 22, 54
43	<b>Length of residency</b>		29
44	<b>Home environment</b>		28
45	<b>Ownership to dwelling</b>		12, 22
46	<b>Skills</b>		13
47	<b>Affecting factors</b>	Factors affecting the possibility to visit green spaces (work, family obligations etc)	12
48	<b>Existence of a pet</b>	Existence of a pet which requires walking outdoors	35
49	<b>Training</b>		13
50	<b>Situational factors in life</b>	Stress related daily hassles- worries about work and money, satisfaction with life; Financial stress and living conditions	14, 35, 41
51	<b>Personality characteristics</b>	nature connectedness, nature hobbies, childhood nature experiences, satisfaction with life	14, 35
52	<b>Personal background</b>	Having children, Access to green spaces, Use of public green spaces Sick-leave, Want to use public green spaces more often, Studies, Work nights, Work shift, Comfort and enjoyment at work	52
53	<b>Social relations</b>	Uplifts of social relations, visiting alone vs. In company	14, 35
54	<b>Social environment</b>	(a) Do your friends and neighbours invite or stimulate you to walk, cycle or practice sports? and b) Do your relatives invite or stimulate you to walk, cycle or practice sports?	50
55	<b>Sense of community</b>		35
56	<b>Communication</b>		22
57	<b>Opportunities</b>	availability, social integration	27
58	<b>Support</b>	encouragement to go outdoors	22, 31
59	<b>Smoking</b>	yes, no	15, 22, 42
60	<b>Habits</b>	habits regarding visiting green spaces	17, 52, 53
61	<b>Behaviour</b>	choices people make	27

62	<b>size of municipality</b>	number of habitants	17
63	<b>Density of green areas</b>	surface and density of green areas per inhabitant and neighborhood	18
64	<b>Fuel consumption</b>	fuel consumption per inhabitant by use of automotive vehicles.	18
65	<b>Participation</b>	physical-urban, technological, environmental, financial-economical, legal-regulatory and public participation	18
66	<b>Type of health insurance</b>		20
67	<b>Rooms in the house</b>	Number of rooms in the house	20
68	<b>Presence of garden</b>	also access to garden	20, 28
69	<b>Childhood experience</b>	childhood experience with nature	14, 21, 35
70	<b>Transport</b>	transport means used	22
71	<b>Reliance on automobiles</b>	due to disability, due to work etc	34
72	<b>Walking time</b>	Time spent in walking	
73	<b>Seasonality</b>	summer, winter	12, 26, 33
74	<b>Workload</b>	number of working hours per week as an indication of the amount of workload	35
75	<b>Liking of nature holidays</b>		35
76	<b>Noise sensitivity</b>	Weinstein's (1978) noise sensitivity scale	35
77	<b>Need for restoration</b>	Daily hassles refer to minor annoyances of everyday life, such as frustration resulting from rush-hour traffic. The participant indicates whether each of 94 possible hassles has occurred during the preceding week	39
78	<b>Self-esteem</b>	Self-esteem before activity in green area	40
79	<b>Weight</b>	Weight of a person in kg	41
80	<b>Height</b>	Height of a person in cm	41
81	<b>Economy</b>	Economic situation economic difficulties	41, 48
82	<b>Neighbourhood satisfaction</b>		48
83	<b>Frequency of the visit</b>	How often one visits the green area	11, 12, 14, 17, 28, 29, 31, 35, 43, 54
84	<b>Duration of stay</b>	How long one stays in the area	14, 28, 35, 51
85	<b>Ancestry</b>		54
86	<b>Influence of temperature</b>		54