User perception of ecosystem services in urban parks in Rotterdam

Translating ecosystem services for citizens and identifying park perception profiles using Q methodology

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MSc Thesis Environmental Policy

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ABSTRACT

In the European Union 41% of the population lived in urban areas in 2011 (Eurostat 2012). This shows that cities are not only our economic, cultural, and innovation centers but also one of the most common human habitats. These densely populated urban regions are vulnerable to changes in the state of their surrounding environment. Ecosystem services are the benefits people obtain from ecosystems, and urban ecosystems deliver services that can help cities cope with some of these challenges, as well as contribute to human wellbeing in other ways.

Urban green spaces deliver valuable ecosystem services, however to city inhabitants the benefits derived from ecosystems are not always clear, and not all of them can be directly perceived by the senses. There is to date no structural way to translate the ecosystem services into concepts familiar to urban green space users. Also, the commonly used methods to measure nature perception (e.g. value and quality models, surveys, monetary valuation) often do not give a clear picture of the various profiles of green space users. This research thesis aimed to contribute to an understanding of the perceptions of users of urban parks towards the ecosystem services delivered by these spaces, as well as develop a method that translates the concept of ecosystem services for citizens so their perceptions of these services can be studied.

In order to make ecosystem services understandable to park users a selection of ecosystem services was made, based on the criterion of direct perception. The remaining ecosystem services were fine-grained into ecosystem subservices, which delivered statements understandable by the layman. These statements were presented to park users of Rotterdam's Kralingse Bos, Het Park, and the Zuiderpark. Q methodology was used so users could sort the statements according to their own view on the importance of the benefits these statements represented.

Five perception profiles were discovered in the study by Q analysis (inverted factor analysis). For two of these profiles the sample size was so small the validity and exact nature of the profiles can be questioned. The person associated with factor 1 is a nature lover with a sense of place. They enjoy the beauty of nature and the natural sounds and fresh air in the park. The user associated with factor 2 experiences the park as a haven for recreation and revitalization. They feel a strong cultural connection to the park, and use it for active and passive recreation. The park user identified with factor 3 sees the park as a quiet oasis within the city: a place to relax, to meet people, and to play. They are fair weather users who come to the park most often to enjoy the sunshine.

The fact that the statements and the methodology were understandable to the interviewed park users shows that it is a method that succeeds in translating ecosystem services to them. However, the results show that respondents rate the individual statements (which represented different aspects and interpretations of their ecosystem subservices) regardless of the ecosystem subservice they referred to. Overall, air quality control, noise reduction, and aesthetic appreciation are the most highly valued ecosystem subservices by Rotterdam park users. The least valued are spiritual experience and sense of place, social setting, and inspiration. Because of the limitations of the study it is difficult to say if these results can be extrapolated to other seasons, regions, or methods, but the varied and in-depth quality of the profiles could give an interesting color to results from other methods, like surveys or monetary valuation studies.

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1. INTRODUCTION

1.1 PROBLEM STATEMENT

In 2010 the global urban population numbered roughly 3.5 billion people, approximately half of the world population (United Nations, 2011). In the European Union, 41% of the population lived in urban areas in 2011 (Eurostat 2012). This makes cities not only the economic, cultural, and innovation centers of the world but also one of the most common human habitats. With their high population density and human-built structures, these urban regions are vulnerable to changes in the state of their surrounding environment. Some of the most challenging hazards to cities are extreme weather events like heat waves, draughts, floods, hurricanes, and heavy precipitation. These events are a growing threat due to the combination of (uncontrolled) city growth, climate change, and other factors, which reduce cities' resilience (Ernstson et al. 2010; Stockholm Resilience Centre 2010). In turn, cities have a large impact on the environment: urban sprawl fuels habitat and biodiversity loss; high energy use and consumption levels produce large amounts of greenhouse gases (GHGs) and waste; urban transport, buildings and waste generate air, water, soil, noise, and light pollution; and sealing the ground with buildings and pavement induces the urban heat island effect, where the temperature is higher than the surrounding natural areas. Many of these adverse effects greatly impact human health and wellbeing (Jansson 2012).

Ecosystems deliver services that can help cities cope with some of these challenges, as well as services that contribute to human wellbeing in other ways. According to the Millennium Ecosystem Assessment (MA), one of the most important global assessments regarding biodiversity and ecosystems, "an ecosystem is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit" and "ecosystem services are the benefits people obtain from ecosystems" (Millennium Ecosystem Assessment 2005). The MA divides ecosystem services in four categories: provisioning services (e.g. food, water), regulating services (e.g. climate regulation, flood regulation), cultural services (e.g. aesthetics, recreation), and supporting services (e.g. nutrient cycling, soil formation).

In cities urban green spaces form the (elements of) ecosystems that contribute ecosystem services to the city. These green spaces deliver valuable ecosystem services to their inhabitants in terms of environmental regulation and wellbeing in all four MA categories (Bolund & Hunhammar 1999). To city inhabitants these benefits derived from ecosystems are not always clear, and not all of them can be directly perceived by the senses. To evaluate the performance of green spaces in cities, and to create a city in which green space is designed to address not only ecological priorities but also user perception, it is essential for planners and policy makers to explore the experiences of urban green space users (Jim & Chen 2006a). This will identify the perceived benefits of a green space to inhabitants of the city.

Many studies have looked at the perception of (urban) green space and specific ecosystem qualities and services by using a large variety of methods (e.g. Chiesura 2004; Bulkens 2006; Brander & Koetse 2011). However, there is to date no structural way to translate the ecosystem services framework as described by MA and TEEB into concepts familiar to urban green space users. Also, the abovementioned methods (e.g. value and quality models, surveys, monetary valuation) often do not give a clear picture of the various types of green space users.

1.2 SCOPE OF THE STUDY

Rotterdam

This study will focus on the city of Rotterdam in the Netherlands. Rotterdam is the second largest city in the Netherlands with over 616.000 inhabitants (Centrum voor Onderzoek en Statistiek 2013). It is an economic capital in the center of the Northern European river delta and contains one of the largest harbors in the world. The city contains a diverse spread of modern and traditional architecture, of industry and service providers, of different socio-economic layers of society and a large range of nationalities (Gemeente Rotterdam n.d.). The variety of this typical European city makes it very interesting to study in the light of wellbeing and resilience.

Urban Parks

This study of urban green spaces will be limited to urban parks. Urban parks are green spaces with clear boundaries and diverse natural properties that can be well conceived by their users. There are also often designed with citizen use as a primary function in mind, and are used by a variety of people (Gemeente Rotterdam 2013). On top of this, research on citizen wellbeing and urban green often focuses on urban parks (e.g. Chiesura 2004; Lo & Jim 2012) and provides a good foundation for this study.

Perceived Ecosystem Services

Of the ecosystem services described by MA (2005) and The Economics of Ecosystems and Biodiversity (2011), this research will mainly focus on a selection of cultural and regulating ecosystem services. The selection of services for this study is further explained below and is based on direct perception by users. The methodology used will focus on these ecosystem services, rather than those that have indirect benefits to society. When looking at urban parks, it is often difficult to separate human-made and ecosystem services, because the natural elements of a park are also designed to suit user needs and are integrated with built elements like pavement, lighting, park benches, fountains, etc. The two are intertwined. However, for the purpose of this study the focus will be on the natural aspects of the ecosystem, i.e. plants, water, rocks, animals.

Methodology

Many different methods have been used to measure the perception of environmental quality, experience of nature, and the valuation of ecosystem services. With this study, however, I wanted to map the various user perceptions of a park, without having users rate, value or compare their experiences or self-reported behavior. This allows the subjective perceptions to be linked to specific ecosystems services and have them classified accordingly. For this purpose Q methodology (inverted factor analysis used to detect viewpoints) will be used. The details of the methodology are further explained in chapters 3 and 5.

1.3 RESEARCH OBJECTIVE

This research thesis aims to contribute to an understanding of the perceptions of users of urban parks of the ecosystem services delivered by these parks, as well as develop a method that translates the concept of ecosystem services for citizens.

1.4 RESEARCH QUESTIONS

- What are the dominant perception profiles of citizens regarding the benefits gained from visiting urban parks in Rotterdam?
- Which ecosystem services can be associated with these profiles?

1.5 Relevance of the Research

This study will translate the knowledge we have on ecosystem services to urban park users in a way that relates to their perception of them. The study will create a new ecosystem services framework with a focus on directly perceptible ecosystem services and a fine graining of them into subservices. This framework, in combination with Q methodology, creates a new method of studying citizen perception of nature in general, and ecosystem services in particular. On top of this the study works with perception profiles, rather than averages or other values, which will give a representative image of the breadth of urban park perception in Rotterdam. Furthermore, there have not been many studies that specifically look at citizen perception of ecosystem services in the urban context, so this study will be a meaningful addition to the existing knowledge in these separate fields.

1.6 Reading Guide

After this brief introduction in chapter 1, this thesis first provides the theoretical framework on which the study was based. Chapter 2 explains what ecosystem services are and how they are viewed in an urban context. It gives specific attention to urban parks and the ability of park users to perceive urban ecosystem services. The chapter presents a framework that highlights those ecosystem services that can be directly perceived by park users and their fine-grained subservices. Chapter 3 offers a description of the studied urban parks of Rotterdam, their facilities and visitation numbers. Chapter 4 discusses the various types of methods and discourses used to measure and describe the perception of nature benefits by citizens. It reviews nature quality and value frameworks, survey methods, monetary valuation methods, and Q methodology, which was used in this study. This thesis goes on to describe the steps taken to develop the Q method study and the data analysis in chapter 5. Chapter 6 presents the results of the study and their interpretation. In chapter 7 discusses these results and interpretations and links them to the theoretical background of the study, as well as touch upon relevant observations about the data collection, data analysis and results. Chapter 8 synthesizes the thesis into conclusions and answers the research questions presented in the first chapter. Recommendations for future research and policy implications are made in this chapter.

I want to thank you in advance for reading this thesis and wish you an interesting, pleasant read. Perhaps it will inspire you to see the parks in your city in a different light.

2. URBAN ECOSYSTEM SERVICES

This chapter will elaborate on the theoretical concepts and knowledge on which this study is based. It starts with an exploration of the trend for more sustainable city planning, and the necessity of environmental resilience for cities. The chapter then zooms in on urban green spaces and urban parks in particular. Next, an overview is given of the ecosystem services classification in general and a narrowed down framework of ecosystem services relevant for this study in particular. The chapter is concluded with a more in-depth explanation of the ecosystem services included in this study.

2.1 SUSTAINABLE AND RESILIENT CITIES

In vision and planning documents of city governments a section on sustainable growth and development is often included. Increasingly these sustainability plans not only include issues like energy and climate mitigation, but also measures to increase environmental resilience (City of New York 2011; Gemeente Rotterdam 2011). According to the Stockholm Resilience Centre "resilience is the capacity of a system to continually change and adapt yet remain within critical thresholds" (Stockholm Resilience Centre 2010). Climate change, extreme weather events, floods, pollution and many other environmental hazards can affect cities. Urban green spaces can increase the resilience of a city to these events (Ernstson et al. 2010; Jansson 2012).

An example that illustrates vividly the value of urban resilience is New Orleans, USA. New Orleans is situated in a river delta, a dynamic environment. A combination of so-called 'slow variables' increased the vulnerability of the city since the 1960s: rising sea levels, coastal wetland loss, a compacting deltaic landscape, population decline, suburban sprawl below sea level, economic decline and low maintenance of levee systems. In 2005, hurricane Katrina pushed the fragile New Orleans socio-ecological system over a critical threshold causing large areas of the city to flood. Many lives and homes were claimed. Each of the slow variables brought the system closer to this threshold, to the point where the system could not withstand the shock of a hurricane. Increasing resilience of the system will prevent future events from being as catastrophic (Ernstson et al. 2010). Clearly in this case poor green space maintenance (wetlands) was only a minor element of the city's incapability to cope with the hurricane. Political and socio-economic factors and poor coastal defense systems had a much bigger influence on bringing the city so close to threshold. However, it does illustrate nicely the many different elements of a city that need to be balanced and maintained in order to create resilience in a city. Decision makers in many cities are starting to realize the importance of resilience and the role of natural systems as buffers for environmental changes. Their sustainable city plans often include restoration or reconstruction of ecosystems and landscapes to this end, especially in cities on waterfronts like New Orleans, New York, and Rotterdam (Ernstson et al. 2010; City of New York 2011; Gemeente Rotterdam 2011).

A sustainable city, however, is more than resilient. Sustainability is generally thought to encompass environmental quality, social equity, and economic interests. A much cited study by Chiesura (2004) reviews studies to support her claim that natural components in an urban setting increase quality of life in many ways, e.g. reduce stress and provide a sense of tranquility and health (see below for a more in-depth analysis).

2.2 URBAN PARKS

Bolund and Hunhammar (1999) differentiate seven kinds of urban green: street trees, lawns/parks, urban forests, cultivated land, wetlands, lakes/sea, and streams. The ecosystem services generated by these green areas substantially increase quality of life in urban areas (Bolund & Hunhammar 1999). Other types of green spaces specific to the urban setting have received attention recently, like green roofs, green walls, and urban agricultural initiatives. Domestic gardens and brownfields are also common in urban settings. Considering that the contested space in cities the variation in types of urban green is large, and the spaces fragmented

throughout the city. To increase the availability of urban green spaces to citizens Copenhagen decided to build small 'pocket parks,' dubbed by Peschart et al. (2012) as examples of small public urban green spaces (SPUGS). Many cities contain other forms of SPUGS, like those mentioned by Bolund and Hunhammar (1999) described above. Because of their diversity both in ecosystem elements and usage, the focus of the current study will be on urban parks rather than other urban green spaces, even though all the abovementioned spaces are vital elements of urban ecosystems.

Chiesura (2004) showed that city inhabitants value their time in urban parks greatly, mostly because it gives them a space in which to relax, experience nature, and to escape from the city. The majority of respondents in Chiesura's study indicated they felt a sense of freedom when they visited the park. Other common emotional responses experienced by respondent were, among others, the feeling of unity with nature and happiness. Chiesura explains that these frequently given visitation motives and emotional responses indicate that urban parks are experienced as natural 'oases' that provide refuge from city air, noise and bustle. Next to these emotional needs, parks also fulfill social needs by providing a safe and pleasant space for children to play and in which to meet with others.

2.3 ECOSYSTEM SERVICES

The benefits provided by nature as described above all contribute to the wellbeing of city inhabitants. An urban environment that is both safe and pleasant constitutes a livable, sustainable city whose inhabitants are generally healthy and satisfied. In 2000, the UN called for a global assessment of ecosystems by experts and stakeholders. The UN Environment Programme headed the Millennium Ecosystem Assessment, the first research program to make an in-depth assessment of global ecosystems, ecosystem services and threats to them, running from 2001 to 2005. The board of representatives included international (research) institutions, governments, NGOs, business representatives and indigenous peoples. The objective of the MA was "to assess the consequences of ecosystem change for human wellbeing and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human wellbeing" (Millennium Ecosystem Assessment 2005). It describes human wellbeing as consisting of multiple constituents, namely (Millennium Ecosystem Assessment 2005):

- Basic material for a good life (e.g. secure and adequate livelihoods, food security, shelter, clothing, access to goods);
- Health (incl. feeling well and having a healthy physical environment);
- Good social relations (incl. social cohesion, mutual respect, ability to help others and provide for children);
- Security (incl. secure access to natural and other resources, personal safety, security from natural and human-made disasters);
- Freedom of choice and action (incl. the opportunity to achieve what an individual values doing and being).

The MA (and older studies) classifies the elements of ecosystems that facilitate human wellbeing as ecosystem services. The terminology around ecosystem services developed gradually in the late 20th century, and has gotten mainstream attention in the early 2000s through the MA. It grouped ecosystem services into four categories of services with different contributions to society:

- Provisioning services (e.g. food, water, timber, fiber);
- Regulating services (i.e. that affect climate, floods, disease, wastes, water quality);
- Cultural services (i.e. that provide recreational, aesthetic, and spiritual benefits);
- Supporting services (e.g. soils formation, photosynthesis, nutrient cycling).

The MA acknowledges that people are also concerned with the intrinsic value of ecosystems and species, irrespective of their utility for people or society, and undertake action to protect ecosystems for this reason (Millennium Ecosystem Assessment 2005).

In 2010, a series of reports were released under the header of The Economics of Ecosystems and Biodiversity. They were based on extensive review by a large group of experts and initiated by the G8+5 governments' environment ministers with the aim to "analyze the global economic benefit of biological diversity, the costs of the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation" (The Economics of Ecosystems and Biodiversity 2010). The focus of TEEB was thus on biodiversity and valuation, whereas MA focused mainly on ecosystem change and resilience. TEEB used an adapted version of the MA ecosystem services framework as a key element in the program. The *TEEB Manual for Cities: Ecosystem Services in Urban Management* (2011) was created as a helpful tool for urban researchers, planners and policy makers interested in urban ecosystems. In this document an adapted framework of ecosystem services relevant to cities can be found, see table 1. This framework is the basis for the ecosystem services approach of the current study.

These research programs are based on a large body of literature that previously used the concept of ecosystem services. An example of an often-cited article that made a classification of urban ecosystems services is by Bolund and Hunhammar (1999), who used the seven kinds of urban green spaces in Stockholm mentioned above as a basis for their classification. They concluded that these ecosystems provide seven local and direct services to the city: air filtration, microclimate regulation, noise reduction, rainwater drainage, sewage treatment, recreational values, and cultural values. Bolund and Hunhammar (1999) continued to state that these local ecosystem services substantially increase quality of life in urban areas and that they should be addressed and valued as such in urban land-use planning. It should be clear that each urban ecosystem generates several services simultaneously. For instance, Bolund and Hunhammar (1999) conclude that all urban ecosystems defined by them provide climate regulation, and recreational and cultural values.

The ecosystem services framework as presented by TEEB is generally accepted as the current basis of research on nature's benefits to human society and it is based on a large body of work by many different scientific fields. However, it is merely one framework in a long tradition of nature categorization and, as its predecessors, it is not ideal or complete. Both TEEB's classification framework and its focus on monetizing ecosystem effects have received ample criticism from the scientific community. Especially the classification of cultural systems has received criticism, which will be described in more detail below. Many scientist think there are ecological, economic, and political challenges when presenting ecosystem degradation and biodiversity loss in the form of costs. The effects of biodiversity and ecological trade-offs and thresholds are still poorly understood, and the economic measures used to calculate their costs are not fully representative and based on many assumptions (Ring et al. 2010; Spangenberg & Settele 2010). For a more in-depth review of monetary valuation, see chapter 4.

The ecosystem services of cities presented in table 1 can be seen as twofold. Many of the services are imported from ecosystems outside of cities, either in the surrounding hinterlands or elsewhere in the world, i.e. food provision, fresh water, assimilation of nitrogen, etc. These services are introduced as services of "ecology *of* cities" by Jansson (2012). On the other hand, there are the ecosystem services provided by ecosystems within cities themselves, as described by Bolund and Hunhammar (1999), providing a balanced, healthy environment within a city. Jansson (2012) identifies these ecosystems as "ecology *in* cities." This can be seen as a local and a regional (or global) environment of cities. However, for many cities the distinction between the services provided by the city itself and by ecosystems outside of the city is not this clear-cut. Many services originate from both inside and outside the city, like air filtration and floodwater retention. Other services generated by the green areas of a city, like carbon sequestration, contribute to larger regional or global processes that, as a whole, have benefits on the city. The current study only takes into account the ecosystem services provided by

the local environment, to the local environment, but is aware of the more complex spatial dimensions of many of these services. A more detailed selected of ecosystem services for this study will be made below.

Table 1: Ecosystem categories and types relevant to cities (based on *TEEB* 2011)

Ecosystem sevice	**Service description**
Provisioning services: ecosystem services that describe the material or energy outputs from ecosystems	
Food	Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems, but marine and freshwater systems, forests and urban horticulture also provide food for human consumption.
Raw materials	Ecosystems provide a great diversity of materials for construction and fuel including wood, biofuels and plant oils that are directly derived from wild and cultivated plant species.
Fresh water	Ecosystems play a vital role in providing cities with drinking water, as they ensure the flow, storage and purification of water. Vegetation and forests influence the quantity of water available locally.
Medicinal resources	Biodiverse ecosystems provide many plants used as traditional medicines as well as providing raw materials for the pharmaceutical industry. All ecosystems are a potential source of medicinal resources.
Regulating services: The services that ecosystems provide by regulating the quality of air and soil or providing flood and disease control, etc.	
Local climate and air quality regulation	Trees and green space lower the temperature in cities whilst forests influence rainfall and water availability both locally and regionally. Trees or other plants also play an important role in regulating air quality by removing pollutants from the atmosphere.
Carbon sequestration and storage	Ecosystems regulate the global climate by storing greenhouse gases. As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues; thus acting as carbon stores.
Moderation of extreme events	Ecosystems and living organisms create buffers against natural disasters, thereby preventing or reducing damage from extreme weather events or natural hazards including floods, storms, tsunamis, avalanches and landslides. For example, plants stabilize slopes, while coral reefs and mangroves help protect coastlines from storm damage.
Waste-water treatment	Ecosystems such as wetlands filter effluents. Through the biological activity of microorganisms in the soil, most waste is broken down. Thereby pathogens (disease causing microbes) are eliminated, and the level of nutrients and pollution is reduced.
Erosion prevention and maintenance of soil quality	Soil erosion is a key factor in the process of land degradation, desertification and hydroelectric capacity. Vegetation cover provides a vital regulating service by preventing soil erosion. Soil fertility is essential for plant growth and agriculture and well-functioning ecosystems supply soil with nutrients required

	to support plant growth.
Pollination	Insects and wind pollinate plants which is essential for the development of fruits, vegetables and seeds. Animal pollination is an ecosystem service mainly provided by insects but also by some birds and bats.
Biological control	Ecosystems are important for regulating pests and vector borne diseases that attack plants, animals and people. Ecosystems regulate pests and diseases through the activities of predators and parasites. Birds, bats, flies, wasps, frogs and fungi all act as natural controls.
Habitat or Supporting services: These services underpin almost all other services. Ecosystems provide living spaces for plants or animals: they also maintain a diversity of plants and animals	
Habitats for species	Habitats provide everything that an individual plant or animal needs to survive: food, water, and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.
Maintenance of genetic diversity	Genetic diversity (the variety of genes between, and within, species populations) distinguishes different breeds or races from each other, providing the basis for locally well-adapted cultivars and a gene pool for developing commercial crops and livestock. Some habitats have an exceptionally high number of species which makes them more genetically diverse than others and are known as 'biodiversity hotspots'.
Cultural services: These include the non-material benefits people obtain from contact with ecosystems. They include aesthetic, spiritual and psychological benefits	
Recreation and mental and physical health	Walking and playing sports in green space is a good form of physical exercise and helps people to relax. The role that green space plays in maintaining mental and physical health is increasingly becoming recognized, despite difficulties of measurement.
Tourism	Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits and is a vital source of income for many countries. In 2008 global earnings from tourism summed up to US$944 billion. Cultural and eco-tourism can also educate people about the importance of biological diversity.
Aesthetic appreciation and inspiration for culture, art and design	Language, knowledge and the natural environment have been intimately related throughout human history. Biodiversity, ecosystems and natural landscapes have been the source of inspiration for much of our art, culture and increasingly for science.
Spiritual experience and sense of place	In many parts of the world natural features such as specific forests, caves or mountains are considered sacred or have a religious meaning. Nature is a common element of all major religions and traditional knowledge, and associated customs are important for creating a sense of belonging.

Next to benificial ecosystem services, ecosystems also create effects that can be experienced as unpleasant or undesirable by people. Lyytimäki et al. (2008) made an overview of 'ecosystem disservices' of the urban environment, the main categories being aesthetic issues, safety issues, security and health issues, economic issues, and mobility issues. Especially because cities are largely designed by humans and have a historical function of protection against the threats of nature, inhabitants of cities experience the unpleasantries of nature as troublesome and unnecessary, even when these are essential or inavoidable apects of urban ecosystems (Lyytimäki et al. 2008). While these disservices, and the balance between these and the positive services of urban nature, are valid and should be taken into consideration by urban planners, they are outside the scope of this study.

One of the elements in many sustainable city plans or vision documents is the directive to increase the density of existing and newly developed urban areas, as to relieve the pressure of urban sprawl on the surrounding environment (Tratalos et al., 2007; European Union, 2011). However, as shown in a study of cities in the United Kingdom (UK) by Tratalos et al. (2007), high density urban areas have less coverage by green space and tree cover, smaller habitat patches, greater run-off, higher maximum temperatures and lower carbon sequestration. Tratalos et al. (2007) conclude that these ecosystem services, and thus ecosystem quality, decline consistently as urban density increases, although with appropriate consideration of these services there is significant potential to increase ecological performance, with a strong potential for (heterogeneous) domestic gardens. In many regions ecosystem services are not or scarcely used in urban planning (Niemelä et al. 2010), whereas they could be potentially useful for putting certain planning trends in perspective, as Tratalos et al. (2007) show, or in other environmentally focused urban planning initiatives (Niemelä et al. 2010).

2.4 Perceiving Ecosystem Services

As described in chapter 1, it is valuable to study ecosystem services of urban green spaces as perceived by urban citizens. However, a user of an urban park, for instance, only directly experiences and judges a fraction of the ecosystem services the park provides to society at large. The user could, for instance, experience a slight cooling effect in the air compared to the urban areas surrounding the park, but the user will not directly perceive the carbon sequestration and storage of the plants in the park. Even though carbon sequestration can be valuable to the inhabitants of the park's city and is therefore a service, these inhabitants do not experience it directly with their senses. Figure 1 explains which ecosystem services can or cannot be experienced directly by urban park users.

Provisioning services were filtered out because of their limited use in urban settings. Food provision is the provisioning service most present in cities through urban agricultural plots often maintained by individuals or communities. These, however, are not present in any of the parks included in this study and also provide only a very small amount of the food consumed in Rotterdam.

Supporting services by definition support other ecosystem services, and are essential to their functioning. Although citizens could be aware of biodiversity or habitats, their benefits to other services are difficult to perceive directly.

Wastewater treatment and carbon sequestration are services that are valuable to the city as a whole, but not visible to the urban dweller. On top of this, natural wastewater treatment facilities are not present in Rotterdam. Many of the other regulating services, i.e. biological control, erosion prevention and soil fertility, moderation of extreme events, and pollination, provide services that are invisible when the ecosystem is in balance. When the system is disturbed and these services are not properly provided, citizens can only notice the negative effects of the imbalance, e.g. flooding and declining quality or availability of plants.

Tourism was filtered because nature tourism plays a very limited role in Rotterdam, and because tourism is an ecosystem service of a different nature than the other cultural services (this is further explained below).

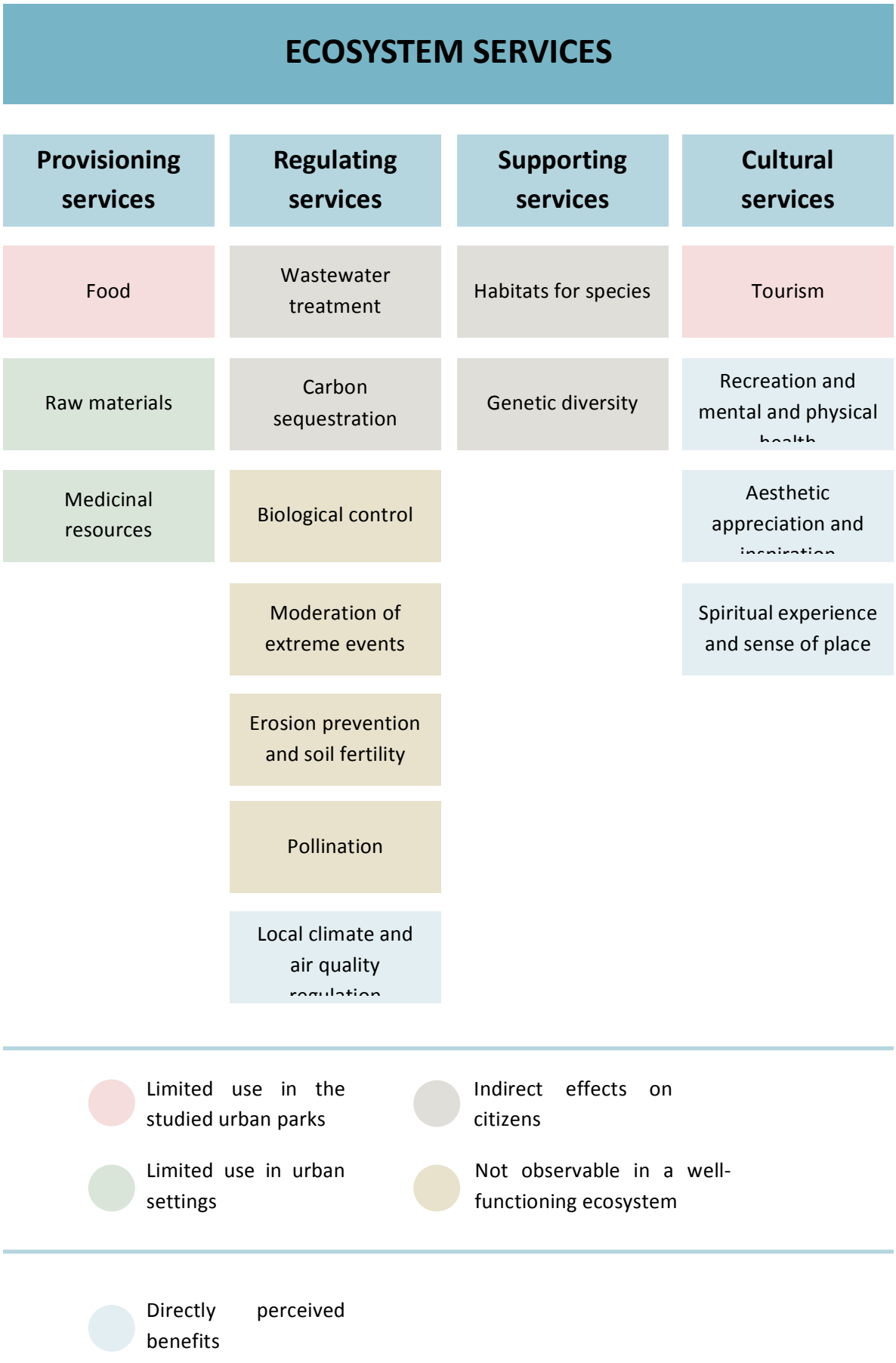

Figure 1: Overview of urban ecosystem services in light of the scope of this study (based on *TEEB* 2011)

The services that remain have benefits that can be directly perceived by the users of an urban park, and were included in the study. These services (local climate and air quality regulation, recreation and mental and physical health, aesthetic appreciation and inspiration, and spiritual experience and sense of place) are described in more detail below. They contain many aspects and were therefore fine-grained into subservices for the purpose of this study. The subservices were defined as shown in figure 2.

Figure 2: Selected ecosystem services fine-grained to subservices

Regulating, provisioning and supporting services have functions that are present regardless human perception. Some of these can be perceived directly, such as local climate regulation, but the effects that are perceived in this case are present in the ecosystem without the perception or interpretation of people. Cultural ecosystem services, however, are inherently related to their perceivers. Without human perception, cultural services would not exist. They come into being when people perceive nature and interpret nature within their personal context. Therefore cultural services are inseparably linked to nature perception. This is also apparent in the description of cultural ecosystem services by the MA: “the nonmaterial benefits people obtain from ecosystems” (2005). Cultural ecosystem services demonstrate a link between ecosystems and the satisfaction of medical, psychological, and social human needs and wants. For this reason cultural ecosystem services are often characterized as subjective (Daniel et al. 2012). Although it is true that cultural ecosystem services depend on social and cultural structures more than other ecosystem services, the latter are not free from subjectivity. Per definition ecosystem services contribute to human needs and desires, which are always susceptible to change and necessarily include intangible and subjective aspects.

A visual presentation of the perception of the various types of ecosystem services is shown in figure 3. Supporting services are at the basis of the regulating and provisioning services and make it possible for them to function well. People cannot directly perceive them. As shown in figure 1, people can only perceive some of the provisioning and regulating services, but they exist without human perception. Cultural services, however, only exist after human perception, as explained above.

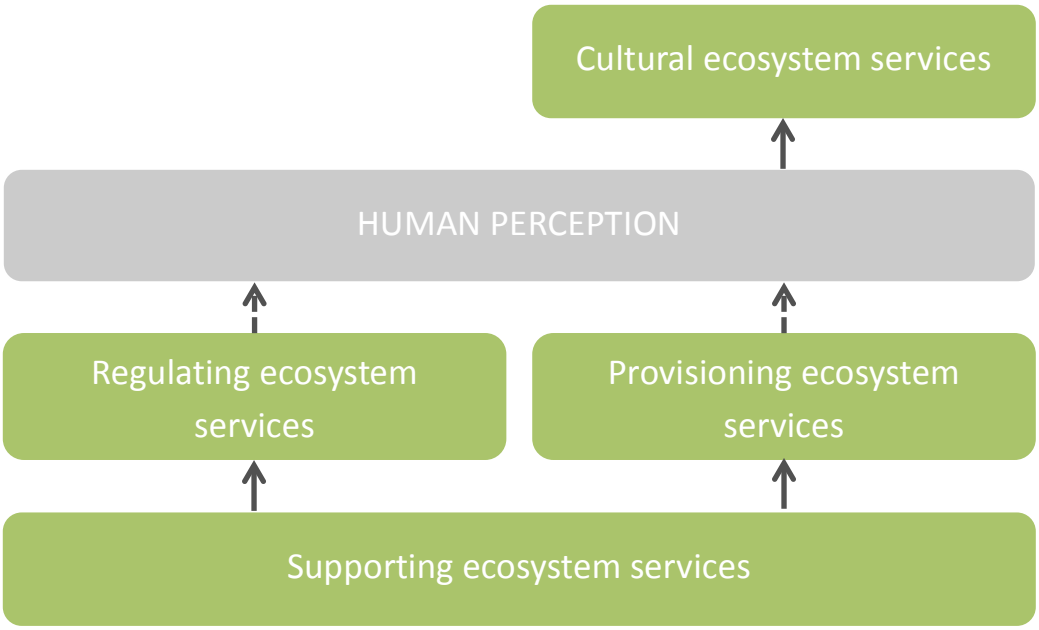

Figure 3: Relationships between ecosystem services types and human perception

An interesting case is the tourism service. Nature tourism is a human activity in which people go to natural places that are foreign to them, in order to enjoy the other ecosystem services this ecosystem generates (aesthetic appreciation, recreation, etc.). Because tourism encompasses or makes use of other cultural ecosystem services, it makes the TEEB's cultural services category very complex. Some argue tourism should not be a separate service, but rather be included in recreation or seen as a form of aesthetic appreciation. Other say the economic benefits of tourism make it a service in and of itself (Daniel et al. 2012).

Along with ecosystem services amenities of urban parks that are human made, like park benches or streetlights, also provide services to park users and increase their valuation of the urban park. However, they are not provided by the park's ecosystem and are thus excluded from the current study.

Local Climate and Air Quality Regulation

Local climate and air quality regulation is manifested in various ways. Firstly, ecosystems can regulate the local climate by generating cooling effects. Vegetation does not only provide shade, but also cools down the local air by using surrounding heat for the evaporation of water from the soil through its own structures. This process, by which water travels through the plant and evaporates to the air from its leaves, is called evapotranspiration (Jansson 2012). By the same evaporation process water bodies (like rivers or ponds) also have a cooling effect, which is even stronger than that of vegetation. Water bodies also absorb heat directly, relieving the surrounding air of the incoming heat from the sun.

Cooling is an increasingly valuable service, since climate change makes cities vulnerable to heat waves. On top of this, city structures generate a lot of heat themselves and have difficulty disposing of warm air. Cities usually have a higher average temperature than their surroundings, with an average yearly mean temperature of 1-3° Celsius higher. In the evenings, the difference can be up to 12° Celsius (US Environmental Protection Agency 2013). This effect is called the 'urban heat island effect,' illustrated by figure 4. The effect is created by the sealing of land by urban built elements like buildings and pavement. This hinders evapotranspiration, and the dark colors of brick, concrete, and asphalt also absorb heat rather than reflect it. On top of this cities are composed of narrow streets lined by high buildings, which form windless 'canyons' where hot air lingers. In many cities these heating effects are added to by heat generating technology and infrastructure like the emissions from air conditioners and cars. In the evenings, when the direct sunlight is gone, the heat absorbed

by the city structures is reemitted and warms up the air, causing the elevated temperature in the evenings (Arrau & Peña 2011). In addition, the higher structures in cities hinder wind from cooling down the city air (Bolund & Hunhammar 1999). Heat is unpleasant and, when extreme, dangerous to human health in itself. On top of this, the urban heat island effect increases the dangers of air pollution by pollutants like carbon dioxide and particulate matter because there is little mobility of air, which makes these particles linger in the city air. These particles in turn trap heat and contribute to the heating effect (Arrau & Peña 2011). Urban green spaces have shown to generate local cooling effects that reduce the urban heat island effect (Wenting et al. 2012).

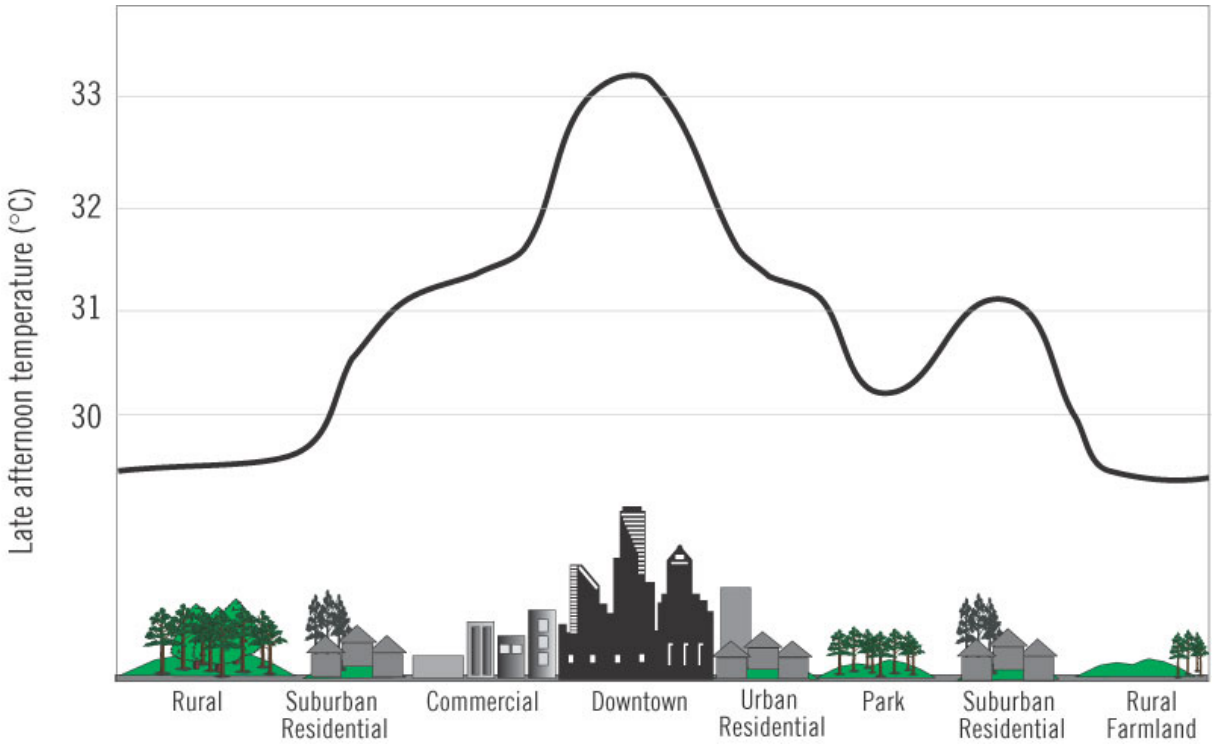

Figure 4: Late afternoon temperature in various landscape types illustrating the urban heat island effect (EPA 2008 in Arrau & Peña 2011)

Secondly, ecosystems can filter air of destructive particles and thereby improve its quality with regards to human health. Especially trees have high air filtering capacity because of their large leaf surface. Urban parks, street trees, green roofs, and urban forests have been shown to filter air and improve urban air quality (Bolund & Hunhammar 1999; Jansson 2012). Some studies estimate that 1 ha of mixed (urban) forest can remove up to 15 tons of particles from the air (Bolund & Hunhammar 1999).

Lastly, urban ecosystems help reduce noise. Cities generate a lot of noise, which can damage hearing as well as the mental health of citizens. Many countries and cities have regulations in place to manage the volume levels of noise in the built environment. Soft ground cover, i.e. a lawn, can decrease noise levels by 3 dB(A) compared to concrete pavement and can therefore contribute to maintaining the maximum noise levels. Vegetation and green walls and roofs also seems to aid in noise reduction, although it is unclear to which extend (Bolund & Hunhammar 1999; Jansson 2012).

Recreation and Mental and Physical Health

In the hectic lives of city inhabitants, the ability to relax and recreate is essential to their mental health and a positive appreciation of their city environment. Chiesura (2004) already showed the psychological importance of urban ecosystems, but Bolund and Hunhammar (1999) also emphasize that exposure to nature reduces

stress levels rapidly. Citizens also positively associate the availability of green space in their environment with their perceived health. Measurable physical and psychological health benefits are associated with urban green spaces, which increase with biological complexity (Jansson 2012). A review by Walter et al. (1999) showed that people who spend nine days in the wilderness came back with more mental energy, more satisfaction, a more positive attitude, less annoyance and in harmony with nature. On top of that, people that have access to a natural view from a building seem to take less time to recover from injury and need less pain medication, be less afraid of the dentist, to have less pre-operative stress, be ill less often when imprisoned, be more focused when studying, and show a decrease in fatigue and head aches.

There seems to be a universal appreciation of people for recreation in natural environments. The 'livability' of a city is often thought to include ample green space for recreation, closely associated with social values, health benefits and aesthetic appreciation. Recreation is the service which is one of the most appreciate services of urban ecosystems and the one for which people are most willing to pay (Chiesura 2004; Jim & Chen 2006b).

Aesthetic Appreciation and Inspiration for Culture, Art and Design

Next to their social and ecological functions, urban parks are valued highly by users for their aesthetic value, perceived not only visually but also with the auditory, tactile and olfactory senses. Aesthetic quality depends not only on the landscape of an ecosystem, but also largely on the personality and socio-economic profile of the observer, on the composition and complexity of the landscape, and the location and conditions of observation (Chen et al. 2009). However, in a review of cultural ecosystem services literature Daniel et al. (2012) show that consensus on the aesthetic quality of landscapes is often greater than disagreement among groups with different demographic or ethnic identities. Citizens generally take the 'scenic beauty' of the natural environment into consideration when choosing both sites for recreation and housing locations (Daniel et al. 2012).

Spiritual Experience and Sense of Place

Individuals and communities associate nature and the natural aspects of their environment with their identities. These environments are often the setting to social and cultural activities, and they provide a backdrop to experiences across generations. The cultural heritage of societies often places high value on specific natural scenes, environments or species (Daniel et al. 2012). Urban parks are often associated with the historical and cultural heritage of a city.

3. ROTTERDAM PARKS

This chapter starts by explaining the most recent numbers on visitation of urban green spaces in and around Rotterdam. It then zooms in on the three focus parks of this study: the Kralingse Bos, Het Park, and the Zuiderpark.

3.1 ROTTERDAM PARK VISITATION

Rotterdam has many green spaces and recreation facilities, which are frequently used by its inhabitants. Examples of these are neighborhood parks, squares with trees and other green units, etc. The city parks, however, are by far the most used green space in Rotterdam. In 2007, 66% of inhabitants visited a city park at least once, though on average people visit city parks 15 times a year (Centrum voor Onderzoek en Statistiek 2008). Figure 5 shows the percentage of inhabitants that visited the six types of most used green spaces at least once a year in 2007.

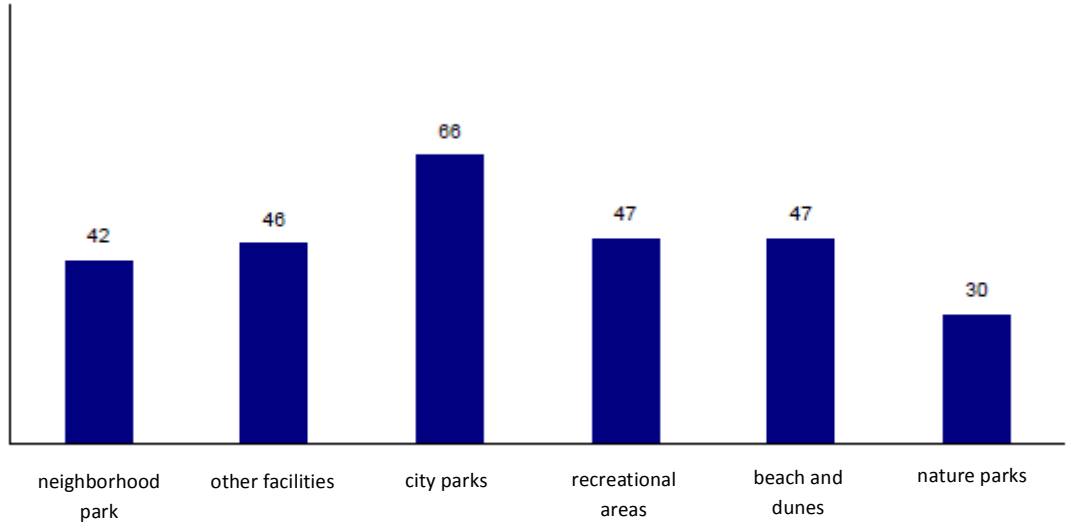

Figure 5: Percentage of inhabitants of Rotterdam visiting varying green spaces at least once a year in 2007 (Centrum voor Onderzoek en Statistiek 2008)

The municipality of Rotterdam maintains 19 neighborhood and city parks within the municipal boundaries. The three most visited city parks were included in the current study: the Kralingse Bos, Het Park, and the Zuiderpark, as shown in figure 6. Figure 7 shows a map of Rotterdam in which the three parks are highlighted. These parks also represent the large variety in urban parks. The Kralingse Bos is a human-made urban forest and quite a large park, including a lake and many facilities (see below). It is near the neighborhood Kralingen, which is one of the few historic neighborhoods of Rotterdam, and has a high socio-economic profile. Het Park is a small, historic, inner-city park. Because of its central location it attracts visitors from various neighborhoods and also people who work, study, or recreate nearby. The Zuiderpark is a large city park with many different use areas, but it is less old than the other two parks. It is located in Rotterdam South, which has a low socio-economic profile and more immigrant inhabitants. The differences in location and nature made the three parks an interesting combination to study, since the demographics and use (and possibly nature perception) of visitors were likely to differ as well.

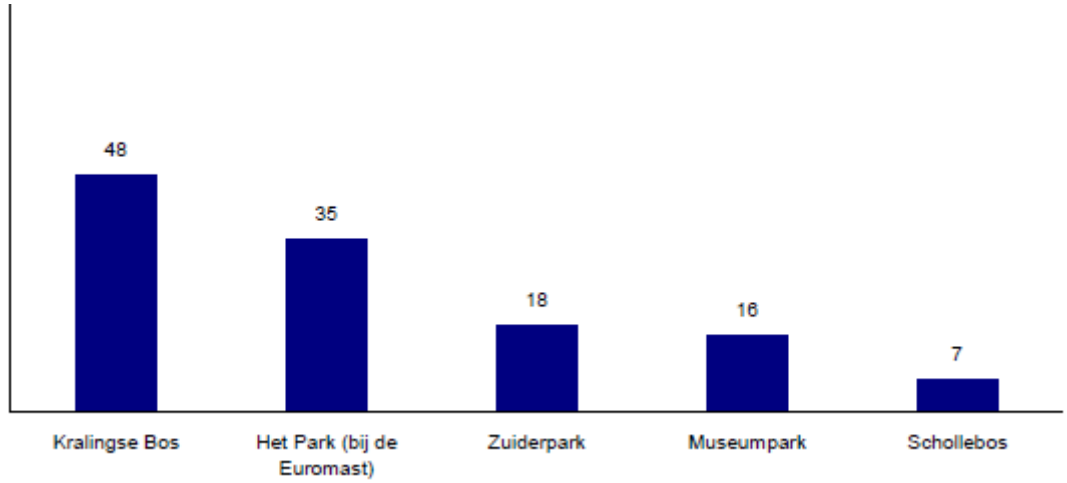

Figure 6: Percentage of inhabitants of Rotterdam visiting city parks in 2007 (Centrum voor Onderzoek en Statistiek 2008)

Figure 7: Rotterdam and surroundings, the parks included in the study are highlighted (Google Maps, 2013)

Men and women visit the city parks in Rotterdam almost equally, but there is a discrepancy between various age groups of users. They are most visited by the age group of 25-44 years old (72% of inhabitants), followed by 69% of inhabitants aged 13-24. Of 45-64-year-olds 61% visits the city parks, as opposed to 52% of 65-75-year-olds. The decline in age groups represented in city park visits in compensated in other recreational and natural areas, where visiting numbers increase with age. City parks are the only areas where the composition of the household does not strongly influence visiting behavior. Factors that do strongly influence visiting behavior are education level and income. The city parks are visited most by people who are highly educated (university level) and who earn more than an average income. Of highly educated in habitants 82% visited a city park in 2007, versus 54-68% for groups with various lower levels of education. Of those who earn up to twice the average income 69% visit city parks and of those who earn more than twice the average income 74% visits the parks. The minimum and average income groups visited the parks 61% and 63% respectively. These trends in education and income levels of visitors is present in the visitation numbers of all green facilities, but strongest

in city parks and larger natural areas. All in all, the group that is represented best in the park visitation numbers is 13-44 years of age and highly educated (Centrum voor Onderzoek en Statistiek 2008).

3.2 KRALINGSE BOS

The Kralingse Bos is the largest park in the Rotterdam area on the edge of the city and contains a lake of 100 hectares and forested area of about 200 hectares. The park was created by the municipality around the existing lake, which appeared because of the peat extraction in the area. The first trees were planted in 1911, and after the interruption of the First World War the forestation was used as an employment project in the 1930s. The park was officially opened in 1953 (Gemeente Rotterdam 2007). The park is close to wealthy neighborhoods and the university area, but people travel from beyond these areas to visit. This most visited park or the city is used for a large variety of recreational purposes throughout the year and was elected the 'best public space in the Netherlands' in 2009. The park has many facilities and organizations for a range of recreational activities, including:

- Walking, jogging, cycling, horse riding and skating routes
- Sport leagues
- Beaches including large playground, paddling pool, and nudist area
- Harbor for sailboats and yachts
- Petting zoo, aviaries, deer area
- Information center and educational garden
- Botanical garden including swamp area
- Fishing pier
- Horse riding school
- Golf court
- Historic wind mills
- Barbeque and picnic areas
- Cafés and restaurants (Gemeente Rotterdam 2013)

The forest, maintained by the municipality, was previously maintained in traditional city park fashion by removing dead wood and carefully mowing and cleaning out lawns. Nowadays a more ecological approach is used in order to stimulate species diversity and ecosystem balance (Gemeente Rotterdam 2007).

Figure 8: Map of the Kralingse Bos and Lake (Gemeente Rotterdam 2007)

3.3 HET PARK

The second park is simply known as Het Park ('the park'), because it is the oldest city park of Rotterdam, built in 1863. It is a smaller park in the center of the city, along the river. The park contains grass fields, many species of trees, some small waterways and a small historical garden. It is often used for walks, picnics, and sunbathing, but also for many festivals and other events. Because of its location in the city center and the early origins, Het Park contains several national monuments and is part of the cultural heritage of the city. These monuments include 18th and 19th century mansions, a traditional Norwegian sailor church (gift of the newly independent state of Norway in 1914), statues of historic figures, and the modern Euromast tower. The park includes five cafés and dining facilities and a barbeque zone (Gemeente Rotterdam 2013).

Figure 9: View of Het Park, the Maas River and Rotterdam from the Euromast tower (Gemeente Rotterdam 2013)

3.4 ZUIDERPARK

The third park that was included is the Zuiderpark, a large park in the South neighborhood of Rotterdam, which is known as the least wealthy quarter of the city with a few problematic areas and an overall lower socio-economical status than the rest of the city. The park is situated close to the Ahoy events center and an area where carnivals, circuses and festivals are often held. With its 215 hectares the park is the largest city park in the Netherlands, designed in 1951. In recent years many elements of the park were changed and facilities added to speak more to the local community, as well as connect to other green areas and waterways of neighboring regions. The Zuiderpark contains a large amount of accessible recreational facilities, including:

- Two kilometer long promenade
- Large playground
- Beach
- Swamp and forest areas
- Outdoor fitness machines
- Allotment gardens
- Water, islands, canoe facilities, fishing pier
- Adventure point (community activities)
- Outdoor art spaces
- Sport leagues (e.g. soccer, tennis, netball, handball)
- Sports plaza with freely accessible turf and asphalt fields, basketball courts, tennis courts
- Petting zoo
- Skate park
- Historical garden
- Restaurants and cafés
- Barbeque zones
- Educational center and informative GPS route
- Dog walking areas (Gemeente Rotterdam 2013).

Figure 10: Map of the Zuiderpark (Gemeente Rotterdam 2013)

4. MEASURING NATURE PERCEPTION

This chapter explores the various ways to measure and explain citizens' perception of nature and ecosystems, with a focus on urban parks. First, the chapter will outline the concepts spatial quality and values that are used to indicate the landscape quality of (urban) green space and the manner in which these concepts are linked to perception. Then several examples of survey methods are highlighted that show how various types of questionnaires are used to study urban green space user perception, including some of their results relevant for the current study. The chapter goes on to explain several types of monetary valuation illustrated by examples relevant for the urban green space context. Lastly, this chapter will introduce Q methodology and explain the choice for this method in the current study.

4.1 SPATIAL QUALITY AND VALUES

In the Netherlands, regarding nature planning in cities or municipalities, many studies and policy documents have focused on spatial quality and values as indicators for this quality. Spatial quality is often not very clearly defined (Bulkens 2006). In a key publication the Dutch Council of Advice on Spatial Development (RARO) considered spatial quality to consist of at least these three key values: use value, experience value, and future value (RARO 1990). This classification of values can be found in several other publications with or without links to policy and planning (Bulkens 2006). Another classification spatial quality is that of the *Nota Landschap* as described by Van Zoest (1994) and developed for landscapes in general, not limited to cities. Van Zoest explains landscape quality as "the degree in which the physical characteristics of the landscape connect to the pattern of interests – needs, values – of the user or user group".

Environmental psychology has looked at the way in which people observe and value their surroundings. Environmental psychologist Coeterier (1992) states: "Quality of surroundings is more than just spatial quality. It also includes developments in time, forms of maintenance, sensuous experiences, use and use options, etc." (in Dijkstra & Klijn 1992). Qualitative research in this field by Kaplan and Wendt has formed the basis of a model of landscape preference, which states landscape quality is judged by its cohesion, complexity, understandability, and mystery (Dijkstra & Klijn 1992).

In the context of spatial quality, there are many thoughts and theories on the way people value their natural surroundings. One example is given in Paasman et al. (1999), which states that people value nature because it enables them to escape from everyday reality. The parameters that enable this escape are 'amusement' (a 'normal' walk in the neighborhood), 'change' (different atmosphere from busy daily life), 'interest' (searching for things one does not find in daily surroundings), 'rapture' (delightful confrontation with the 'other'), and 'control' (need to grasp and maintain nature). This is in line with the observation by Jacobs et al. (2003) that people want an increasingly intense experience of nature because of the increased pace of society.

As the abovementioned documents show quality and values are interpreted in many different ways, described with different terminologies, and are often determined by scientists and planners without a clear translation to or from citizens' perception. Some studies in this trend do map preferences, attitudes or values of citizens, like that of Reneman et al. (1999). They show the preferred types of natural (rural) areas of citizens, and show that people prefer those intrinsic characteristics of nature that they cannot experience in their daily surroundings, e.g. high valuation of silence and tranquility by urban residents. Unfortunately, this study does not specify the qualities underlying the survey or why certain aspects were selected for inclusion (Bulkens 2006).

There are literature reviews that combine scientific frameworks of quality with behavior studies, like that of Pronk et al. (1997), but the goal of this study is to come to a framework of analysis of the attractiveness of various urban parks without explicitly looking at the perception of the users of these parks. Other studies that do interact with users are often focused on identifying which design aspects people appreciate (like vegetation

diversity, amenities, complexity of landscape, sense of safety, etc.) (Bulkens 2006). The current study aims to use a different framework at the onset (ecosystem services rather than spatial quality), because of the origin of spatial quality frameworks in a tradition of landscape design and urban planning. Instead of focusing on the perception of landscape design and use aspects, this study aims to understand user perception of natural benefits of urban parks to people.

4.2 SURVEYING PERCEPTION

Studying the user perception of urban green spaces is usually done by measuring the users' self-reported behavior and values. Research has mostly studied perception through value-attitude or attitude-behavior linkages, seeing as attitude cannot be measured directly. In this context attitude is seen as "a learned and summary evaluation that influences thoughts and actions" and values are "consistent knowledge and belief about the worth and importance of an object" (Balram & Dragićević 2005). Many studies with this aim use structured questionnaire survey methods. A much cited study on urban parks by Chiesura (2004), also mentioned above, uses a survey method to gather value-attitude results about motives for nature (why do people visit the park?), emotional dimension and perceived benefits (how do people feel in the park?), and public satisfaction about the amount of green areas in their city. The survey was done in the Vondelpark in Amsterdam, a large urban park created in 1865 that attracts roughly 10 million visitors a year. The questionnaire distributed to 750 park users was composed of questions with a closed (dichotomous or multiple choice), ranking scale, or open response format. The three most prevalent motives for nature were 'to relax' (73% of respondents) and 'to listen and observe nature' (54%), and 'to escape from the city' (32%). To understand the emotional responses of park users they were asked which feelings nature evoked in them. 'Freedom' was the most reported experience (64% of responses), followed by 'unity with nature' (43%). Factor analysis on the responses to this question revealed two factors that Chiesura dubbed 'recreation' and 'spirituality.' The responses 'freedom,' 'happiness,' 'luck,' and 'adventure' load under the factor that represents the recreational aspect of nature itself, as a provider of a sense of relaxation, regeneration and joy. The spiritual element was represented by the responses 'unity with self' and 'unity with nature,' and reflects the need to reach higher states of mind, for meaning, harmony and tranquility. When asked to score the importance of these feelings to their daily wellbeing, 94% of respondents rated them important to essential.

An interesting methodological aspect to Chiesura's (2004) study is the use of a questionnaire for both quantitative and qualitative data collection and analysis. Alongside the quantitative analysis shown above, Chiesura constructs narratives around responses of both the closed and open-ended questions. The main dimensions underlying the open reflections on nature and the park were 'restorative' (regeneration, restoring psycho-physical equilibrium), 'amenity' (diversion from everyday life, recreation), and 'spiritual' (nature as a driving force, essence of human existence).

Jim and Chen (2006a) used a survey to study knowledge and perception of ecosystem services, attitudes to green space conditions, expectations of landscape design, and venue preference of urban green spaces in Guangzhou, China. Recognition and perception of urban green space benefits and negative impacts was measured on a scale of -1 to 2: not important (-1), unclear (0), important (1), and very important (2). 81% of respondents rated the ecosystem services as important to very important. The most valued groups of ecosystem services were amelioration of urban microclimate (incl. shading, oxygen release, lower air temperature, etc.), and environmental quality (incl. air pollutant absorption, noise abatement, etc.). Most ecosystem functions that are psychologically remote to citizens, in comparison to health and comfort benefits, got low scores in the survey. This supports the scope chosen in the current study, which excluded ecosystem services that cannot be directly perceived. One exception in the survey results of Jim and Chen (2006a) is oxygen release and carbon dioxide sequestration, which got very high scores. Jim and Chen suggest that this result, in combination with the high scores for local air quality control benefits, is due to the recent aggravation of air pollution in Guangzhou that may have increase environmental awareness and concern on air quality

topics among citizens. Other benefits with high scores include 'aesthetic enhancement,' 'places for recreational activities,' 'opportunities to know and contact nature,' and 'soil erosion prevention.' Respondents rated services as unclear most often in the environmental function group (>12%), further supporting the claim that many regulating and supporting ecosystem services are far from citizens' frame of reference.

Chen et al. (2009) used a survey to study aesthetic user preferences in Hangzhou Flower Garden in Hangzhou, China. Respondents identified the most important reasons for their appreciation of the garden to be 'scenic beauty' (42%), 'a suitable environment to relax' (27%), and 'peace with nature' (19%). Respondents were also asked about their (aesthetic) perception of the park through other senses than vision. The results showed that the natural garden sounds (mostly birds) as well as the music on the garden's sound system were more prominently heard that the background noises of the city, which only 9% of respondents said was the most dominant sound they heard. A large majority of respondents (90%) identified olfactory input when visiting the garden, of which 70% reported 'good smells' from flowers, grass, and water. 62% of respondents agreed some things in the garden would be appreciated more if touched. They listed water, tree barks, rocks, sculptures, flower petals, pebbles and turf as structures in the garden that would be pleasant to touch. This study shows that even when studying a limited element of an urban green space (in this case aesthetic perception), it is valuable to look at the wide range of aspects it contains. The current study tries to take this into account by fine-graining the ecosystem services studied into subservices.

Other survey methods used in this field of research include integrated questionnaire and collaborative GIS techniques to capture spatial data and knowledge (e.g. Balram & Dragićević, 2005) and surveys combining observed and self-reported behavior or green space use (e.g. Peschardt et al. 2012).

4.3 MONETARY VALUATION

In order to identify the public perception of nature or urban parks, monetary valuation methods are increasingly often used to express the value of a park. TEEB is one of the mainstream projects that worked with valuation methods to put a monetary value on natural systems and services, but a lot of research has been done in urban settings and with park users specifically. For instance, Jim and Chen (2006b) used questionnaires with willingness-to-pay (WTP) and open-ended payment card approaches in Guangzhou (China) to estimate the monetary value of the non-priced benefits of urban green spaces in the city. This study showed that respondents used green spaces actively, with a preference for urban parks. Most parks in Guangzhou charge entrance fees, which probably caused the higher than average WTP (in comparable research in other cities and countries) by the respondents. The average WTP was US$ 2.11 per person per month, higher than the actual entrance fee, although significantly associated with respondent income. Aggregate WTP for the green spaces in this study was US$ 66.2 million per year, which was six times larger than the city's annual expenditures on these spaces. According to the authors, these results plead for Guangzhou to attribute more resources to its green spaces ((Jim & Chen 2006b).

The abovementioned method is an example of contingent valuation. It asks people either how much they would be willing to pay to preserve an environmental unit or feature (like Jim & Chen, 2006b) or how much money they would be willing to accept (WTA) if compensated because of the loss of this feature. This method is often referred to as the stated preference method, in contrast to the revealed preference method. In revealed preference the actual expenses made by users of an environmental unit or function are used to estimate its value. One revealed preference method is hedonic pricing, which uses the sales prices of properties (like residential homes) with different levels of amenity of a certain ecosystem (service) to determine the value of this ecosystem or service (Boardman et al. 2011). Sander and Haight (2012) used hedonic pricing in Dakota County, Minnesota to estimate the value of nearby natural recreation areas, views of natural elements, and neighborhood tree cover.

Many other studies use WTP surveys and hedonic pricing methods to indicate the value of an urban green space (Lo & Jim 2010; Brander & Koetse 2011). Brander and Koetse (2011) found over 90 published studies concerning open space valuation between 1980 and 2011. Their extensive review of both hedonic pricing and contingent valuation studies concluded that the mean value of forest in 2003 was US$ 1500 per hectare per year. The value of urban parks is higher, but decreases with the size of the area. While these are interesting indications of value, they do have to conclude that the different valuation methods reviewed do not lead to similar value estimates and are thus only very rough estimates of value.

Other authors also claim that one should be careful to draw conclusions about the value of a natural element, system or service like Jim and Chen did. As Gómez-Beggethun and Barton (2012) state, the values of ecosystem services are greatly dependent on the conditions and scope of the study. They argue that social valuation processes often involve multiple and conflicting valuation languages and methods, which they dubbed the 'value pluralism' perspective, and should only be used to inform decisions, not be presented as single metrics data like that of Jim and Chen (2006b) above. Gómez-Beggethun and Barton (2012) identify a range of valuation methods for various ecosystem services, including expenditure or replacement costs for regulating services, insurance value, travel cost method, hedonic pricing, and stated preference methods. They continue to discuss the challenges when using these methods in an urban setting at different scales. Considering cultural ecosystem services Gómez-Beggethun and Barton (2012) state these cannot be captured adequately by the abovementioned monetary methods or metrics. This is exceptionally difficult in urban areas, where the high cultural, religious, and social heterogeneity leads to diverse values of community, sense of place, spiritual experiences, etc. Other researchers support their criticism (Spangenberg & Settele 2010; Wegner & Pascual 2011). Spangenberg and Settele (2010) make an elaborate argument against using monetary valuation to express or indicate the value of nature and ecosystem services because there is "no sound way of calculating the value of ecosystem services." They say that aggregated value indications can be good alarm bells to actors, but that they do not indicate political priorities. The varying reasons why people use a space and their opinions about its function are also not revealed by monetization methods, which is why this study takes a different approach.

4.4 Q Methodology

As shown above, there are a multitude of methods available that can be used as indicators of perception. Questionnaire surveys and monetary valuation methods provide the researcher with quantitative data about the self-reported behaviors and attitudes of their participants. The goal of the current study is to harvest the individual perceptions of people. These perceptions are important drivers of use of parks, and can provide policy makers with valuable information about the identity of a park and the benefits perceived by citizens concerning urban parks. The previously mentioned methodologies usually ask a participant to choose from a variety of answers, rate statements on a scale or give them values, which in their own right have meanings associated with them that cannot be accounted for by the researcher. In the analysis phase, the responses between questions and participants sometimes need to be averaged or grouped in order to create results, losing some of the participants' individual and personal position in the process.

An example of this process is given by Brown (1980): in British and American political science liberalism and conservatism are often measured on a continuum from left-wing to right-wing. When testing participants' political preference they are given statements from both ends of the scale and each respondent receives an average score and a corresponding place on the continuum. This gives the impression that the left-right scale exists in reality whereas the results are an artificial distillation of the possibly more complex individual perceptions and opinions of the subjects, created by the methodology.

Measuring subjectivity in a structured way that provides personal, qualitative data can be done with Q methodology. Originally developed by physicist and psychologist William Stephenson in the 1930s the Q technique was designed to "assist in the orderly examination of human subjectivity" (Brown 1980). Q

methodology can reveal perspectives without having to impose predefined categories on the subjects. The categories of analysis can be manipulated by the participants and because of this the power to signify reality is no longer merely with the researcher (Cuppen et al. 2010).

Q methodology studies people's individual viewpoints or perceptions, by presenting an inverted factor analysis; inverted in the sense that Q correlates with persons instead of tests (Van Exel & De Graaf 2005). Correlations between personal results group respondents according to similar viewpoints, or the segments of subjectivity that exist. In this way, Q methodology provides information about similarities and differences within a range of perceptions. Consequently, Q methodology can be used to describe a population of viewpoints rather than a population of people (Van Exel & De Graaf 2005). Q analysis will identify the common perceptions towards an issue, and thereby show the variety of human perception profiles concerning the topic at hand. By creating statements that relate to specific ecosystem services, perceptions and ecosystem services can be linked. In this way Q methodology aims to reveal the variety of perspectives on an issue (Cuppen 2009).

Q methodology is based on the assumption that there is a limited set of viewpoints people have on a certain topic, and has the advantage that it does not need many participants per 'viewpoint'. This means the sample size can be small. One of the challenges of Q methodology is the setting of the Q set, or the statements that are used in the experiment. These are always relative to the selected concourse, which is supposed to represent the topic. The choice for the concourse and the statements used in the Q set is always with the researcher, and therefore represents the framing of the experiment. Further challenges include the interpretive nature of the Q analysis. As will be explained below, the extraction of factors is partly an intuitive process (Davies & Hodge 2012).

5. METHODOLOGY

This chapter describes the methodology used in the study step by step. The development of the Q set of statements is described. Then the chapter goes into the experimental design and lastly into the details of the analysis of the results.

5.1 DEVELOPMENT OF THE Q SET

In a Q methodological study a set of respondents, referred to as the P set, is presented with a set of statements about a topic, called the Q set. The respondents are asked to rank the Q set statements from their own point of view in order of preference or judgment (usually ranging from 'agree' to 'disagree') using a normal distribution. The setup of the current Q methodological study was done following a series of steps based on the Q methodology development description of Van Exel and De Graaf (2005), yet adapted to the context of this study:

1. A Q set is developed on the basis of the concourse, the conversational discourse, surrounding the topic at hand. The concourse is a collection of all the possible subjective statements, pictures, etc. about the topic at hand, developed on the basis of discourse analysis, tests interviews, (popular) literature research, and other methods. The researcher then draws a representative set of statements from the concourse to form the Q set. In this study the concourse was created on the basis of terms and statements used in the TEEB Manual for Cities (2011), the URBES park survey, the literature research done for this study, and test interviews and free association exercises about parks and associated ecosystem services done by me and a selection of my colleagues and acquaintances.

2. From the concourse, an initial Q set was developed. Multiple statements were formulated associated with each of the following fine-grained ecosystem services: recreation, social connection, mental and physical health, aesthetic appreciation, inspiration, spiritual experience, sense of place, air quality control, noise reduction, and thermal comfort. The short statements were formulated in everyday language without the use of jargon, so as to speak to the perception of all participants. The statements were formulated in active and first person form in order to create a connection between the statements and the subjective experience of the participants. In each statement the words 'this park' or 'an environment like this' were used in order to clarify that the statements were meant to be associated with the park the participants were currently visiting.

3. These statements were tested with several external contacts (with various backgrounds) to see if they could understand and relate to the statements, and if any difficulties arose with the methodology. Some statements were adapted based on these interactions.

4. For each fine-grained subcategory of ecosystem services one to four statements were selected which were deemed to cover the various aspects of perception of the ecosystem subservice.

5. Those statements that related to the non-natural elements of the park (other visitors, utilities like park benches, recreational services like restaurants) were excluded from the Q set in order to focus on the natural ecosystem elements of the parks. The 26 remaining statements of the Q set are presented in appendix II (Dutch) and their translation in appendix III (English), in which the statements are grouped per subcategory of ecosystem service. Note that Van Exel and De Graaf (2005) state that different Q sets on the same topic can be expected to arrive roughly at the same conclusions, since they accumulate around fixed attitudes of the P set on the topic.

6. The statements were randomly assigned a number and printed on separate plasticized cards with magnets: the Q deck. A magnetic blackboard was used for the sorting task (explained below), with the sorting structure drawn in chalk on the board. These instruments were developed because of the outdoor, on-site nature of the study. A picture of the Q sorting chart is attached in appendix IV, and photograph of the Q deck cards and board used in the field can be found in appendix V.

5.2 Q SORTING

In order to get the desired results, Q methodology does not need a large set of participants. The P set usually contains of roughly four or five people per anticipated viewpoint, which are often two to five. Because there was no indicator of the variety of viewpoints among the participants, this study used a P set of 39 respondents: 13 in each park.

The respondents were asked to partake in the Q sorting task in the park to which the statements referred. Because of this, the Q sort was done offline, outside and the interview time was limited to 5-10 minutes. The subject was presented with the Q deck and asked to sort these from 'agree least' to 'agree most' on the blackboard. They were told there are the same amount of cards and sorting boxes, so they need to fill up the entire board. After the sorting task they were asked for their year of birth, area of residence (postal code), travel time to the park, mode of transportation and average visitation behavior throughout the year.

The interviews and Q sorts were done in January, February, and March of 2013 on weekdays between 10 AM and 5 PM. Every respondent that walked by was asked to participate, regardless of their gender or other aspects, or whether they were part of a group or not.

5.3 Q ANALYSIS

For the analysis of the Q sorts the MS-DOS software *PQ Method* was used. The analysis run on the data set was done in seven steps:

1. After entry of the Q statements and Q sorts, the software created a correlation matrix of the Q sorts by calculating the levels of agreement between them.

2. Factor analysis was run on the correlation matrix to identify groupings of Q sorts that showed similarities. Similar Q sorts would have the same factor. PQ Method gives various methodological options for factor extraction, mainly centroid analysis and principal component analysis. In Q analysis centroid analysis is commonly used and was therefore chosen in this study. The 'Brown approach' to centroid analysis was chosen in this case, which extracts seven factors by default.

3. The centroid analysis determined a factor loading for each Q sort to express the extent to which the Q sort was associated with each of the seven factors.

4. Next, the factors were rotated by hand. Whenever two factor loadings of a Q sort were close together and the dominant factor loading was ambiguous, these two factors were rotated with respect to one another to try and dissolve the ambiguities. This was done for most factor combinations until as much of the ambiguity as possible was removed.

5. After factor rotation, each Q sort was 'flagged.' Flagging is the allocation of a Q sort to one factor. The factor loading of each Q sort after rotation for all of the factors was considered, and the Q sort was allocated to the factor for which it had the highest factor loading. Note that a Q sort is associated with one factor in this process, but that it is possible to have a significant factor loading on more than one factor (especially if the factor have similarities as is the case in this study). During this process two factors were eliminated because no Q sorts were allocated to them.

6. A factor score was calculated for each Q statement. A factor score is the normalized weighted average statement score (Z-score) of respondents that define that factor. These Z-scores rank the statements according to saliency for each factor. Factor scores point out the characterizing statements that help best interpret the factor.

7. Finally, the factor rotation was done again in a different way, to control the results of the rotation by hand. This time, Varimax rotation was used. This is an automatic orthogonal rotation style that uses the so-called 'Varimax criterion' to rotate the factors to. The software performed this rotation and automatically flagged the Q sorts that had a distinguishably high factor loading for one factor. This analysis was only used to verify the analysis done by hand and showed no substantial differences.

6. RESULTS AND INTERPRETATION

This chapter first introduces the results of the study by showing some data on respondent demographics and self-reported park use. The results or the Q analysis are then shown. The third part of the chapter gives an interpretation of the results by creating perception profiles for each of the factors found in the Q analysis and linking these profiles to the demographic and park use data.

6.1 RESULTS

Demographics and Park Use

In each on the three parks 13 people participated in the study, adding up to a total number of 39 respondents or a P set of 39. Slightly more men participated in the study (61.5%), especially in the Zuiderpark. For a presentation of gender and age groups of the respondents in each park, see figures 11 and 12.

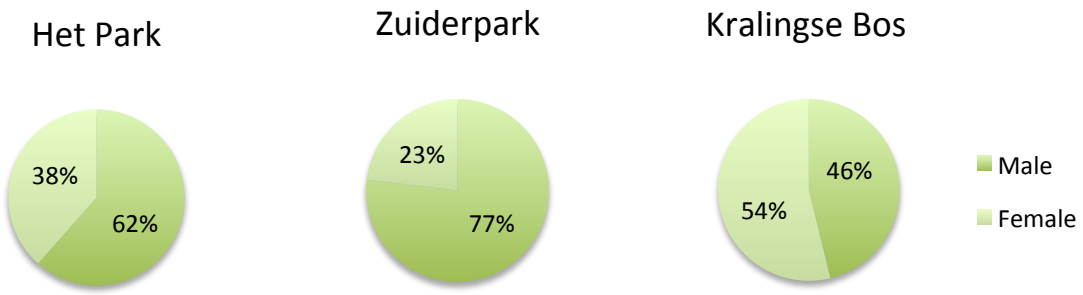

Figure 11: Percentages of male and female respondents for each park

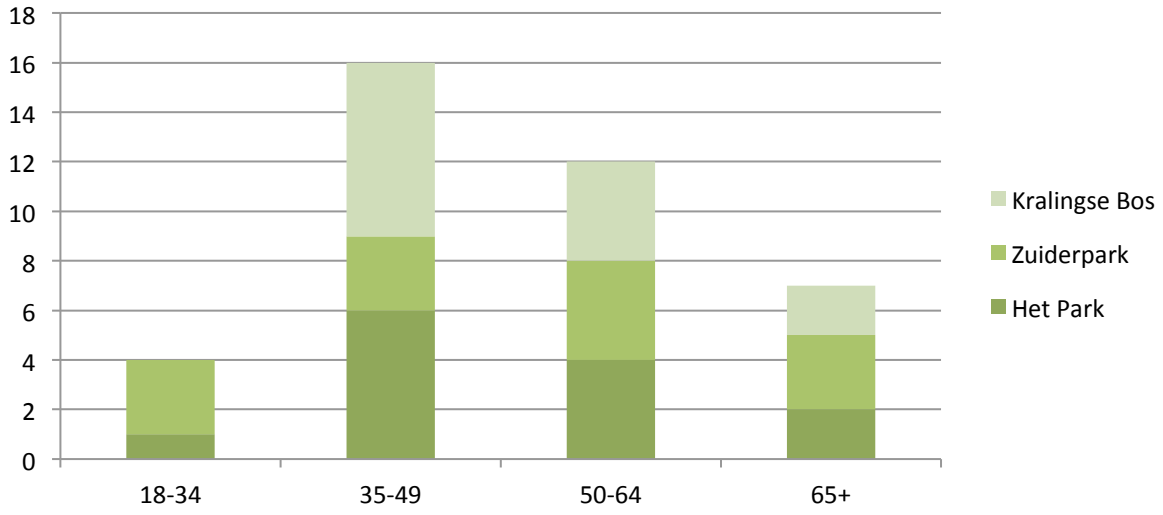

Figure 12: Number and age of participants in the selected parks

Most of the questioned visitors lived close to the park they were visiting. Of the users of Het Park questioned over 40% came from other areas than the center and West areas of the city, including 30% from other towns than Rotterdam. For a detailed overview of the living area of respondents, see figure 13.

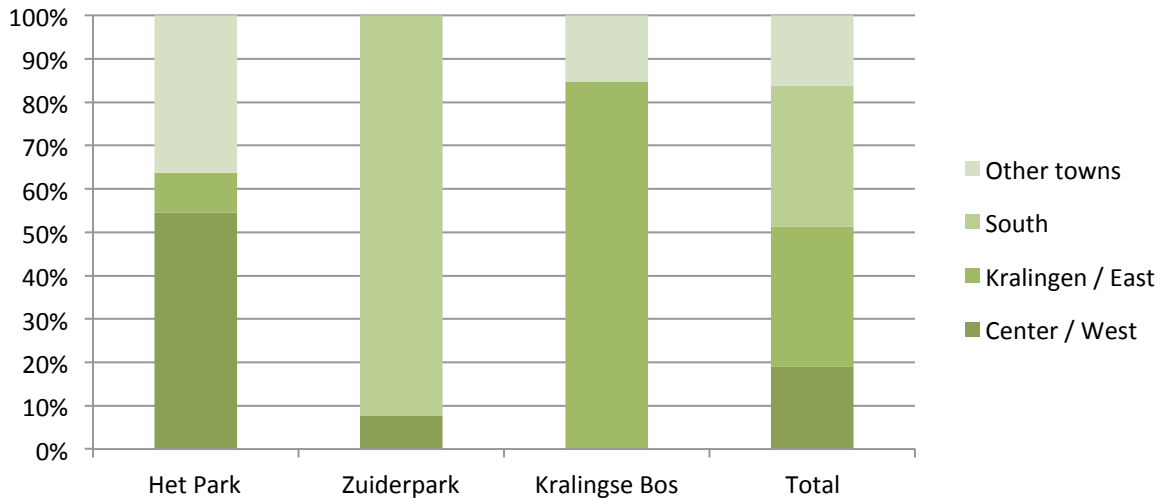

Figure 13: Living area of respondents per park and total, with the Northern city regions divides in West and East

As figure 14 shows, a large majority of the respondents visited the park in which they were questioned at least several times a week or even daily. These findings were consistently present in all three parks. 62.2% of the respondents said their visitation frequency did not differ per season. Of the ones who reported seasonal differences in their visitation behavior 85.7% stated they visited more often in spring and summer, whereas the other 14.3% said they visited less frequently in these seasons. In cases where respondents reported different visitation frequencies per season on a daily, weakly or monthly basis the researcher calculated the total yearly visits based on 22 warm (spring/summer) weeks and 30 cold (fall/winter) weeks a year, based on the Dutch weather and climate patterns.

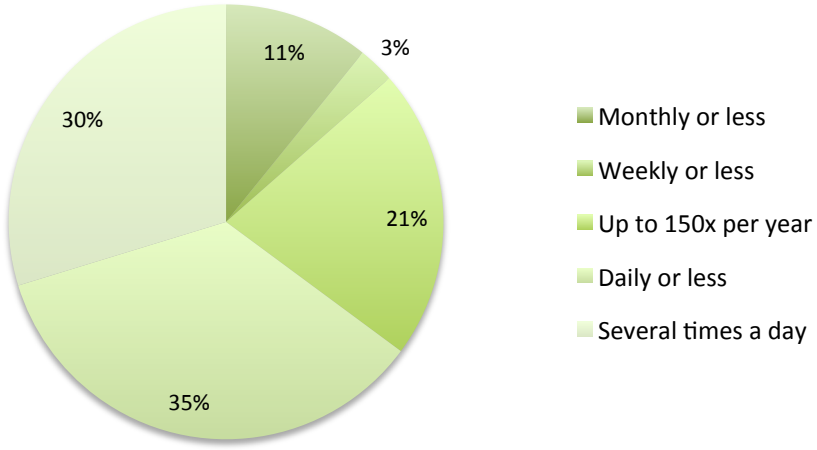

Figure 14: Reported visitation frequency of the specific park by respondents

Correlation Matrix

After the flagging of the Q sorts (of which and overview can be found in appendix VI) five factors remained. The correlations between the factor scores of the factors can be found in the correlation matrix in table 2.

Table 2: Correlation matrix of factor score correlations between factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1.0000	0.4836	0.3860	0.4435	0.2833
Factor 2	0.4836	1.0000	0.2617	0.2822	0.3089
Factor 3	0.3860	0.2617	1.0000	0.3530	0.1355
Factor 4	0.4435	0.2822	0.3530	1.0000	0.2397
Factor 5	0.2833	0.3089	0.1355	0.2397	1.0000

Factor Representation

Some factors associated with more Q sorts than others. The number of Q sorts allocated to each factor can be seen in figure 15. The representation of factors among the different parks can be found in figure 16. Statistical analysis by means of a X^2-test was attempted to see if there were any correlations between the factors and the parks in which users were questioned, but the sample size proved too small for this type of analysis. The same was true for any analysis done on demographics and factors.

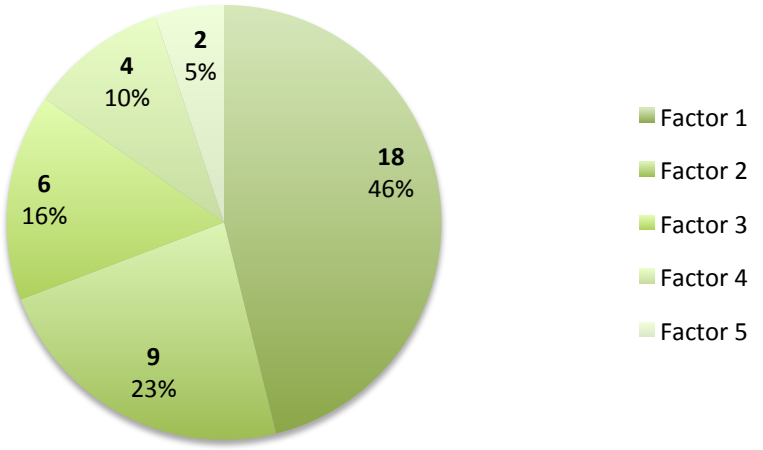

Figure 15: Number and percentage of Q sorts per factor (N = 39)

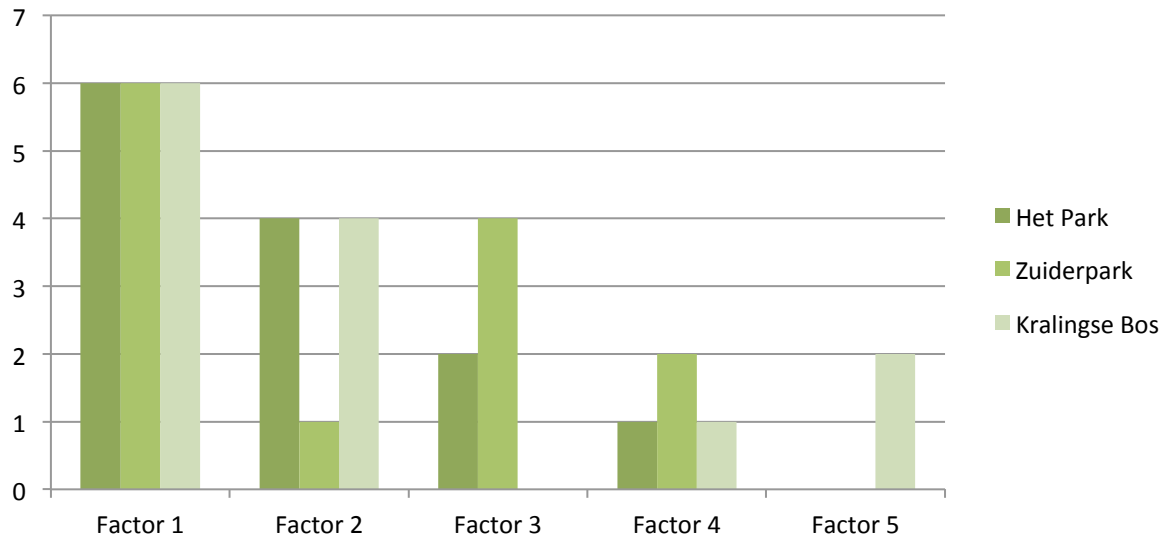

Figure 16: Number of Q sorts per factor for the selected parks (N = 39)

6.2 INTERPRETATION

Factors

Conventional factor analysis is used to describe variability among correlated variables to reveal a lower number of unobserved variables. These last variables are the factors. In the case of Q analysis, factor analysis is reversed and used not to determine the variability among observed variables, but among participants. The factors in this case represent a group of respondents that show similarity in their responses.

Some of the five factors found in this study correlate more closely to one another than others, as can be seen in the correlation matrix above. Despite some of the closer correlations, however, no two factors correlate very strongly since all factor scores are smaller than 0.5. This makes all five factors valid and shows they are different enough to deserve their own identity and profile.

Perception Profiles

Each factor is associated with a profile of park perception. The saliency of each statement for each factor was used to create a narrative of the park perception for each profile. This profile is made for the 'ideal' respondents for this factor. Note that no respondent's Q sort fully represents any of these factors, and thus profiles. All respondents score on each of the factors and are associated with all of them to some extend.

Factor 1 profile: 'love of nature'

People associated with factor 1 are nature lovers. They enjoy the beauty of nature, the natural sounds, and fresh air in the park. They experience the park by walking or sitting in it, enjoying the various species of plants, trees, and animals around them. When they are in the park they feel healthy, energized, and connected to their surroundings. They do not come for their children or to meet others and they do not specifically come in warm or cold weather. They simply come to take in their natural surroundings and appreciate them in all their richness.

Table 3: The five most salient statements for factor 1

Statement	Z-score	Ecosystem subservice
I enjoy the natural beauty of this park	1.391	Aesthetic appreciation
I find the natural sounds of this park more pleasant than those in the city	1.351	Aesthetic appreciation
I go to this park for fresh air	1.340	Air quality control
I like to sit or walk in this park (e.g. lunch, reading, walking dog)	1.223	Recreation
I enjoy the various trees, plants and flowers in this park	0.940	Aesthetic appreciation

Factor 1 was represented in equal numbers of respondents in all three parks (see figure 16). 61% of the respondents (N=18) associated with factor 1 was male and 39% female, which is the same ratio as the total sample. All age groups were represented in this factor, with the 35-49 and 50-64 as the largest groups of 33% and 39% of respondents respectively. Compared to the representation of age groups in the sample as a whole, the 50-64 group (31% overall) is slightly larger and the 35-49 group (41% overall) smaller. Respondents are represented from each of the residence regions with no striking differences to the overall sample; the same holds true for visitation frequency.

Factor 2 profile: 'recreation & connection'

The people associated with factor 2 experience the park as a haven for recreation and revitalization. They feel a strong connection to the park, and use it for active and passive recreation. They enjoy the fresh air and the plants and trees when they sit or walk in the park, and they bring their (grand)children to play and ice skate with. They feel recharged and energized after a park visit, even though they do not use it to exercise or meditate.

Table 4: The five most salient statements for factor 2

Statement	Z-score	Ecosystem subservice
I feel connected to this park	1.567	Spiritual experience and sense of place
I find the natural sounds of this park more pleasant than those in the city	1.302	Aesthetic appreciation
When it freezes I like to come to this park to ice skate or be in the snow	1.247	Recreation
I like to sit or walk in this park (e.g. lunch, reading, walking dog)	1.149	Recreation
I go to this park with my children to play or walk	0.759	Social setting

As can be seen in figure 16, factor 2 is present more in Het Park and the Kralingse Bos than in the Zuiderpark. This might be due to the fact that the Zuiderpark is the newest of the three and has been recently renovated. The historical connection to this park might be less present because of this than with the other parks. The respondents (N=9) represented by this factor were 22% male and 78% female, which is a large difference compared to the total sample. The age group 18-34 was not represented, 35-49 comprised 44% of the group, 50-64 22%, and 65+ 33%. Especially the last group differs from the total sample, in that it is represented more.

The most represented living region in this group with 63% is Kralingen, known as the wealthy, historic neighborhood of Rotterdam. None of the respondents in this group visited the parks less than weekly. It seems like this is a group of mostly well-off elderly people (the majority women), who feel connected to and recharged by the historical parks in the city.

Factor 3 profile: 'social setting & relaxation'

The park users identified with factor 3 see the park as a quiet oasis within the city: a place to relax, to meet people, and to play. They are fair weather users who come to the park most often to enjoy the sunshine and to have a pick nick or barbeque with their children, family, or friends. They sit or walk in the park to enjoy the air and sounds that are more pleasant than those of the city and feel like they entered a quiet zone. In this oasis they can recharge their batteries and empty their minds. This feeling of calmness increases their respect for nature.

Table 5: The five most salient statements for factor 3

Statement	Z-score	Ecosystem subservice
When the weather is nice I come to this park for a pick nick or barbeque	1.429	Social setting
I come to this park to enjoy the sunshine	1.240	Thermal comfort
I prefer the air in this park to that on the street or indoors	1.182	Air quality control
I find the natural sounds of this park more pleasant than those in the city	1.171	Aesthetic appreciation
I experience this park as a quiet place within the city	1.159	Noise reduction

From this factor on it is difficult to generalize on the respondents' demographic and visiting information, since the sample sizes are smaller than those of the first two factors. Nonetheless, the general data will be discussed here. Of the respondents in factor 3 (N=6), 83% was male and 17% was female. The youngest three age groups were represented by 17%, 50% and 33% respectively, making 35-49 the most present group. 40% of the respondents lived in the center or Western part of Rotterdam, whereas 60% lived in Rotterdam South. This corresponds to the fact that this factor was only present in the interviews done in Het Park and the Zuiderpark. Most likely these parks are more friendly to social visitors because of their grass fields, benches, barbeque areas, and central locations. Visitation of these respondents differed widely, with 40% visiting monthly or less, and the other 60% daily or several times a day.

Factor 4 profile: 'energy & respect'

The factor 4 profile seems to be a hybrid between those of factors 1 and 2. The people associated with it see the park as a small pocket of nature they can access from the city, in which to recreate and recharge. Being in the park greatly enhances their respect for nature as a whole. They like to exercise in the park because it makes them feel energized and the air is pleasant. They feel a connection to the park and use it to play with their children, to escape from summer heat, to recharge their batteries and get some fresh air. Other social, spiritual and inspirational aspects of the park do not appeal to them, but they have great respect for nature nonetheless.

Table 6: The five most salient statements for factor 4

Statement	Z-score	Ecosystem subservice
Being in this park increases my respect for nature	1.948	Spiritual experience and sense of place
I like to come to this park to exercise (i.e. running, cycling, skating)	1.372	Recreation
When I have been to this park I have more energy	1.309	Mental and physical health
I prefer the air in this park to that on the street or indoors	1.196	Air quality control
I feel connected to this park	1.126	Spiritual experience and sense of place

The respondents in this factor were all male (N=4). The respondents represented the three oldest age groups, and all three living regions of Rotterdam. The factor was also found in all three parks. All respondents were frequent visitors of the park, either daily or several times a day.

Factor 5 profile: 'health & creativity'

The users associated with factor 5 are healthy and creative people who like to come to the park for recreation and inspiration. They greatly enjoy walking in the park and instantly feel healthier when they do. The quietness of the park gives them a chance to empty their minds and feel energized. They like to ice skate and exercise in the park, and also feel like the park gives them creative inspiration. They are less focused on the inherent aspects of nature, but more on the effect it has on their own mental and physical state.

Table 7: The five most salient statements for factor 5

Statement	Z-score	Ecosystem subservice
I like to sit or walk in this park (e.g. lunch, reading, walking dog)	1.912	Recreation
It feels healthy to be outside in this park	1.615	Mental and physical health
When I have been to this park I have more energy	1.231	Mental and physical health
I experience this park as a quiet place within the city	0.978	Noise reduction
I come to this park to clear my head	0.978	Mental and physical health

The respondents in this factor (N=2) were both male and both interviewed in the Kralingse Bos. They were both in the 35-49 age group. One of them lived in Kralingen, the other outside of Rotterdam. One of them visited the park up to 150 times a year, the other several times a day.

7. DISCUSSION

This chapter will shed a critical light on the findings and interpretations of this study. It will discuss striking observations and considerations made during data collection and analysis, and link these to the results of the study. Then the chapter will go on to place the findings in the context of reviewed literature to see where the results overlap with or differ from other studies. It will become clear what the contribution of this study is to the field and which areas have to be looked at critically.

7.1 STUDY SETUP

This study aimed to translate ecosystem services to urban park users, in order to discover their various perceptions of them. It is interesting to see that this can be done with the methodology used in this study, which introduced a selection of fine-grained, perceptible ecosystem subservices and Q methodology to the field. This approach does, however, come with some challenges. The ecosystem services frameworks used as a basis for this study were originally developed as tools for nature conservation and policy making, for instance by helping to determine the economic value of ecosystems to society (Millennium Ecosystem Assessment 2005; The Economics of Ecosystems and Biodiversity 2010). They were not developed to study public perception of green spaces and therefore exclude many aspects of urban park perception that other studies reviewed in this thesis touch upon, like landscape design, park amenities, emotional responses, qualities of design, etc. These aspects are not separated from ecosystem services in user perception, and it is therefore slightly artificial to separate the study of them. This study shows how the gap between ecosystem services literature and park user perception can be bridged by developing a framework of fine-grained, perceptible ecosystem subservices. The results also show which benefits of urban ecosystems within this framework are rated highly by different types of park users, without attaching a monetary value to the ecosystem services. Although the results of the current study are informative, they are one aspect of a range of perceptions on all of the themes mentioned (and many others).

7.2 STUDY CONDITIONS

There were certain external conditions under which the study was done which could not be avoided, but which potentially have a significant influence on the sample and results of the study. First of all, the study was done during winter, in the coldest months of the year (January-March). Many outdoor activities are (warm) weather-bound, and even within the current sample many respondents indicated they visited the parks more frequently in spring and summer. The timing of this study thus greatly affected the sample, since there are most likely many people who visit the park in times of warm weather only (or much more frequently). The limited availability of various types of people for the sample was observed in the fact that a large majority of park visitors during the time of the study were dog owners who used the park frequently to walk their dogs. The respondents and other park users during the time of the study are the people that come to the park rain or shine, any day of the year, either out of necessity (to walk their dog), routine, or for other reasons. This may explain why social and weather-bound statements like “I use this park as a place to meet people,” “With good weather I come to this park to have a picnic or barbeque,” and “I come to this park to enjoy the sunshine” were not highly rated in most factors.

Other frequent visitors often seen were people on lunch breaks who work nearby the parks, unemployed people and pensioners getting some afternoon fresh air, and stay-at-home parents, babysitters, and grandparents with young children. The dominant presence of these groups can be explained partly by the season, but mostly by the fact that studies could only be done during the week. In weekends these groups might be accompanied or outnumbered by people who work during the week and only have time to visit the park on weekends.

These influences on the sample selection could in turn have affected the results found. The nature of the factors could be different if a larger variation of people were included (e.g. the abovementioned social and weather-bound statements could be more salient in some factors). Also, the presence of factors within the sample size could vary greatly. Factor 1 represents the 'nature lovers' in the sample and is broadly represented among the respondents (46%). This large representation could however be attributed to the large group of very frequent visitors who come to the park to enjoy nature more than the weather or other aspects.

The low number of respondents in factor 4 and 5 make the existence and exact nature of these factors questionable. These respondents could be outliers that do not represent a larger group of people with these perceptions. Yet, they could also be the few representatives of these groups who visit the parks frequently and during the week. Repeating the study under different conditions could confirm either hypothesis, and even possibly reveal other perception profiles (and factors) that are not found in this sample due to the study conditions.

Due to the season as well as the fact that the study worked with citizens rather than experts, it was not possible to use purposive sampling, as is common with Q methodology. Q methodology needs only small sample sizes because there is often an estimation available of the number and types of viewpoints within a debate. Therefore the sample is selected to include at least a handful of people per viewpoint, where it is roughly known where they stand (albeit not necessarily the subtleties of their viewpoints). In this case, however, even the relatively large sample size (for a Q study) did not eliminate questions of validity or absence of viewpoints, like the case of factor 4 and 5.

7.3 Q Sort Observations

For most participants the Q sort methodology was easy to use after a brief initial explanation, others needed more guidance during the Q sort. I always made an effort not to influence the responses of the participants during this process. However, to some participants the method was too demanding and it was clear that they did not fully understand the assignment while they were doing the Q sort, or they quit sorting somewhere during the process. In many cases these people were either not motivated to partake in the study, under influence of alcohol or drugs, or they were not in a stable mental state. When this was evident the cases were excluded from the study and they were not part of the sample (N=39).

Most of the statements were well understood by the participants and did not evoke questions. Some statements induced reactions in people otherwise. The statements concerning sounds and noise reduction triggered many participants to actively listen for both natural and city sounds (i.e. birds, wind, traffic, overflying airplanes) and reflect on them verbally. The statements about fresh air similarly stimulated respondents to sniff the surrounding air, just as some of the statements on aesthetics triggered people to look around and take in their surroundings actively. These behaviors confirmed the importance of the decision to interview people while they were using the parks, so they could relate the statements to their current surroundings.

The statements that were least well understood by respondents were "I feel connected to this park" and "In a green area like this I can recharge my batteries." The former statement often inspired a question about the kind of connectivity meant, which the researcher responded with a broad explanation of connection due to historical, cultural, or personal significance. The latter statement sometimes caused respondents to ask whether or assume that the batteries were meant literally (charged with electricity), rather than the intended figurative meaning (the feeling of being rejuvenated or energized). Other problematic statements were the two about children ("I go to this park with my children to play or walk" and "Me or my children learn about nature by coming to this park"), since people without children or whose children were now adults did not identify with them, but handled them in various ways. Some rated them very low (at "most disagree"), others put them in the middle of the sort since they felt indifferent about them or because they could imagine doing this if (or when) they had children.

Another barrier to participation was language. The statements were written in Dutch, which scared off potential respondents who were (to their own standards) not proficient enough in Dutch or not literate enough. The researcher helped some people for whom Dutch was not the first language and people who had limited eyesight partake in the study successfully. Others could not be convinced and rejected participation for this reason. This may have affected the representation of immigrants in the sample, which is important since Rotterdam (especially the Southern part) has large immigrant populations.

7.4 Q Analysis Observations

First of all, Q analysis is a quantitative, but also an intuitive and subjective process. During factor rotations with data that is not black-and-white one often has to make decisions about the nature and degree of rotations and the flagging of respondents for certain factors that are not clear-cut. In this study, I tried to dissolve ambiguities in the data with factor rotations as much as possible and validate them with an alternative factor rotation method (Varimax), but at some point I did draw a partly arbitrary line after which analysis was stopped.

When looking at the similarities and differences across factors after the Q analysis a few observations were made that are worth mentioning. First of all, there are some statements that were often agreed with over all five factors, and some that were little agreed with. Statement 13, "I like to sit or walk in this park (i.e. lunch, reading, walking dog)," was rated highly in all factors except 4. This can intuitively be understood because the respondents were asked to participate in the study while they were walking or sitting in the park. Statement 26, "In a green environment like this one I can recharge my batteries," scores similarly (medium-high) on all factors except 5. Statements that score very low on most factors are statement 24, "I use this park as a place to meet people," statement 21, "I come to this park for creative inspiration (e.g. drawing, painting, music)," statement 20, "I or my children learn more about nature by going to this park," and statement 6, "I pray or meditate in this park." Statement 2, "In this park I enjoy the beauty of nature," was only associated highly with factor 1, and rated medium-low on the other factors.

The most surprising of these observations is that statement 24 was rated low overall, since the park is generally often used as a place to meet people. A likely explanation is the fact that the study was done in winter, when most visitors are people who come there very often regardless of the weather (see also park use data). The people who use the park in a more social setting might be inclined to use the park less when the weather is wet or cold. On top of this, most respondents were in the park by themselves because people in pairs or groups refused to participate more often, probably because of the disturbance of their social interactions.

7.5 Results in Context

As described above, the validity of the fourth and fifth factors in this study's results is unclear due to the small number of respondents associated with them. Therefore the further reflection on the results will focus on the first three factors and their interpretation.

A few recent studies have specifically looked at nature perception by citizens in the Netherlands. In his doctoral thesis Buijs (2009) concluded there are four dominant 'images of nature' among Dutch citizens, based on interviews. Buijs defines images of nature as the interconnected meanings people assign to nature. The dimensions of these meanings are threefold:

- The normative dimension of images of nature refers to the moral status people assign to plants, animals, and ecosystems. In this dimension 'intrinsic value' and 'anthropocentric value' can be distinguished. Intrinsic value of nature is the value ascribed to nature in and of itself, without its services to people. It can be interpreted in the 'ecocentric' or the 'biocentric' way. The ecocentric interpretation gives the highest moral status to natural systems, like ecosystems and habitats, rather than individual plants or animals. The biocentric interpretation, on the other hand, values the life of

the individual being more highly than the vitality of the system. Anthropocentric value views nature in light of the benefits for people.

- The cognitive dimension encompasses the definitions people use to describe nature. The main aspects of this dimension are a broad definition of nature versus a narrow definition. Generally people in the Netherlands have a broad definition of nature, meaning they do not only assign the definition of nature to large natural areas (narrow definition), but also to urban parks or agricultural land. This dimension also includes the beliefs people hold about how nature works, e.g. whether it is resilient or fragile.

- The expressive dimension is based on human experiences of nature and which ones people find important. Examples of these experiences are landscape aesthetics, a sense of connection with nature, or a fascination for natural processes.

Based on a series of interviews he did and the abovementioned dimensions, Buijs (2009) defines four dominant images of nature among citizens of the Netherlands:

- **Wilderness image:** In this image nature is seen as autonomous and independent of people. According to this image, the autonomous development of ecosystems should be respected and (visible) human interference should be limited to an absolute minimum. This image relies heavily on the intrinsic, ecocentric value of nature. This image has a narrow view of nature and only deems pristine, intact nature as worthy of the name. Nature is seen as fragile yet possible to be scientifically understood.

- **Broad image:** The broad image is also based on the intrinsic value of nature, but with a large biocentric component. Individual animals and plants are believed to have intrinsic value and should be protected. Regarding preservation this means that human interference with nature is sometimes required when the health of individual plants or animals is endangered. The presence and visibility of human interaction with nature is not seen as a hindrance to nature, as in the wilderness image. This image holds a very broad view of nature, encompassing every living thing. Nature is seen as fragile, unpredictable, dynamic, and complex.

- **Aesthetic image:** The aesthetic image focuses on the beauty and pleasant experiences nature offers to people. It is defined as a weak anthropocentric value, because even though the human experience of nature is central to the image, it does not focus on resource use but rather on beauty, recreation, and tranquility. This image advocates a preference for well-maintained, designed landscapes in which human interference is essential. A broad definition of landscapes is associated with this image, including urban parks and other cultural landscapes. The balance between culture and nature is valued highly, and nature is considered to be fragile yet in equilibrium.

- **Functional image:** This image is utilitarian and the most anthropocentric of the four. The focus lies on the use and protection of natural resources for economic benefit (i.e. agriculture, forestry, recreation, tourism). For this purpose nature should be intensely managed and natural hindrance (pests, weeds, etc.) should be controlled. The view of nature is quite broad. Nature is seen as less fragile than in other images; rather it is flexible, dynamic, and robust.

Similar terminology is used in a study on public support for nature conservation in the Netherlands by De Bakker et al. (2007). This study concludes that generally Dutch citizens have a cognitive dimension of nature that includes both autonomously developed and human-made natural elements. However, in the normative dimension differences between groups become more apparent. Three most prominent normative nature types are defined: pristine nature, robust nature, and well-ordered nature. Being fragile and free of human interference, pristine nature lies closest to the wilderness image as defined by Buijs (2009). Robust nature is also seen as self-regulating, but in contrast to pristine nature it is considered to be more resilient and open to

human interaction. It is closest to Buijs' broad image. Well-ordered nature is a combination of Buijs' aesthetic and functional images, representing the appreciated of the maintenance and sculpting of nature by humans, e.g. agricultural landscapes and neat parks or forests.

A different characterization of nature perception types was made in a recent study commissioned by the municipality of Rotterdam (The SmartAgent Company 2008). The aim of the study was to determine how the different inhabitants of Rotterdam experience green space, how they value the natural areas in their neighborhoods, city, and wider region, and how the municipality can use this information to increase citizen satisfaction. Almost 2000 people participated in an online survey in 2008, and the results were weighed to accurately represent the gender, age, household composition, ethnicity, and neighborhood representation of Rotterdam at large. General results indicated that the inhabitants of Rotterdam value nature in their neighborhoods far more (79% said it was most important) than in the city at large or in the surrounding region. The main associations with green spaces are 'tranquility,' 'relaxation,' and 'natural.' In their ideal neighborhoods, people considered the presence of a park to be the most important (63%), followed by large trees (59%), and their own garden (44%). The availability and quality of the green spaces in Rotterdam was scored quite low overall (2.6 and 2.7 out of 5 respectively).

A model was used that classifies people according to their values, needs, and motives. This model was visualized as a matrix with a psychological axis (introvert vs. extravert) and a sociological axis (individual vs. social). These axes divided the sample into four archetypes of lifestyles with the key words vitality (individual, extravert), harmony (social, extravert), control (individual, introvert), and protection (social, introvert). Every respondent was assigned to one of these four lifestyles based on their character, household composition, profession, hobbies, and values. The experience of green spaces for each of these groups and the types of respondents associated with them was explained based on the survey:

- **Vitality:** People in this segment are extravert and individualistic. They live a busy and dynamic life, in which social connectivity, enthusiasm, challenges, freedom, creativity, and joy in life are important values. The typical respondent in this category is young, highly educated, and part of a one or two person household. They use green spaces to meet people in, for exercise, or for cultural activities (i.e. festivals). The three most important aspects of the attitude of this group towards green space are a pleasant environment, health, and little interference in pristine nature.

- **Harmony:** People in this group are social, extravert, cheerful, spontaneous and interested in others. They enjoy spending time with their friends. Friendship, enjoying life, respect, and social security are important values. Many of the respondents in this group were women with young children, often with a slightly lower income and education level than the previous group. They use green spaces for walks, for their children to play in, and for gardening. Their three most important themes are children, meeting people, and dynamic and colorful green spaces.

- **Protection:** This introvert-social segment is characterized by people who are sober, calm, and serious. They value tranquility, privacy, security, and anonymity. The majority of respondents in this group is male, and many people are older than average. They have lower income and education levels than average. People in this segment are social in a more closed setting, i.e. family, neighborhood, or club. They are less proactive towards green space and use it mostly to walk in and to look at. They visit less green spaces than average and are overall less positive about green spaces. The three most important elements for this group are good maintenance, green space in the neighborhood, and less hindrance by green spaces (i.e. youth, dogs).

- **Control:** The introvert, individualistic people in this group are confident, ambitious and businesslike. They value joy for life, enthusiasm, success, and the acknowledgement of accomplishments and they are looking for challenges and experiences. This group is very individualistic and strives to gain control

in every situation. People in this group often have an income that is higher than average. The majority of respondents in this group was male. They use green spaces to walk and exercise in, and to reconnect with nature. Their three most important themes are design, maintenance, relaxing through exercise.

When comparing the profiles of the first three factors with the various types of nature perception reviewed above certain parallels can be drawn. However, the objectives of the current study, that of Buijs (2009), and the study commissioned by Rotterdam municipality (The SmartAgent Company 2008) are very different. Buijs' (2009) focus was on nature perception in general, with a focus on nature reserves and their maintenance, not on urban green spaces. Some of his images even have a narrow view of nature, excluding urban nature from the definition. On top of this, we have to be cautious with drawing one-to-one connections between the current study and the normative dimensions of Buijs' images of nature. The current study uses ecosystem services as a point of departure, which are by definition anthropocentric (although some ecosystem services could have intrinsic value elements, like spiritual experience or biodiversity and habitats), whereas the normative dimension of Buijs can advocate either anthropocentric or intrinsic value to nature. The study done by The SmartAgent Company, on the other hand, does focus on urban nature, and on Rotterdam specifically. However, the types of people described in the study are categorized much more according to character and demographics, supplemented with self-reported green space use and wishes concerning green space in their area. The focus is much less on the perception of natural elements than in this study.

Regardless of these differences, there are certain parallels that can be drawn between these three studies. Some of these links and their common aspects are shown in table 8. The 'love of nature' profile values the aesthetic and regulating ecosystem services more highly than any personal effect of nature, which indicates a sense of intrinsic value of nature. It can therefore relate to the wilderness and broad images of nature. The vitality and control types prefer the pristine, 'wild' landscapes that are associated with these viewpoints. The 'recreation and connection' profile has a more anthropocentric view of nature, and therefore links better to the aesthetic and functional images of nature. Due to the recreation and connection aspects of the profile both the harmony and the control types show similarities to this profile. The 'social setting and relaxation' profile is also anthropocentric and associated with the aesthetic and functional images of nature. The harmony type has a strong social characteristic and therefore can be associated with this profile, but the orderly control type, who is more focused on the inner social circle and neighborhood, can also be linked to this profile. As can be drawn from the explanation above, these links should be seen only as an indication of certain overlaps between studies with different methods and objectives, not as any conclusive evidence of similarities.

Table 8: Comparison of nature perception profiles in different studies

Factor profile (Buchel)	Image of nature (Buijs)	Personality type (The SmartAgent Company)	Common aspects
1: Love of nature	Wilderness / broad image	Vitality / control	Love for pristine nature, intrinsic value of nature
2: Recreation and connection	Aesthetic / functional image	Harmony / control	Anthropocentric value of nature, social and recreational use, cultural or historic connection
3: Social setting and relaxation	Aesthetic / functional image	Harmony / protection	Anthropocentric value of nature, social and recreational use, enjoy aesthetics of nature

7.6 Results Synthesis

The results of the current study also confirmed the value of aspects of green space user perception that proved to be important in other studies: feelings of unity with nature (Chiesura 2004), air quality regulation (Jim & Chen 2006a; Jansson 2012), recreation (Jim & Chen 2006a), etc. In order to link the valuable green space aspects found in this study to ecosystem services, a rating system for the factors was set up. The Q statements were linked back to their corresponding fine-grained ecosystem subservice. Each subservice was given a rating for each factor, according to the saliency of its corresponding statements for that factor. This rating was based on the Q sort format, which included two statements with score 1, three with score 2, five with score 3, six with score 4, five with score 5, three with score 6, and two statements with score 7. Since the number of statements per subservice varied from 1 to 4, the scores of each subservice were divided by the number of statements so they could be compared. The results of this rating are shown in table 9.

Table 9: Ecosystem subservices scored on saliency per factor and across factors

Ecosystem subservice	Average	Scores factor 1	Scores factor 2	Scores factor 3
Sense of place	5.3	5.0	7.0	4.0
Noise reduction	5.2	5.5	4.5	5.5
Air quality control	5.0	5.0	5.0	5.0
Aesthetic appreciation	4.6	5.8	4.5	3.5
Mental and physical health	4.4	4.5	4.5	4.3
Recreation	4.1	4.3	4.7	3.3
Thermal comfort	3.7	3.0	3.0	5.0
Social setting	3.2	1.7	3.7	4.3
Spiritual experience	2.7	3.0	1.5	3.5
Inspiration	2.7	2.3	3.0	2.7

Figure 17 illustrates which of the ecosystem subservices were rated high, medium and low across the first three factors (based on the average scores in table 9).

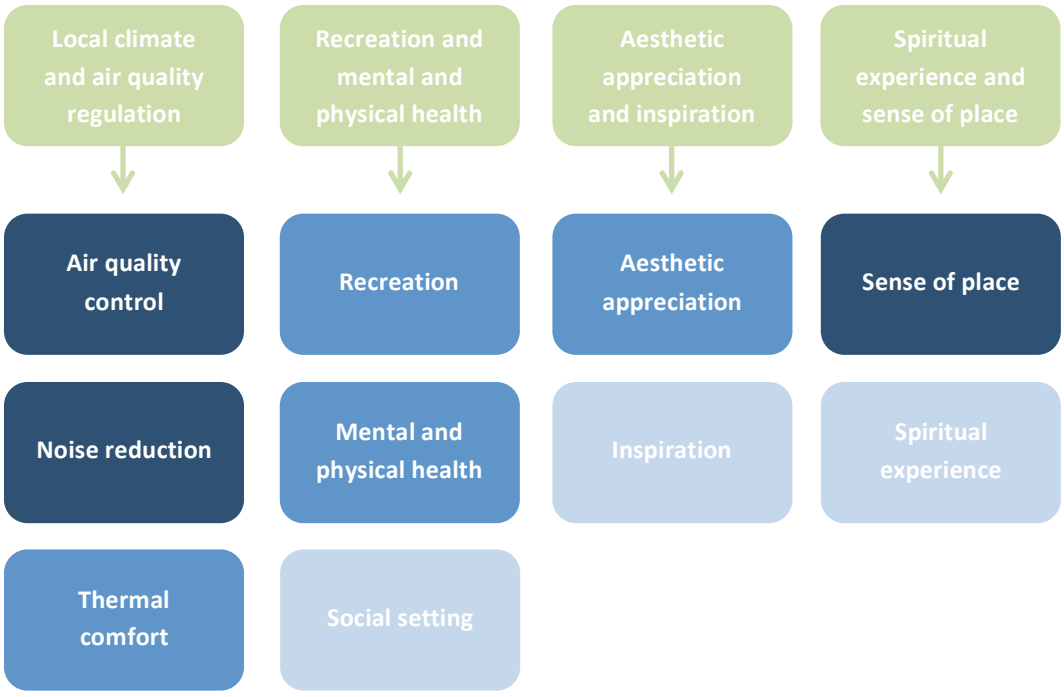

Figure 17: Ecosystem subservices with the highest rated ones in dark blue and the lowest rated ones in light blue

In chapter 6 and 7 the ecosystem subservices associated with the factor profiles were mentioned in different contexts. Two ways of looking at these connections were introduced. Each statement is associated with an ecosystem subservice. The first five statements of the list of statements most associated with each factor were presented in the profile tables in chapter 6. In these tables the ecosystem subservices that the statements refer to are also mentioned. These services are repeated in table 10. However, to encompass the ratings of all statements, as well as the fact that not all subservices have the same number of statements associated with them, a rating system was introduced in chapter 7. The top five ecosystem subservices based on this rating system are also presented in table 10.

Table 10: Factor profiles with most important ecosystem subservices

Factor profile	Ecosystem subservices of most salient statements	Ecosystem subservices with highest rating
1: Love for nature	1: Aesthetic appreciation	1: Aesthetic appreciation
	2: Aesthetic appreciation	2: Noise reduction
	3: Air quality control	3: Air quality control
	4: Recreation	4: Sense of place
	5: Aesthetic appreciation	5: Mental and physical health
2: Recreation and cultural connection	1: Sense of place	1: Sense of place
	2: Aesthetic appreciation	2: Air quality control
	3: Recreation	3: Recreation
	3: Recreation	4: Aesthetic appreciation
	4: Social setting	5: Noise reduction
3: Social setting and relaxation	1: Social setting	1: Noise reduction
	2: Thermal comfort	2: Thermal comfort
	3: Air quality control	3: Air quality control
	4: Aesthetic appreciation	4: Sense of place
	5: Noise reduction	5: Social setting

Both of these lists provide valuable information about each of these profiles, but the difference between them is even more fascinating. The fact that the lists based on both systems are so different shows that not all statements that refer to the same ecosystem subservice speak to respondents in the same way. They might rate one statement of a subservice very highly, whereas the same respondent can rate another statement of the same subservice as very low. This causes the score for this subservice to decrease, whereas they might be associated with one of the top statements. This is the case with 'recreation' in the first profile for instance, and with 'social setting' in the third profile.

Most ecosystem subservices have several statements, and the results show that these individual statements can be rated quite differently (regardless of their ecosystem service). This problem arises when formulating different statements for each ecosystem subservice, and when not all ecosystem subservices have the same number of statements assigned to them. I think it is more valuable to look at the ecosystem services associated with the most salient statements in each factor, because these resonated most with the respondents and were verified by the factor analysis. The fact that for other statements, referring to the same service, lower scores were found implies that the selection and phrasing of the statements is very important.

8. CONCLUSIONS AND RECOMMENDATIONS

This final chapter wraps up the thesis by synthesizing it into conclusions. First, the research questions asked at the onset of the thesis will be answered based on the results and interpretation. Then the unique findings of the study will be highlighted. Finally, recommendations for both policy makers and research will be made on the basis of the results, discussion, and conclusions.

8.1 CONCLUSIONS

What are the dominant perception profiles of citizens on the benefits gained from visiting urban parks in Rotterdam?

Five perception profiles were discovered in the Q methodology study. For two of these profiles the sample size was so small the validity and exact nature of the profiles can be questioned. Therefore, only the other three profiles will be considered when answering this question. The following profile descriptions were based on the most salient statements for each factor, and the demographics of the respondents associated with this factor.

Factor 1 profile: 'love of nature'

People associated with factor 1 are nature lovers. They enjoy the beauty of nature, the natural sounds, and fresh air in the park. They experience the park by walking or sitting in it, enjoying the various species of plants, trees, and animals around them. When they are in the park they feel healthy, energized, and connected to their surroundings. They do not come for their children or to meet others and they do not specifically come in warm or cold weather. They simply come to take in their natural surroundings and appreciate them in all their richness. Factor 1 was not more dominant in a specific park, and it was representative of the gender balance of the sample. The 50-64 age group was a little more dominant than others.

Factor 2 profile: 'recreation & connection'

The people associated with factor 2 experience the park as a haven for recreation and revitalization. They feel a strong connection to the park, and use it for active and passive recreation. They enjoy the fresh air and the plants and trees when they sit or walk in the park, and they bring their (grand)children to play and ice skate with. They feel recharged and energized after a park visit, even though they do not use it to exercise or meditate. Factor 2 was present more in Het Park and the Kralingse Bos than in the Zuiderpark. The historical connection to this park might be less strong. The respondents in this group were largely female, and the 65+ age group was strongly represented. None of the respondents in this group visited the parks less than weekly.

Factor 3 profile: 'social setting & relaxation'

The park users identified with factor 3 see the park as a quiet oasis within the city: a place to relax, to meet people, and to play. They are fair weather users who come to the park most often to enjoy the sunshine and to have a pick nick or barbeque with their children, family, or friends. They sit or walk in the park to enjoy the air and sounds that are more pleasant than those of the city and feel like they entered a quiet zone. In this oasis they can recharge their batteries and empty their minds. This feeling of calmness increases their respect for nature. This factor represented men slightly more than women, and the 35-49 age group was the most dominant. Most respondents live near the Zuiderpark.

Which ecosystem services can be associated with these profiles?

I developed a framework of ecosystem services that encompasses only those that can be directly perceived by the urban park users in Rotterdam. These services were associated with the five most salient statements for each factor:

Factor 3 profile: 'social setting & relaxation'

- Aesthetic appreciation
- Air quality control
- Recreation

Factor 2 profile: 'recreation & connection'

- Sense of place
- Aesthetic appreciation
- Recreation
- Social setting

Factor 1 profile: 'love of nature'

- Social setting
- Thermal comfort
- Air quality control
- Aesthetic appreciation
- Noise reduction

Unique findings

Part of the aim of this study was to develop a method that translates the concept of ecosystem services to citizens so their perception of these services can be studied. In order to make ecosystem services understandable to park users a selection of ecosystem services was made, based on the criteria of direct perception and local context. The remaining ecosystem services were fine-grained into ecosystem subservices, which delivered statements understandable by citizens. These statements were presented to park users with Q methodology for them to sort them according to their own view on the importance of the benefits these statements represented. The fact that the statements and the methodology were understandable to the interviewed park users shows that it is a method that succeeds in translating ecosystem services to them.

However, the results show that respondents rate the individual statements (which represented different aspects and interpretations of the ecosystem subservices they referred to) very differently, regardless of the ecosystem subservice they belong to. In certain profiles some statements belonging to social setting were rated as very important, whereas another statement representing this same service was rated as not important at all. Because of this only those ecosystem subservices that were associated with the five most salient statements of the factors were considered valid. This showed that aesthetic appreciation is the most valued ecosystem

service across the board. Other ecosystem services that scored highly in two out of three factors were recreation, air quality control, and social setting. Furthermore, sense of place scored the highest in one of the three profiles.

Because of the limitations of the study it is difficult to say if these results can be extrapolated to other seasons, regions, or methods, but the varied and in-depth quality of the profiles could give an interesting color to results from other methods, like surveys or monetary valuation studies.

8.2 RECOMMENDATIONS

For policy makers and planners

It is clear that urban park users care about the various benefits of the parks they visit. The variety in user types and their valuation of different ecosystem services (and most likely different aesthetic and amenity appreciations) is important for planners to consider when designing or evaluating parks. Ecosystem services on a planning level are generally associated with supporting and regulating services that benefit the city as a whole, yet when the perception of users is taken into account the livability of the park and the city are incorporated. One of the ways in which planners could incorporate this study is by creating different 'pockets' of nature in the city or within a park, catering to the different types of users. This facilitates the diversity of citizens in a park or neighborhood. It is important to mention that the different types of users are not necessarily based on demographics, which is often used by planners when designing these spaces. Awareness of the different types of users in terms of park perception could enhance the current knowledge on user types.

For future research

First of all, this study should be repeated in different seasons to get a more varied sample and validate or reveal some of the other profiles among park users. A larger or more targeted sample could furthermore increase the validity by compensating for the lack of purposive sampling in the study. Studying park perception with other methods alongside this study, in order to reveal both qualitative and quantitative information, could broaden the limited focus of the study. A hybrid methodology of this kind could reveal more varied information on park use, aesthetic landscape qualities, park amenities, emotional responses, etc. Some future research questions and topics that this study triggers are:

- Do these results vary with seasonal conditions and larger sample sizes?
- Are factors 4 and 5 outliers or representative of larger groups? Are there other factors that this study did not discover?
- Can these results be repeated in other cities and countries, or are some of them context-specific?
- How do these results (and methodology) translate to other types of urban green spaces?
- Can the difference in statement ranking within an ecosystem subservice be diminished in some way? (by adapting the concourse the statements are based on, the number of statements per subservice, or other methodological aspects)
- What is the role of intrinsic nature value in the urban context?
- How do other nature perception elements tie into this study? (i.e. visitation behavior, satisfaction with green spaces, landscape appreciation, emotional responses)
- How do these results differ from large-scale surveys done in the same area?

- How do these results differ from the perspectives of city planners and policy makers on urban parks and their users?
- How do different age groups (specifically youth and elderly) perceive urban ecosystem services?
- Can one only experience a connection to an urban park if one has lived in the specific city for a long time?

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APPENDICES

The URBES Project

My thesis, written for the Environmental Policy Group of Wageningen University as part of the MSc Environmental Science, is part of the international research project URBES, which is conducted by a partnership of academic institutions and international organizations. Drift, the Dutch Research Institute for Transitions and part of the Erasmus University Rotterdam, is one of the URBES partners and my co-supervisor for this thesis research. Among the 17 partners of URBES are Humboldt University Berlin, ICLEI, Stockholm Resilience Center, and IUCN (URBES n.d.).

The URBES Project started in January 2012 and will run until 2014. It aims to study the role of urban biodiversity and ecosystem services for human wellbeing, and to inform urban governance actors on how best to integrate the natural environment (within and outside city boundaries) and human needs. URBES aims to bridge knowledge gaps on how urban ecosystems function, how they change and what strengthens or limits their performance, in order to stimulate the development of 'nature-based' solutions for cities to adapt to climate change and reduce their ecological footprints. URBES studies urban nature through the ecosystem services framework, which identifies many services relevant to cities, like air purification, water filtration, flood prevention, noise reduction, recreation, and climate change mitigation and adaptation. URBES will also explore valuation of urban ecosystems and biodiversity and develop guidelines for implementation measures to enhance ecosystem service benefits in urban landscapes (URBES 2013).

URBES will communicate research outcomes to key local governance stakeholders. The focus of the project is the development of practical sustainability applications for Berlin, Stockholm, Salzburg and Rotterdam, with contributions from Helsinki and New York. The municipality offices of these cities have been involved with the URBES project since the application for research funding. The project is interested in finding the policy gaps in the biodiversity and nature management plans of these cities, and in working with them to develop a strategy to bridge these gaps in a science-policy interface.

The URBES project is organized around four research questions or components, each tackled by a different consortium of partners:

I: What is the interaction between urban biodiversity, ecosystem services and land use change?
II: What is the market and non-market value of biodiversity and ecosystem services for cities?
III: How can cities integrate biodiversity and ecosystem services into planning and management?
IV: How to translate knowledge into local action?

Drift is mainly involved in the third research component dealing with governance and management of urban biodiversity and ecosystem services.

CULTURAL SERVICES

Recreation

1. Ik kom graag naar dit park om te bewegen (bijv. hardlopen, fietsen, skaten)
2. Ik zit of wandel graag in dit park (bijv. lunch, lezen, hond uitlaten)
3. Als het vriest kom ik graag naar dit park om te schaatsen of in de sneeuw te zijn

Social setting

4. Ik ga met mijn kinderen naar dit park om te spelen of wandelen
5. Als het mooi weer is kom ik naar dit park voor een picknick of barbecue
6. Ik gebruik dit park als plek om met mensen af te spreken

Mental and physical health

7. In een groene omgeving als deze kan ik mijn batterij opladen
8. Het voelt gezond om buiten in dit park te zijn
9. Ik ga naar dit park om mijn hoofd leeg te maken
10. Als ik in dit park ben geweest heb ik meer energie

Aesthetic appreciation

11. Ik geniet in dit park van de schoonheid van de natuur
12. Ik kijk graag naar de dieren in dit park (bijv. vogels, eendjes voeren)
13. Ik geniet van de verschillende bomen, planten en bloemen in dit park
14. Ik geniet van de geuren van het gras en de planten in dit park

Inspiration

15. Ik krijg nieuwe ideeën als ik in dit park ben
16. Ik kom naar dit park voor creatieve inspiratie (bijv. voor schilderen, schrijven, muziek)
17. Ik of mijn kinderen leren meer over de natuur door naar dit park te gaan

Spiritual experience

18. Ik bid of mediteer in dit park
19. In dit park zijn vergroot mijn respect voor de natuur

Sense of place

20. Ik voel me verbonden met dit park

REGULATING SERVICES

Air quality control

21. Ik ga naar dit park voor frisse lucht
22. De lucht in dit park vind ik prettiger dan de lucht op straat of binnenshuis

Noise reduction

23. Ik ervaar dit park als een stil plekje in de stad
24. Ik vind de natuurlijke geluiden in dit park fijner dan de geluiden in de stad

Thermal comfort

25. ‘s Zomers kom ik naar dit park om aan de warmte te ontsnappen
26. Ik kom naar dit park om van de zon te genieten

CULTURAL SERVICES

Recreation

1. I like to come to this park to exercise (e.g. running, cycling, skating)
2. I like to sit or walk in this park (e.g. lunch, reading, walking dog)
3. When it freezes I like to come to this park to ice skate or be in the snow

Social setting

4. I go to this park with my children to play or walk
5. With good weather I come to this park to have a pick nick or barbeque
6. I use this park as a place to meet people

Mental and physical health

7. In a green area like this I can recharge my batteries
8. It feels healthy to be outside in this park
9. I come to this park to clear my head
10. When I have been in this park I have more energy

Aesthetic appreciation

11. In this park I enjoy the beauty of nature
12. I like to watch the animals in this park (e.g. birds, feeding ducks)
13. I enjoy the different plants, trees and flowers in this park
14. I enjoy the smells of grass and plants in this park

Inspiration

15. I get new ideas when I come to this park
16. I come to this park to get creative inspiration (e.g. for painting, writing, music)
17. Me or my children learn about nature by coming to this park

Spiritual experience

18. I pray or meditate in this park
19. Being in this park increases my respect for nature

Sense of place

20. I feel connected to this park

REGULATING SERVICES

Air quality control

21. I like to go to this park to get fresh air
22. I prefer the air in this park to that indoors or on the street

Noise reduction

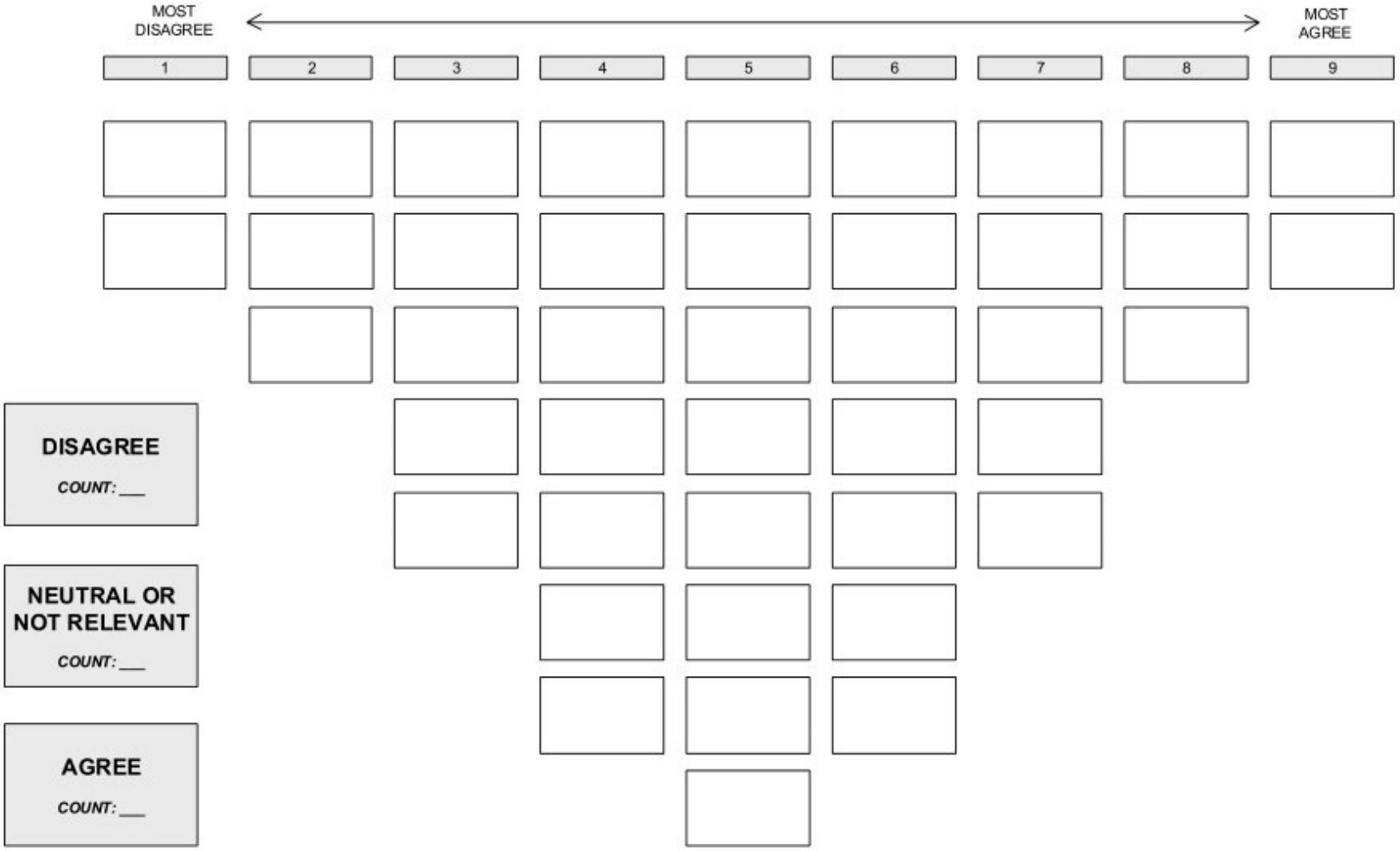
23. I experience this park as a quiet place within the city
24. I prefer the natural sounds in this park to the city sounds

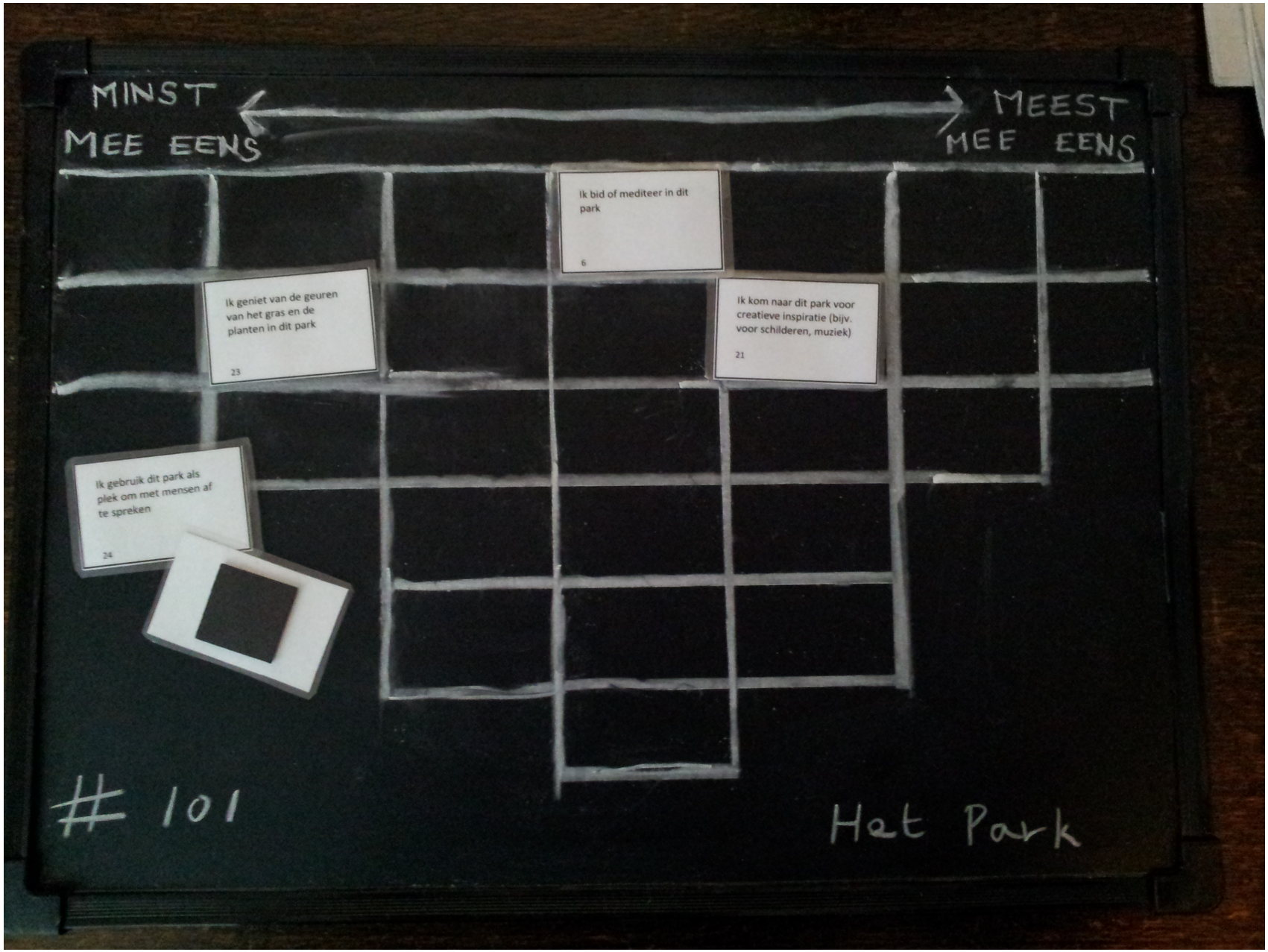
Thermal comfort

25. In summer I come to this park to escape the heat
26. I come to this park to enjoy the sunshine

1 Als ik in het park ben geweest heb ik meer energie
2 Ik geniet in dit park van de schoonheid van de natuur
3 Als het mooi weer is kom ik naar dit park voor een picknick of barbecue
4 Ik krijg nieuwe ideeën als ik in dit park ben
5 ‘s Zomers kom ik naar dit park om aan de warmte te ontsnappen
6 Ik bid of mediteer in dit park
7 Ik ga naar dit park voor frisse lucht
8 Als het vriest kom ik graag naar dit park om te schaatsen of in de sneeuw te zijn
9 In dit park zijn vergroot mijn respect voor de natuur
10 Ik ga met mijn kinderen naar dit park om te spelen of wandelen
11 Ik voel me verbonden met dit park
12 Ik geniet van de verschillende bomen, planten en bloemen in dit park
13 Ik zit of wandel graag in dit park (bijv. lunch, lezen, hond uitlaten)
14 Ik kijk graag naar de dieren in dit park (bijv. vogels, eendjes voeren)
15 Het voelt gezond om buiten in dit park te zijn
16 Ik kom graag naar dit park om te bewegen (bijv. hardlopen, fietsen, skaten)
17 Ik kom naar dit park om van de zon te genieten
18 Ik ervaar dit park als een stil plekje in de stad
19 De lucht in dit park vind ik prettiger dan de lucht op straat of binnenshuis
20 Ik of mijn kinderen leren meer over de natuur (seizoenen, planten, dieren) door naar dit park te gaan
21 Ik kom naar dit park voor creatieve inspiratie (bijv. voor schilderen, schrijven, muziek)
22 Ik vind de natuurlijke geluiden in dit park fijner dan de geluiden in de stad
23 Ik geniet van de geuren van het gras en de planten in dit park
24 Ik gebruik dit park als plek om met mensen af te spreken
25 Ik ga naar dit park om mijn hoofd leeg te maken
26 In een groene omgeving als deze kan ik mijn batterij opladen

RESPONDENT NUMBER: _____ *NAME:* _____

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Ik gebruik dit park als plek om met mensen af te spreken
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Het Park