IDENTIFICATION OF BLUE GREEN STRUCTURES AND PERCEIVED VALUES IN PUBLIC URBAN GREEN SPACES:

A COMPARATIVE CASE STUDY OF A NATURAL AND A CONSTRUCTED GREEN SPACE IN OSLO

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ABSTRACT

Population growth is increasing and further increase will occur in cities. This densification will effect and reduce urban green ecosystems. Urban ecosystems contribute to the quality of life of urban dwellers and the cultural ecosystem services (CES) provided are the focus of the present thesis. The non-existence of a common framework for assessing CES and the insufficient attention towards CES is leading to the use of two recently developed tools within this thesis: the Blue Green Factor, developed by Oslo and Bærum municipality, and the Structural Diversity Tool, developed by Voigt et al. (2014).

The aim of this thesis is to compare a park and a natural green space in Oslo using those tools and to assess the perceived values of the green spaces. Further the connection of those values, on the basis of the CES concept, to the blue green structures assessed, is discussed. The theoretical basis of the research relies on the concepts of cultural ecosystem services, the aesthetics of the pleasant and the experience of nature.

Results show an immense difference of the blue green factor scores. The natural green space achieves a score that is five times higher than the score of the park. The structural diversity tool revealed similar result, the natural space scores however slightly higher. The observations and the interviews in the natural green space demonstrate that the green space is perceived as a restorative environment, but only during the day. The social environment in the evening was perceived as not pleasant and no activities were carried out at this time. The interviews demonstrated that accessibility, safety, tidiness and maintenance were of importance whilst deciding about a visit of the green space, nevertheless the aspects of compatibility, nature, the feeling of being away, extent of the space and the fascination elements were decisive for a visit. The observations within the park however revealed a picture of little use and no respondents were willing to participate in the interview study.

The research identified five CES subservices in the natural green space: recreational services (stress relief), social interactions, educational services, the feeling of being away and aesthetical services. Some of these services can be connected to the provision of basic blue green settings, however abiotic side conditions have to be taken into consideration.

Key words: Urban green space, Blue green factor (BGF); Structural Diversity Tool, Cultural ecosystem services, Restorative environment, Oslo, Norway

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“We still have a lot to learn about the nature of value

and the value of nature”

(Pavan Sukhdev)

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ABBREVIATIONS

BG
Blue green

BGF
Blue Green Factor

CES
Cultural ecosystem services

CICES
Common International Classification of Ecosystem Services

COP
Conference of the Parties

EPPS
Ecosystem properties, potentials and services framework

ES
Ecosystem services

ESTIMAP
Ecosystem service mapping at European scale

MA
Millennium Ecosystem Assessment

NINA
Norwegian Institute for Nature research (Norsk institutt for naturforskning)

OpenNESS
Operationalization of natural capital and ecosystem services

ROS
Recreational opportunity spectrum

SDT
Structural Diversity Tool

TEEB
The Economics of Ecosystems and Biodiversity

WHO
World health organization

1 INTRODUCTION

Urban population in many of the more developed countries has been greater than 75 per cent in the year 2000 (Francis and Chadwick 2013) and by 2050 and estimated two third of the population will live in cities (Gómez-Baggethun and Barton 2012). Population growth will further increase and this mainly in cities (Dye 2008). The phenomenon of urban sprawl contributes to the urbanisation process (Pickett et al. 1997) and in industrialized countries this phenomenon is spreading more rapidly than population itself (Cadenasso et al., 2007).

Environmental effects of urbanisation are evident, likewise theses effects are obvious in Norway. Urban growth is predicted to increase, since the urbanisation process focuses on building developments within the existing city boundaries (Nordh and Østby 2013). This densification process challenges the maintenance of urban green spaces (Tzoulas et al. 2007) and those spaces are in the risk to be replaced by impermeable spaces: i.e. building projects, parking lots, streets and so on (Maas et al. 2006). Urbanisation causes furthermore several environmental challenges concerning loss of biological diversity, especially loss of native species. Removing such green spaces removes habitat for all kinds of animals and plants (Blair 1996; Fernández-Juricic and Jokimäki 2001; Hansen et al. 2005), it restrains species movements (Fernández-Juricic 2000) and removes outdoor recreation and health possibilities for human beings.

A growing urban population is in need of urban green spaces and their contribution to the quality of life and to well-being of urban inhabitants (Bonaiuto et al. 2003; Chiesura 2004; Kaplan and Kaplan 1989; Miljødirektoratet 2014). The prerequisites of time, motivation and mobility are decisive for urban dwellers to engage in outdoor activity and thus urban green spaces in proximity to their homes are needed (Koppen et al. 2014). Such access to green spaces is furthermore providing social and psychological services (Chiesura 2004) as well as mental and physical health services (Davis et al. 2011). Urban green space is elementary to support urban living (Davis et al. 2011) but nevertheless, the services that green urban ecosystem provide are seldom discussed even though the majority of people is living in urban areas (Bastian et al. 2012; Chan et al. 2012; Gómez-Baggethun et al. 2013). Generally the goods and services potentially derived from urban ecosystems are considerable within urban environments but these services are not recognized to their fullness and their potential is not realized (Davis et al. 2011).

Research indicates a great dependency of the well-being and life satisfaction of human beings towards engaging in nature related activities or through simple proximity, easy access and outlook to nature (Chiesura 2004; Davis et al. 2011; Kaplan and Kaplan 1989, Thompson 2002). In order to take care of the benefits green spaces present within the urban environment, green spaces need to be maintained. Especially cultural ecosystem services (CES), such as recreation or relaxation through urban green spaces are important in an urbanised context. The dependency of human beings of such services is expected to increase with a country's economic development (Hernández-Morcillo et al. 2013) and hence CES are of great importance especially within west European urban areas such as Oslo.

1.1 OBJECTIVES

The main objective of this thesis is to compare an artificially constructed green space in a residential area, Bjerkedalen Park, with a natural green space, Svartdalen, in Oslo.

Two indicators have recently been developed for assessing urban structures. The present study investigates the structural diversity as well as the blue green structures of those green spaces. The green- and blueness is identified with the Blue Green Factor (BGF), developed by Oslo and Bærum municipality (Ardila and de Caprona 2014a). The Structural Diversity Tool (SDT), developed by Voigt et al. (2014), is used to assess the structural diversity of the selected green spaces. In addition, this thesis discusses an adaptation of the BGF so that urban green spaces can be better integrated.

The secondary objective is to assess the perceived values of the green spaces and to discuss a connection of those values, on the basis of the CES concept, to the blue green structures assessed.

In order to assess the services given, it is of importance to gain knowledge about the inhabitants' usage, needs and preferences. These usages are assessed through qualitative interviews with on-site users. These interviews are crucial to get an insight into the experiences of the visitors. Through this insight the values perceived can be connected to the cultural ecosystem service concept.

The ecosystem service cascade builds the basis for linking cultural ecosystem services to the values perceived and to the provision of those within the blue green structures. The

boundaries of the derived services are defined by the selected green space boundaries, providing the scale for the researched ecosystem, the selected urban green space and its inherent boundaries.

1.2 OUTLINE OF THE THESIS

This thesis is organized in eight chapters with subchapters. The first chapter (1) introduces the importance of urban green spaces and the research objectives. Chapter two (2) gives a short history of urbanization and an introduction to the case study areas and the urban green structures of Oslo. Chapter two furthermore introduces the OpenNESS project and the Oslo case in which this thesis developed. Chapter three (3) describes the statement of the problem, the research questions and the hypotheses. The theory in chapter (4) introduces the basis of the research: the concepts of cultural ecosystem services, the aesthetics of the pleasant and the experience of nature. The experience of nature explores landscape preferences in connection with their attention restoration theory, in connection to landscapes or environments. The connection to urban green spaces is made in the aesthetics of the pleasant. This chapter deals furthermore with issues concerning the process of perception building. Chapter five (5) deals with the methodology of the thesis: the case study approach, observations and qualitative interviews. The Blue Green Factor and the Structural Diversity Tool are explained and the field assessment measurements are described. Ethical aspects and limitations of the study are reported. Chapter six (6) explains and partly discusses the results of the fieldwork observations the interview statements and the results of the tools. Chapter seven (7) compares and further discusses the results. The results are related to the concept of cultural ecosystem services and chapter eight (8) concludes the study. Throughout this thesis translated Norwegian words are mentioned in brackets and are written in italic.

2 BACKGROUND

This chapter gives an overview of urbanization and urban green spaces in a time perspective. Followed by the geographical overview of the case study area in Oslo and the description of the park and the natural green space. The green plan of Oslo is summarized and the OpenNESS project is presented.

2.1 A BRIEF HISTORY OF URBANIZATION AND URBAN GREEN SPACE TODAY

The urbanization process can be traced back to the first settlements of humans in areas where resources where abundant and opportunities to build shelter were available (Francis and Chadwick 2013). Followed by a natural population increase, people clustered around these areas and a more impermeable built environment occurred. The distance you could walk whilst carrying a bucket of water represents the size of the settlement. Access to fields was needed and the home was considered the centre of life (Larson 2012). With the invention of building techniques and the use of resources from the surrounding lands, the urban process developed further. The Industrial Revolution brought a shift in the urbanization process and a population concentration took place (Francis and Chadwick 2013). Cities consisted of a dense core with industry and simple housing (Davis et al. 2011). The development of housing facilities, infrastructure and an increasing wealthy population created an urban society, leading to distinct urban gradients of people working in the core and living in the periphery (Davis et al. 2011; Francis and Chadwick 2013). Centralization such as, learning in schools, or health care in hospitals was a major adjustment, leading to network developments of road and railway. Increased industrialization led to growing urban areas (Francis and Chadwick 2013). In the 1950s more and more suburban developments were introduced and traveling by car was popular, thus reinforcing suburbanisation. The Post-war years were characterised by deindustrialisation and a growing service sector. Suburbanisation slowly ceased in the 1980s and the focus changed to the development of previously built environments (Davis et al. 2011).

Within the city of Oslo, the urban growth is focused inside the city boundaries, since the Norwegian government decided to prevent urban sprawl and to protect forest and farm land surrounding the city (Nordh and Østby 2013). This increases the pressure on urban green spaces.

This paragraph introduces shortly the word urban green space and the variations of urban structure and function. Swanwick et al. (2003) separates an urban area in external environment spaces and buildings. Urban green spaces as well as grey spaces are elements filling the in-between of buildings or the build environment. Green spaces include every green area, whether it is public or private, small or big. It basically includes all land that is mainly covered with permeable soft surface such as grass, soil, shrubs and trees. The term public indicates that the spaces are accessible for everyone (Swanwick 2003). Natural green spaces, as defined by the Norwegian Environmental Agency, are naturally preserved areas that contain native vegetation and are mostly undeveloped and under low management control. Parks however are developed green spaces; landscaped with an obvious artificial influence (Miljødirektoratet 2014). Grey space is defined as a space with mostly impermeable hard surfaces such as concrete, paving or tarmac. Grey surfaces can further be divided into functional and civic spaces. The latter serves as space mainly used for public enjoyment, such as designated pedestrian zones. Functional space refers to spaces that serve a specific purpose, such as roads (Swanwick 2003).

2.2 CASE STUDY AREAS

The natural green space Svartdalen and Bjerkedalen Park are public urban green spaces situated in Oslo, the capital of Norway. Oslo is the highest populated city in Norway and has a total number of 925,228 residents (SSB 2014), with a continuous growth since 1985 (Utviklings- og kompetanseetaten 2014). In the comparative study of Laakso and Kostiainen (2007) of 45 European metropolises, Oslo is ranked 38th in terms of population. In terms of volume of production (total gross value) Oslo is ranked no. 20. Considering the economic structure, the growing service sector employs around 85 % of the workforce (Laakso and Kostiainen 2007). The total urban settlement area in Oslo is 265.76 km^2 with a population density of approximately 3,521 residents per km^2 (SSB 2014). Considering only Oslo municipality the number of residents decreases to 616,754, the area decreases as well (130.55 km^2) but the population density rises (4,724 residents per km^2) (SSB 2014). Compared to other cities the population density of Oslo is quite high. Tokyo, the city with the most residents in the world, reaches a population density of 4,300 residents per km^2 on a total urban area of 8,547 km^2. New York presents a population density of 1 800 per km^2 on a total area of 11,642 km^2 and Paris comprises a total urban area of 2,844 km2 with a population of 10,755,000 residents reaching a population density of 3,800 residents per km^2. The highest

population density (44,400 residents per km^2) with an area of 347 km^2 is found in Dhaka (New Geography 2012).

Located at the Oslo Fjord on 59° 54' North and 10° 45' East, Oslo has a climate influenced by the Gulf Stream and is warmer than the latitude promises. An average temperature of 20º C in summer (June-August) is pointing to a quite warm and fairly long period with highest temperatures in July. The coldest month is January with an average of -4º C (Bendiksen and Bakkestuen 2000). The research areas are situated in the boreal nemoral zone (Moen 1999) that is characterised through dominant elements of temperate deciduous forest. The growing season starts in late April and ends in mid-October. Winters are mild and snow falls rarely before Christmas (Bendiksen and Bakkestuen 2000). After the classification of Köppen, Oslo belongs to the group of snow zones (D) with precipitation in all seasons (f) and cold summers (c) (Kottek et al. 2006). Precipitation increases with height meters and is highest in the period from July to November and lowest in winter (Bendiksen and Bakkestuen 2000).

Descriptions and trip advises connected to the green spaces are neither available at the tourist information, in the Oslo guide (2014) nor in the tourist guide what's on Oslo from August 2014. An Internet search with common search providers on the case study areas provided some information. A search with the keyword Svartdalsparken showed results on pages such as Wikipedia, ut.no, Google maps, yelp.no and skjerioslo.dittoslo.no. Further listed results are not directly connected to the park, more to the adjacent city parts or kindergartens. The search with the keyword Bjerkedalen Park listed results from sites such as Wikipedia, groruddalen.no, bydel-bjerke.oslo.kommune.no, dronninga-landskap.com and osloby.no. Further results are connected to the adjacent apartment blocks and surrounding institutions. The majority of hits found for Bjerkedalen Park were connected to the upgrading project that Oslo municipality initiated in the park in 2009 to 2011 (building started 2012) with an opening of the park in 2013 and the last elements were opened in 2014.

2.2.1 CONSTRUCTED GREEN SPACE (BJERKEDALEN PARK)

Bjerkedalen Park is situated within the housing estate of Økernbråten in the north-eastern part of Oslo in the city part of Bjerke (Figure 1). Public transportation is limited to some bus stops around the park. The nearest subway station is Risløkka.

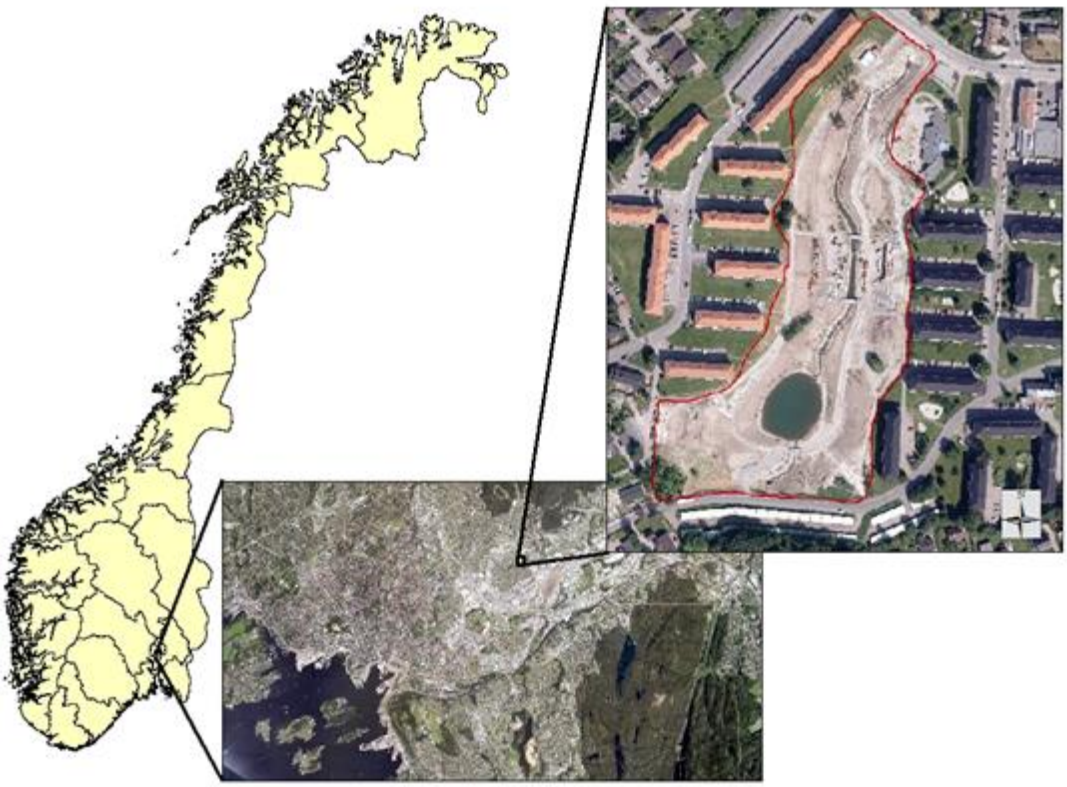


Figure 1: Geographical orientation Bjerkedalen Park
Source: Miljodirektoratet 2015 (edited)

Oslo municipality rehabilitated the area, from 2012 to 2014, in order to prevent flooding and to upgrade the neighbourhood. The main water stream (*Hovinbekken*) was brought onto the surface again for 300 m after having been almost fifty years underground. The watercourse flows almost in a natural way and falls about ten meters on its way down into the artificial pond at the southern end. In the middle of the park the stream is rectified. The lower and the upper entrance point of the river are presented through pipes that redirect the stream under earth, as for the lower end and beneath the street surface on the upper end. The whole area comprises 0.35 ha of land (Dronniga landskap AS 2014).

The constructed green space is dominated by the water elements, but a great part of the area is also covered with flowerbeds. Figure 2 shows the park from the south facing north. Throughout the park these beds are filled with different colourful plants and newly planted trees. The slope walls adjacent to the river at the northern end are also planted with small plants and bushes. Alongside the river bushes and natural-like water plantings are found. Animals that are obvious on first sight are ducks and different birds.

A problem with the sewage system emerged in April 2014; when it was heavily raining an overflow of the sewage system occurred and the water was flowing into the river. A distinctive smell as well as sign with the words no swimming allowed are the consequences (Bremer 2014).

Figure 2: Overview Bjerkedalen Park

2.2.2 NATURAL GREEN SPACE (SVARTDALEN)

The natural green space Svartdalen is situated in the city part of Gamle Oslo (Figure 3). The subway takes about ten minutes from the central station to the nearest stop that is called Brynseng. The area is special since it contains an old forest. There is no direct public transportation at the western end, and the closest bus stops are further away. A bus route is following alongside the park borders throughout Etterstad and the green space can be accessed from here via a pedestrian bridge. The area is accessible from all sides through

several entrances. The western end of the area is connected to Kværnerbyen that is, at the time of the study, being transformed into apartment buildings (Obos Kværnerbyen 2014). A bus route connects this part with the city centre.

Figure 3: Geographical orientation natural green space Svartdalen
Source: **Miljodirektoratet, 2015 (edited)**

The green space is considered important for its near natural forest and also because it inhabits some red listed species (Kålås 2010). The names are given in their English translation, followed by the Norwegian and Latin term in brackets. Within the Etterstad part, three listed fungi species are found: veiled oyster mushroom (*seig østersopp*; *Plerotus dryinus*), rancid bonnet (*gipshette*; *Mycena olida*), lentinellus castoreus (*beversagsopp*; *Lentinellus castoreus*) (Bendiksen and Bakkestuen 2000). Furthermore, some bird species within the area are of high management interest: nightingale (*nattergal; Luscinia luscinia)*, red underwing (*pileordensbånd*; *Catocala nupta*), common sandpiper (*strandsnipe*; *Actitis hypoleucos*), brambling (*bjørkefink*; *Fringilla montifringilla*) and the lesser spotted woodpecker (*dvergspett*; *Dendrocopos minor*). Svartdalen is inhabited by one listed red species: Rusty porecrust (*rustkjuke*; *Phellinus ferruginosus*) (Bendiksen and Bakkestuen 2000). The area around the river Alna provides a unique natural habitat and one species living here is of high

management interest: the freshwater pearl mussel (*elvemusling*; *Margaritifera margaritifera*) (Kålås 2010).

Before the river was brought underground it crossed along marginal deposits of moraines in the Ice Age. Both glaciers and the transport of coarser material have formed these moraines. An intense landslide, that occurred approximately 8,300 years ago, filled the entire valley down to the fjord with clay. The Oslo valley took its beginning at this time a bit outside of the Alfaset-moraine. It is anticipated that this moraine functioned as a dam to hold a lake, which broke under heavy rains and filled the ocean with clay. Tree logs, leaves and great amounts of nutshells have been extant and date back to that event (Bendiksen and Bakkestuen 2000).

The case study area is divided into two smaller parts, which are separated by a train track and a major road. A bridge and a suspension bridge connect the two sides with each other. Furthermore, a pathway beneath the road and the train track allows for a continuous visit of both parts. These elements have been integrated in the park in 2009 to 2011. The western part is limited at the western end by Kværnerbyen, in the north by Etterstad and in the south by Svartdalsveien and the city part of Manglerud. This south-western area will be referred to as Svartdalen. The eastern part is close to the city part of Etterstad in the north and will be referred to as Etterstad.

The part that is located from the train tracks westwards is Svartdalen. Here a waterfall poses the beginning of this part. From there water runs down into a zone of acidic bedrock, such as gneiss and granite. These bedrocks build the basis for a barren pine forest that grows at the south of the river. This part close to the train crossing consists of a narrow north-south going valley with moss-dominated hillsides. From here the river course flattens out into the lower and western part before it disappears underground at Enebakkveien. Alna falls from about fifty-five meters above sea level at the train crossing to about thirty meters above sea level at Enebakkveien. The north-western part consists of bedrock from Cambium and Silur containing limestone and clay slate. The weathered soil is calcareous combined with an exposure southward representing the basis for a warmth loving and nutrition demanding deciduous forest. Elements of marsh and swampy forest as well as dead spruce, pine and leave trees in all stages of decomposition are found close to the river (Bendiksen and Bakkestuen 2000).

Figure 4 gives and impression of the forest in the green space, consisting of thermophile broadleaf forests (*varmekjær edellauvskog*), moist broadleaf forests (*fuktige lauvskogsutformiger*) and coniferous forests (*barskog*). Incidentally elements of meadows dominated by weedy species (*ugraspreget eng- og kantvegetasjon*) and forest-edge vegetation (*trekantvegetasjon*) are found (Bendiksen and Bakkestuen 2000).

Figure 4: Natural green space Svartdalen (Svartdalen)
Source: Own image

Situated within Svartdalsparken a reminder, a blue impeller, of the former use of the area is found. In summary it says that Oluf Onsum bought Kværner farm in 1853 and established Kværner Brug. The company produced cast iron stoves, which were a high demanded product on the market at that time. Specialization led to a split of the company and the company expanded throughout the 1860ies focusing on producing equipment for workshops and machinery. After 1870 the company produced the first water power turbine (Industrimuseum.no) and established itself on the market as one of the world's largest producers of waterpower (Aker Solutions 2015). Oluf Onsum was involved in many different businesses, and as the risks went to high the company went bankrupt. Nevertheless, the company was built on solid ground and Kværner AS emerged as a solid company (Industrimuseum.no). The production was closed down at Kværner in 1999 and the area was sold (Obos Kværnerbyen 2014). The plot of the compnay ensured the existance of the old forest as it is found nowadays.

The name of the Park area situated at the western lower end of the entire area is Svartdalsparken (Figure 5). This name is often used colloquially for the entire area located around the lowest part of the river flowing on the surface.

Figure 5: Natural green space Svartdalen (Svartdalsparken)
Source: Own image

The Etterstad part is delineated in the west by the train crossing and in the northeast by the subway tracks and the adjacent road, Bryn Bru. This part, as defined by Bendiksen and Bakkestuen (2000), is delimited to a smaller area, so that the park area at the north-eastern end is not included. At the same end a waterfall (*Brynsfossen*) incised into the clay terrace. Here the water flows into the green space beneath a building, whilst keeping the river over ground. The river runs in meanders throughout this part with no great height differences. The forest is, influenced by the river, quite luxuriant with big willow trees, which are also characteristic for this part. As in the Svartdalen part, the Etterstad part expands on marine clay except some patches characterized by Cambro-Silurian rocks (Bendiksen and Bakkestuen 2000).

The green space was under great cultural impacts leading into a seemingly untouched forest. Such a forest succession was a quite common process resulting in an area that slowly grew into a forest that is product of human influences. This cultural influence should be kept in mind. Nevertheless, the word nature or natural respectively is used in connection to this

selected green space.

This picture of naturalness and wilderness is a result of thickets, dead trees in combination with big willow trees and a variety of forest types that gradually grew within a small area (Bendiksen and Bakkestuen 2000).

The broadleaf forest changes throughout the area from types influenced by humidity close to the river, and types influenced by dryer soils. Most of the northern Etterstad part is covered by native grass vegetation and forest-edge vegetation, consisting of warmth loving species. This area is presented in Figure 6 (Bendiksen and Bakkestuen 2000).

Figure 6: Natural green space Svartdalen (Etterstad). I2 vegetation
Source: Own image

2.3 GREEN PLAN OF OSLO

Green spaces within the build environment are supposed to invite and inspire inhabitants to go out and engage in sportive or recreational activity. This statement is subliminally challenging the authorities to improve the health and well-being of their citizens by establishing green spaces that invite people to become more active. The overall aim of Oslo municipality is to ensure a widely connected network of green spaces so that the different needs of the city inhabitants are safeguarded. According to the people health act (*Folkehelseloven; LOV 2011 -06-24 nr. 29: Lov om folkehelsearbeid*) green spaces should

contribute to two central functions: (1) inspiring people to engage in nature and experiencing the same, (2) to give the possibility for physical activities. Furthermore, green spaces should be designed universal (*universell utforming*), so that as many people as possible can have access to them. This underlines the need of ensuring secure spaces for different groups, i.e. children, elderly, for visually impaired and disabled people as well as for people with diverse cultural backgrounds (Miljødirektoratet 2014).

Oslo municipality distinguishes between four different public urban green spaces within the land-use objectives in the regulation plan (*reguleringsplan*): natural spaces (*Naturområder*), tour areas (*Turdrag*), recreational areas (*Friområder*) and parks (*Parker*). These spaces are shortly described in the following:

Natural Spaces

Natural spaces represent the wild and the unmanaged within the city. These areas are naturally preserved areas, containing rich biodiversity. Natural spaces are present to stimulate the imagination of the visitors. Such areas can be facilitated with fitting pathways but not with much more than that. A universal design is not supposed to affect natural areas largely, changes could be made to ensure secure movement on pathways.

Tour areas

Tour areas are connected green spaces that allow for consecutive trips in a natural environment. These areas can connect parks, natural areas, and recreational areas which allows for a connection to the surrounding forests (*markaområder*). Such connected spaces are considered crucial for providing a rich outdoor live. Tour areas are seen as the soft network of the city, providing connected trails. Concerning the topic of universal design, elements such as signs, trails and benches can be added.

Recreational Areas

Recreational areas are equipped with facilities for play and physical activity. Such areas can contain natural elements, but the focus lies in providing engaging places, with a lower level of artificial elements than parks. These areas should gratify a universal design containing pathways, spaces to rest and play as well as areas for recreation.

PARKS

Parks are landscaped and artificially made, with architectural qualities. The vegetation is cultured and elements such as fountains and sculptures can be present. Parks are a social meeting point and can be used for cultural arrangements and festivities. These areas are used during day and evening. Additionally a high degree of management is visible. Elements in such areas are open lawns, pathways, lights, eateries, places to sit, sculptures or installations, flowerbeds and big trees to name a few. Parks are the easiest structure to access and are facilitated for summer and winter usages. Pathways must, in addition, allow for wheelchair use. Parks are found to be predominantly used for relaxing than for physical activity (Hansmann et al. 2007). A universal design in a park should include signs for orientation at each entrance, toilets, and parking lots, places to sit and further installations that ease access and use (Miljødirektoratet 2014).

2.4 OPENNESS PROJECT

The present study is developed in cooperation with the OpenNESS project and the following chapter describes the project and the connection to the present thesis.

Operationalization of natural capital and ecosystem services (OpenNESS) is a European project concerned with the translation of ecosystem services and natural capital concepts into operational frameworks that can be used for integrating ecosystem services (ES) into decision-making and management. Furthermore, the project reviews how the concepts connect to and support a wider European Union policy context, whilst investigating the potentials and limitations of ES and natural capital concepts (ECNC 2013). The OpenNESS project involves several case studies throughout Europe of which on is carried out in Oslo.

The tool used to valuate ES in all of Europe is the Ecosystem Services Mapping tool (ESTIMAP). ESTIMAP is a GIS based tool that follows the CICES classification of ecosystem services and is based on the ecosystem service cascade framework (Haines-Young and Potschin 2010), with the main goal of "providing an integrated assessment of the capacity of ecosystems to deliver ecosystem services with standardized output formats" (Zulian et al., 2014: p2). The baseline data used for the European Model is from 2006, and the indicators were mapped at regional level (Zulian et al. 2014).

The OpenNESS project in Oslo is performed by the Norwegian Institute for Nature Research (NINA) in cooperation with Vista Analyse. Constituting the projects advisory board are Oslo municipality and several agencies.

The main objective of the Oslo case is to develop a scenario scoping exercise of total economic value of ecosystem services from blue green structures in greater Oslo, as well as developing a classification and scoring system covering existing blue green spaces across the city. Oslo municipality developed such a Blue Green Factor (BGF) that can be used as a policy instrument to attain a desired level of blue green spaces. The project develops further a map application for evaluation of BGF scoring, an online survey for valuing green space importance and visit frequency, as well as hedonic pricing exercises. The survey has the main objective to examine how the valuation of ecosystem services can be operationalized as decision-making support. The survey focuses on how people value, in a monetary sense, their recreation time in urban spaces (David Barton 2014, personal communication). This inclusion of stakeholders and an introducing of an integrated and participatory mapping approach can decrease especially the intangibility of CES (Hernández-Morcillo et al. 2013).

The present research is developed in cooperation with the OpenNESS project and is testing the BGF and its compatibility with a natural urban green space and a constructed green space. The manually calculated BGF scores in this thesis can furthermore be used to calibrate the results achieved by the map application. Furthermore, qualitative interviews are used to give an insight into non-monetary valuation of residents using the urban green spaces and their needs and values so that cultural ecosystem services provided might be identified within the blue green structures.

At this point it is of interest to clarify the concept of value and how valuation is used within the present study. Value can be simply described as the "measurement of the benefit" (Turkelboom et al. 2013). This measurement can be monetary or non-monetary. The present study uses the term in a non-monetary sense, simply as "an entity which improves the well-being of society-directly or indirectly" (Kumar and Kumar 2008: p.810). Monetary valuation is carried out within the OpenNESS project. The process of how humans form values is subjective (Turkelboom et al. 2013), and people value according to different variables. Some components influencing humans' valuation are elaborated further within the theory. Furthermore, CES that have to be experienced in order to derive a cultural service can be assessed though qualitative interviews.

3 STATEMENT OF THE PROBLEM

Ecosystem properties have to be assessed in order to identify the services derived for humans (Pickett et al. 1997). This statement is confirmed within the ecosystem service cascade by Haines-Young and Potschin (2010) and the ecosystem properties, potentials and services (EPPS) framework by Bastian et al. (2012) and Bastian et al. (2013). The physical properties or blue green structures respectively are the basis that supports ecosystem functions. These structures have the potential or capacity to deliver services. Ecosystem services are derived from ecosystems and their properties and need to be identified in order to enable the assessment of the same. This is even truer for cultural ecosystem services, some essential contributions of ecological structures have to exist to provide cultural services (Daniel et al. 2012).

Voigt et al (2014) describes an existing lack of knowledge concerning the relationship between park properties and the activities and demands of the users. Research focused mostly either on visitors of the park or the park properties and has seldom examined both systematically, even though urban green spaces are considered crucial to the well-being of human beings (Voigt et al. 2014).

Several studies confirm the link between ecosystem services and human well-being (Chiesura 2004; Davis et al. 2011; Gómez-Baggethun and Barton 2012; Haines-Young and Potschin 2010; MEA 2005b), most certainly in the case of the positive impact of urban green spaces to human health and well-being (Bjerke et al. 2006). In the urban study of Maas et al. (2006), a positive relationship is found between the percentage of green space close to the residents' living space and the perceived general health. Furthermore, green areas seem to positively influence health of all age and educational groups. Van den Berg at el. (2010) investigated the connection between the presences of urban green space and health issues and concluded that perceived general health was notably moderated by the quantity of green space in the surrounding. Björk et al. (2008) found that more time was spent on physical activity when green spaces where close to the home of residents. Green spaces provide engaging places, for formal and informal recreation as well as for socializing (Sanesi et al. 2011). Furthermore, in their systematic review of papers Thompson Coon et al. (2011) identified several papers demonstrating that outdoor activities reduce negative emotions and a greater degree of mental restoration is achieved compared to activities that are carried out inside.

Cultural ecosystem services are quite intangible, and most services demonstrate an incompatibility with economic assumptions. These services are built upon individual perceptions and values, based on personal and social driving forces. Hernández-Morcillo et al. (2013) analysed 42 papers, identified in July 2011 on ISI Web of Science, with an explicit quantitative or qualitative measurement approach of any cultural ecosystem service dimension. This analysis disclosed a non-consistency in methods that identified CES. The assessments identified methods that were case specific and individual methods, definitions and classifications were used (Hernández-Morcillo et al. 2013). The difficulties that accompany the operationalization and quantification of CES are resulting in an insufficient attention towards CES. So far no common framework for assessing CES exists (Szücs et al. 2015).

Haines-Young and Potschin (2010) suggest to use the classification by the Millennium Ecosystem Assessment as a list of services and to use the cascade as a method to identify the operation of the specific system (Haines-Young and Potschin 2010). In order to inform decision-making and implementation it is important to acknowledge the perceived values of urban dwellers towards urban parks (Camacho-Cervantes et al. 2014) and to identify how these services are connected to the blue green structures. Furthermore, mapping of ES has been put forward as a tool that has the potential to understand complex systems and interrelationships and thus mapping can improve the acknowledgement and application of ES in decision-making (Szücs et al. 2015).

The aim of this study is to map the selected green spaces and then compare the natural green space to the constructed green space, based on the BGF and the Structural Diversity Tool. These tools are used to identify the ecosystem properties. The interviews and observations carried out within the fieldwork are used to connect the blue green structures of the green spaces to the cultural ecosystem concept.

3.1 RESEARCH QUESTIONS

1. What are the blue green structures of the natural green space and the constructed green space?
2. How is the structural diversity of the natural green space and the constructed green space?
3. Which aspects are important for the different users when they visit the case areas?
4. How do the users value the green structures in the natural green spaces compared to the constructed green space?
5. How important are blue green structures for providing cultural ecosystem services?

3.2 HYPOTHESES

1. The natural green space is expected to achieve a higher BGF score than the constructed green space.
2. The constructed green space is expected to achieve a higher score on the Structural Diversity Tool than natural green space.
3. Identified aspects are assumed to correspond with the aspects found in the aesthetics of the pleasant and the restorative environment.
4. On-site users are expected to value the natural green space higher compared to the constructed green space.
5. Blue green structures in urban environments are of high importance for providing CES.

4 ECOSYSTEM SERVICES: A THEORETICAL CONSIDERATION

This chapter introduces the theoretical bases of the present thesis: the ecosystem services concept, the connection between the concept and human beings, leading to the concept of cultural ecosystem services. Cultural ecosystem services are intangible services that are based on human perceptions, experiences and values (anthropocentric). The operationalization of the concept and some implementations are summarized briefly.

Further theoretical considerations, connected to the valuation of green spaces, are the experience of nature in correspondents with the aesthetics of the pleasant. The experience of nature explores landscape preferences in connection with their attention restoration theory. This theory focuses on landscapes or environments in general and not explicitly with urban environments. The connection to urban green spaces is made in the aesthetics of the pleasant.

4.1 ECOSYSTEMS, URBAN ECOSYSTEMS AND THEIR SERVICES

An ecosystem is a complex concept consisting of several components. Pickett et al. (1997) describes the functional linkage of an organism and its physical environment as the core requirement of an ecosystem. Pickett and Cadenasso (2002) present a broad, basic understanding of ecosystems, describing the ecosystems as a biotic community or assemblage and its associated physical environment in a specific place. Thus indicating a scale independency, a small unit may as well be an ecosystem as a large unit, and presenting an explicit spatial extent of all ecosystems. The presented definition does also not deny the changing content or processes of nutrient and energy cycles within the ecosystem (Pickett and Cadenasso 2002). The World Health Organization (WHO) describes ecosystems in their Health Analysis Report as the planets life-support system for human species. Fundamental needs for humans, such as food, clean air, shelter and balanced climate conditions are derived from ecosystems (MEA 2005a).

URBAN ECOSYSTEMS

Urban ecosystems are systems that exist within a built infrastructure that covers a large proportion of the land surface or those in which people live in high densities, as Gómez-Baggethun and Barton (2012: p.236) describe it. Those systems include all green and blue areas in an urban settlement and are highly modified and fragmented (Gómez-Baggethun and

Barton 2012). Urban ecosystems are much more than simply green spaces, including street trees, gardens, green corridors, outdoor sport facilities, churchyards, burial grounds among others (Davis et al. 2011). The definitions given are setting boundaries to ecosystems and it is important to notice that these boundaries exclude some of the influences that might be important to the specific system (Pickett et al. 1997) whilst evaluating ecosystem services. Developing an ecological understanding of human-natural systems is important especially in a heterogeneous urban area surrounding (Cadenasso et al. 2007).

Considering the term urban, what is urban and what is not urban is difficult to grasp. The term is used in everyday language quite intuitive but definitions defer greatly (Francis and Chadwick 2013) and no international agreement about how to define urban areas or populations exist (Davis et al. 2011; Gómez-Baggethun et al. 2013). In the present case the term urban is used broadly as a great proportion of built-environment and a relatively high population density within a regional context (Francis and Chadwick, 2013), which is true for the case study areas. In the same sense, boundaries for urban ecosystems are difficult to define since important interactions and fluxes required of the respective ecosystem stretch out of urban boundaries made by humans (Gómez-Baggethun et al. 2013).

ECOSYSTEM SERVICES

The importance of ecosystems can be related to the benefits derived, the ecosystem services. These services provide long-term conditions for live (Gómez-Baggethun and Barton 2012). Ecosystem services are defined by Gómez-Baggethun and Barton (2012: p.236) as "benefits that humans obtain from ecosystem functions". Daily (1997: p.3) defines ecosystem services as "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human live". Urban ecosystem services are of particular importance in providing services connected to human health and well-being (Chiesura 2004; Davis et al. 2011; Gómez-Baggethun et al. 2013; MEA 2005a).

Bastian et al. (2013) describes the relationship of ecosystem properties and their services in their five pillar EPPS framework (Bastian et al. 2013), illustrated in Figure 7. In the present study these properties are describes within the blue green structures. These structures determine if an ecosystem service can be provided. Relying upon the properties, a certain potential exist that services can be provided. Only the needs of humans are transferring these potentials into benefits. This service cascade emphasises the differentiation between the

ecological setting, the processes generated and the benefits that humans in the end perceive. This is of importance since humans will value the functions or properties differently at diverse places at varying times. Hence, the importance lies within the identification of the properties, the blue green settings of an ecosystem setting (Bastian et al. 2013; Haines-Young and Potschin 2010).

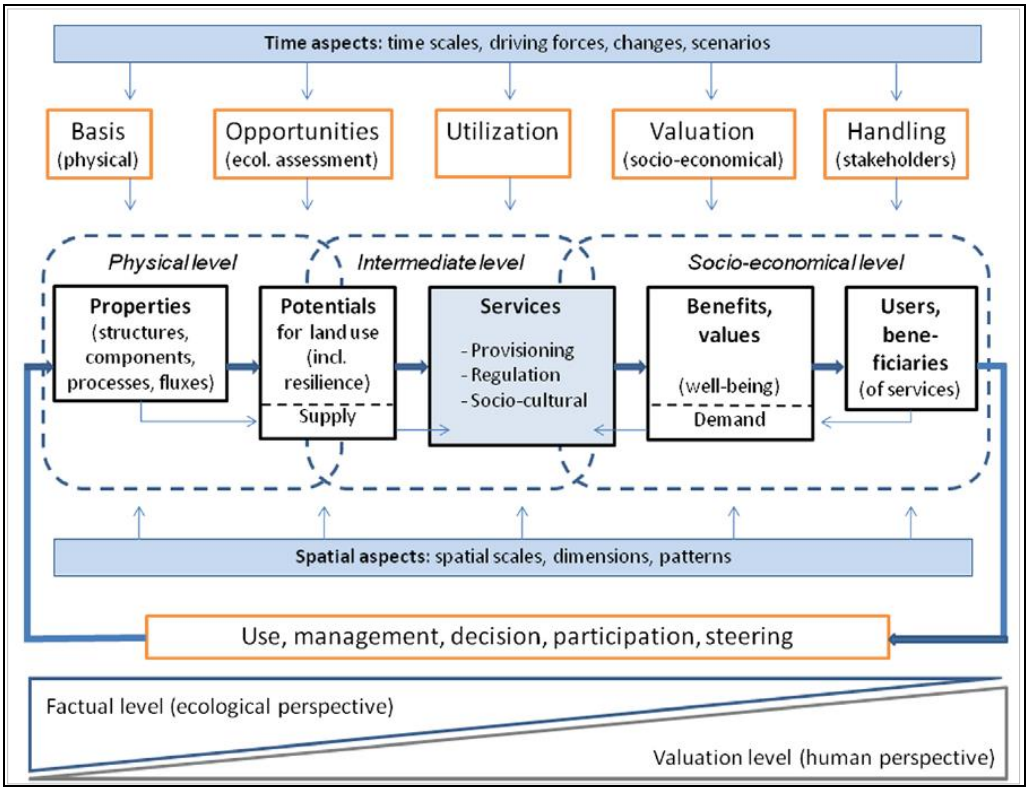


Figure 7: EPPS framework
Source: Bastian et al. 2013

4.2 CLASSIFICATION OF ECOSYSTEM SERVICES

The Millennium Ecosystem Assessment (MA) carried out the first complete global assessment of ecosystem services in 2005. Key findings showed that nearly sixty per cent of the evaluated services are being degraded or are under unsustainable use (Haines-Young and Potschin 2010).

The MA recognized ecosystem services in four general classes, namely: (1) provisioning services that deal with the material or services providing the production of products form

ecosystems; (2) regulating services that regulate other environmental processes or functions; (3) cultural services include services that relate to the need of humans; and (4) supporting services that support the existence of the other services by supporting underlying ecological processes (Francis and Chadwick 2013; Haines-Young and Potschin 2010; MEA 2005a). Cultural ecosystem services are explained in more detail in the following chapter.

Another service that is important to mention are the so-called disservices. These services have been or are perceived to have a negative influence on humans and their well-being (Francis and Chadwick 2013). Especially in an urban environment the services derived by for example an open water surface might be compromised by the negative effects of increased insect populations or the increased vulnerability to water borne diseases (Francis and Chadwick 2013). In general species that can cause any kind of production damage or affect human health negatively are representing possible treats to the well-being of humans. Furthermore, nature might generate some kind of discomfort; i.e. creating the feeling of fear at night or species that develop into nuisances. Disservices are hard to assess since the same service might be perceived by one person as a threat and as a benefit by another (Turkleboom et al. 2013).

Several organisations and groups worked with the classification by the MA, but others used different ways of grouping and naming services, for example the study on The Economics of Ecosystem Services and Biodiversity (TEEB). The diversity in classifications is due to the novelty of the field itself but also due to the complexity that the classification of ecosystem services contains. The European Environment Agency proposed in 2009 a Common International Classification of Ecosystem Services (CICES), in order to name and describe ecosystem services, based on existing typologies and standards for describing economic products and activities. CICES was created in order to make studies and assessments comparable, as well as to simplify the integration of service assessments with other data. CICES, following a hierarchic structure, poses three main categories: provisioning, regulating and maintenance as well as cultural services, with nine sub-categories. Supporting services are within the regulating and maintenance services that are not seen as an own group since these services are supporting the other three categories (Haines-Young and Potschin 2011).

Using the classification by the Millennium Ecosystem Assessment, Layke (2012) describes the tangibility of ecosystem services. Most of the provisioning services are tangible goods and therefore indicators are quite easy accessible. Indicators for regulating services are not as

immediate tangible as the aforementioned, so are the indicators for supporting services. The immediate dependency of people to provisioning and regulating services results into better-known indicators; these services have simply been under more interest than others. In addition, services that are linked to economic markets are supported by stronger indicators, as well are services that are regulated by the state (Layke et al. 2012). Crossmann et al. (2013) underpins these statements. In their literature review 113 papers, with the key word "ecosystem services" that were published until August 2012, were identified by using ISI Web of Science, Science Direct and Google Scholar. This review identified regulating services as the most often mapped service, followed by provisioning, cultural and supporting services (Crossman et al. 2013).

4.3 CULTURAL ECOSYSTEM SERVICES

CES are intangible services, relying on humans to perceived or derive those services. Human beings are not only organic components of the ecosystem. Their system of meaning is constructed by their social surrounding. Humans adjust to situations through learning. Such experiences build unconscious preference behaviour (Pickett et al. 1997). Thus, each individual perceives services differently and each individual has different preferences. The experience of nature and the aesthetics of the pleasant further discuss preference building processes (chapter 4.6).

Throughout these processes of experiencing and knowledge building humans generate institutions to control productivity, storage, and distribution of knowledge. These institutions are the instrument to generate a free-ranging species, using ecosystems to their benefits and simultaneously creating extensive alterations of landforms and communities (Pickett et al. 1997). Thus assessments of cultural ecosystem services are limited. This is reflected within the classification of the MA, where only 38 of the available total of 344 services recognized, are related to cultural services (Hernández-Morcillo et al. 2013). CES are still given insufficient attention (Szücs et al. 2015).

The MA defines cultural ecosystem services as the "non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences" (MEA 2005b: p.40). These are associated with ten subservices: cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage, recreation and

ecotourism (MEA 2005a). CICES describes CES as services that "include all non-material ecosystem outputs that have symbolic, cultural or intellectual significance" (Maes et al. 2012 in Szücs et al. 2015).

Chan et al. (2012) presents a critical view towards these concepts, stating that a definition of cultural ecosystem services should be more than focusing on human well-being. Their definition describes CES as the "ecosystems contribution to the non-material benefits that arise from human-ecosystem relationships" (Chan et al. 2012: p.9). This definition reflects the ecosystem service cascade in integrating the relationship of humans and ecosystems. Such a broad definition however allows for services to be accounted for in more than just one category, causing problems for economic valuations. Some services can simply not be traded with others, such as sacred places or the sense of identity through a certain species. Some CES are a function of experience and as such difficult to articulate. Such transformative services are, nevertheless of importance, since the experience changes the way of thinking (Chan et al. 2012).

The basic structure of CES within the CICES classification contains two classes: (1) physical and intellectual interactions and (2) spiritual, symbolic and other interactions with ecosystems (Table 1). Both classes contain several subservices. These classifications should not be seen as inclusive, many more cultural services are available and more classifications exist.

Table 1: CICES CES overview
Source: European Environment Agency, 2013

Cultural	Physical and intellectual interactions with ecosystems and land-/seascapes [environmental settings]	Physical and experiential interactions
		Intellectual and representational interactions
	Spiritual, symbolic and other interactions with ecosystems and land-/seascapes [environmental settings]	Spiritual and/or emblematic
		Other cultural outputs

Physical and intellectual interactions include services such as recreation and community services as well as tourism (Haines-Young and Potschin 2011). Recreational services are the most tangible of the CES, since the connection between recreational services and human

health is obvious. This class also contains cognitive development services such as environmental education.

Spiritual, symbolic and other interactions with ecosystems comprise services such as aesthetic information and heritage as well as inspirational and spiritual services. Aesthetical and psychological services are seen as enhancing human life with meanings and emotions (Gómez-Baggethun et al.: p.184) and studies relate aesthetical benefits from urban green spaces to increased physical and mental health (Maas, 2006; van den Berg et al., 2010). This beauty of ecosystems is perceived by many people and the feeling of identity, harmony or disharmony, safety or insecurity to name a few can be connected to aesthetic values. Inspirational values are defined as "values providing a rich source of inspiration for art, folklore, national symbols, architecture and advertising" (Szücs et al. 2015: p.125) or simply spaces that allow for new thoughts, ideas and/or creativity (Szücs et al. 2015). Cultural heritage is broadly described as natural or semi-natural features of an environment that contribute to the identity of an individual or a community. As the expressions implies the heritage of biophysical features or physical artefacts is inherited and maintained in the present (Daniel et al. 2012).

4.4 Concept and implementation of ecosystem services

Pickett and Cadenasso (2002) consider the concept of ecosystem services in three dimensions: meaning, model and metaphor. Meaning describes the basic technical definition of the concept, the simple meaning of it. Model provides a "translation of the definition into usable tools" (Pickett and Cadenasso 2002: p.2). However, metaphor describes the concept in a more informal and symbolic use. Showing that the concept of ecosystem services as a metaphor allows for transferring the outputs of the models of ecosystem services into "socially valuable terms" (Pickett and Cadenasso 2002: p.7). In this sense the metaphor helps to involve new researchers as well as to explain the value of ecosystems to the general public (Pickett and Cadenasso, 2002). Using the concept as a metaphor enables the possibility of refocusing the attention of the general public on the old issues of protecting ecosystems. The ecosystem approach highlights a complete, integrated thinking and could provide more united management and policies at a landscape-scale. Furthermore, the focus on human well-being could be enhanced through a wider approach (Haines-Young and Potschin 2010).

Nevertheless, the potentials provided by nature are transformed into services and benefits derived by humans. In order to account for the services they have to be recognized and in doing so the ecosystem services are transformed into commodities (Haines-Young and Potschin 2010). The leader of TEEB, Pavan Sukhdev, takes these issues further and points out that the value that nature provides is not included into markets even though nature provides the basic needs of humanity. He states in his TED talk in Edinburgh 2011 that:

"Economic has become the currency of policy. Unless we address the invisibility of nature we are getting results ending in a gradually degradation and loss of natural capital" (Sukhdev 2011).

The framework of ecosystem services allows for a purposeful way of understanding or rather quantifying of environmental processes and ecosystem values (Francis and Chadwick 2013; Raymond et al. 2009). Whether this process is completely ethical or not is up to discussion but the concept of ecosystem services is the best way so far to integrate scientific disciplines and convey the implications of the loss of services into management processes (Chan et al. 2012; Francis and Chadwick 2013).

The European Union agreed to an improved and updated Strategic Plan for Biodiversity set in the tenth Conference of the Parties (COP) to the Convention on Biological Diversity in 2010. This plan relates to the Aichi Biodiversity Targets for 2011-2020, with an explicit focus on ecosystem services (SCBD 2014). Responding to the tenth COP and the Aichi Biodiversity Targets, the European Parliament adopted the EU 2020 Biodiversity Strategy in 2011. The Strategy stresses the need to account for ecosystem services by mapping and valuation of the same, including six main targets and twenty actions (European Commission 2014). Target two contains the aim of restoring of at least fifteen per cent of degraded ecosystems as well as the maintenance and enhancement of green infrastructure by 2020. Within this target, action five describes the implementation of assessing and mapping the state of ecosystems and their services. This action includes the assessment of the economic value of those services (EUR-Lex 2011). Considering action five the need to map ecosystem services with reliable and comparable spatial information of those services is evident and thus will be crucial for decision-making processes. This action can be used to restore Europeans green infrastructure and prioritize areas that are in need of improvement (Zulian et al. 2014).

4.5 RECREATIONAL OPPORTUNITY SPECTRUM

The recreational opportunity spectrum (ROS) by Clark and Stankey (1979) is a framework for outdoor recreation. The ROS is a structural theory, describing the need of structural diverse spaces, a spectrum of opportunities, in order to fulfil the diversity present in the perceptions of people. It presents several spectra of opportunities, from wild to urban. The ROS is the basis for researching social and management influences on on-site visitors and the urban opportunity spectrum is used to compare the selected green spaces in the discussion chapter.

Opportunities are seen as the function of users' preferences but also as the product of management actions. A recreational opportunity setting consists of a combination of physical, biological, social and management conditions that combined give value to a place. Hence, management as well as social dimensions are of great importance whilst valuing a green space.

Opportunities include qualities related to recreational use as well as qualities that are put at disposal by nature and the management setting. "Quality in outdoor recreation is best assured through provision of a diverse set of opportunities" (Clark and Stankey 1989: p.4). Nevertheless, diversity is only a means to an end, since a tremendous diversity of perceptions of recreational usages exists within a population. A spectrum of opportunities is needed to efficiently serve this diversity. Supporting this statement is the research by Bjerke et al. (2006). This diversity of spectra is reflected within the green plan of Oslo (Miljødirektoratet 2014). The spectrum of opportunities stands for a diversity of green spaces to fulfil the diverse needs of humans. The setting of a green space is reflected within the present study as blue green structures.

Building upon this assumption, the framework uses four levels of recreational use, from settings that are primitive / wild to modern / urban. Furthermore, six factors are used to describe the individual setting. Within these four spectra a wide variety of combination within the six factor settings can be accomplished. The factors have to be in line with the opportunity spectrum they are situated in. The six factors are in itself measurable and under management control. Furthermore, the preferences of the users are connected to the factors and these preferences influence the decision-making process of the users. The ROS subdivides the opportunities into different settings using these six factors:

Factor 1: Access

The first factor deals with access, which can directly increase or decrease the use of an area depending on for example paved roads or dirt tracks.

Factor 2: Non-recreational resource use

The second factor connects to the non-recreational resource use of an area. This factor is dealing with changes in an area, such as clean cutting of a forest and how these actions would affect the use for recreationists.

Factor 3: On-site management

The third factor handles on-site management, including area modifications and to which degree these modifications are appropriate. The appropriateness is taking extend, apparentness, complexity and facilities of the modifications into account.

Factor 4: Social interaction

The fourth factor deals with social interaction and a social carrying capacity can be established.

Factor 5: Acceptability of the visitors impact and factor 6: Regimentation

The fifth factor connects to the acceptability of the impact of visitors and the sixth with an acceptable regimentation. Following these factors and the spectrum of the opportunity, a recreational opportunity spectrum setting is the result of a certain mixture of the factors in a specific location (Clark and Stankey 1979).

The urban opportunity setting

An urban setting is characterized by a considerable built-environment, however natural elements may exist in the setting but vegetation is mostly created or polished in a sense. Equipment is adapted to renewable resources and modernised to allow for certain recreational activities. To encounter other human beings is most likely and the green space is influenced by human sounds and sight. Facilities for parking and some kind of mass transport are available in the area. The experience is described through high interaction with other humans

and an ease of access to the area. In addition physical activities are limited to sports that many find entertaining to watch and for passive uses in particular. The experiences of a natural environment as well as the experience of encountering challenges and risks by nature is not given.

The green spaces selected are situated within the urban opportunity spectrum, but the factors contributing vary greatly.

4.6 AESTHETIC OF THE PLEASANT AND THE EXPERIENCE OF NATURE

Analysing the aspects that lead to a visit of one green space or preferring one green space with respect to another are simply said difficult. Preferences are different, but similar patterns do emerge. Two assumptions are the underlying assumptions of the aesthetic of the pleasant by Tessin (2008). Firstly, an everyday visit of a public green space is more focused on the happenings of the space than the setting of the space itself. Kaplan and Kaplan (1989) are supporting this assumption in another direction by addressing the perception of extent that is more important than the actual extent of the space. The prospect of exploring more than is evident on first sight has a special attraction (Kaplan and Kaplan 1989). Secondly, the pleasant plays an important role for the behaviour of the public within urban spaces. But firstly the process of forming preferences and human categorization are introduced.

Kaplan and Kaplan (1989) used a variety of studies, but their main results are based on studies that researched the preferred settings of participants towards black and white images of green spaces. These images presented a variety of settings. This researched was carried out to assess the categorization that humans make, whilst making a preference judgement or valuation of an environment. This categorization is made subconsciously and develops out of everyday experiences. Elements are experienced in special ways and combinations of elements receive certain names. These names are most certainly not referring to the same mental picture of an element. A richness of patterns is behind those names. These varieties of patterns make definitions difficult. However a shared understanding exists (Kaplan and Kaplan 1989). The simple term park creates a different mental picture for each individual but is nevertheless accepted as a general term that is rarely questioned.

The preferences of humans are closely connected to basic concerns, they are expressions of underlying human needs. In this sense preferences are anticipated to be greater in

environments were organisms flourish and function more effectively. Hence humans assess environments in terms of their compatibility with their needs and purposes (Kaplan and Kaplan 1989). Compatibility is simply the conformity of the environmental features with the needs of the individual (Bjerke et al. 2006). Several factors are influencing the preference valuation. These factors include the degree of human influence, the content, the presumed possibilities for action and the possible limitations of movement. Furthermore, the degree of openness of the setting and the spatial definition are of importance. Spatial definition implies the presence of elements for orientation purposes (Kaplan and Kaplan 1989).

Human beings perceive environments subjective, both in the way of what they are seeing and also towards the recognition of this perception. Furthermore, the way of judging the perceived perceptions is different. Perceptions are superficial, distant (Tessin 2008) and direct. A preference decision seems immediate but the process of assessing the environment consists of a variety of variables (Kaplan and Kaplan 1989). Nevertheless the complexity of the urban environment forces human beings to condone the known environment optically. This means that on the one hand humans are able to categorize an environment on first sight and on the other hand they are able to look over a lot on a superficial basis. This categorization is made of previous experiences (Kaplan and Kaplan 1989) and is needed in order to make fast judgements (Tessin 2008).

The previous paragraphs introduced how humans categorize and how preferences arise, resulting in a different mental picture, a different approximate notion of a perfect green space for every individual. This notion is partly built upon personal experience, partly on the basis of hearsay from media and social exchange and partly from purely subjective imagination. It is of importance to understand that a perfect green space varies greatly for each individual. The values and attitudes developed influence behaviour and preferences (Bjerke et al. 2006).

Kaplan and Kaplan (1989) further considers the difficulty of focusing. Effortless attention that allows the mind to follow exciting stimuli is involuntary. But focusing on one thing and inhibiting other thoughts requires effort, especially in an urbanized context where specialization let to more and more focus on one single activity and essential things to pay attention to are not as interesting as other stimuli. Such attention is direct, voluntary, conscious (Kaplan and Kaplan 1989) and as such controlled by cognitive processes (Berman et al. 2008). Deducing therefrom a conscious perception is for the complicated, the unknown, the new, the demanding. This state of mind is to be avoided by the mind since it is expansive

in the sense of metabolic physiology, it is simply too exhausting, to complicated and prone to mistakes. In addition, this conscious perception is also selective. It is not controlled by situational interest but is random as well as indifferent. Simply said, interests and intentions are diffuse and unspecific. This state of perception is called contemplative perception and is widespread in the everyday behaviour within green and grey spaces (Tessin 2008).

Referring these concepts to urban green spaces, spaces that feature a relaxing and restful, not targeted, direct attention are spaces that allow for relaxation and recreation (Tessin 2008). Kaplan and Kaplan (1989) refer to these spaces as restorative environments.

Perceiving objects or elements as aesthetical is based on three conventions. Such objects need to be designed and a direct intention by the producer needs to be recognizable. Furthermore, a socially accepted convention, that this is an aesthetical object, exists. Lastly the object should differ from the standard (Tessin 2008). Such aesthetical elements seek involuntary attention. Objects that simply catch the attention and release it again within seconds can be anything, from a bee to clouds. Such soft fascination elements evoke indirect attention, enough to keep the mind occupied but not too much so concentration is needed.

In summary, besides the stated features and the individual interest as well as the state of mind, also the social convention decides about whether an object is perceived as a primary aesthetical object or not. Taking all these features that influence the process of preference it is inevitable clear that values are highly individual. Perceptions and values are undeniable dynamic.

Furthermore, perception is selective not only because of the above mentioned aspects but also because an object can become close to a person. In this case an object develops a meaning for an individual. The individual sees something in the object that is not really there. A sense of place is developed. This can also be related to certain species found at this place inducing some kind of connection to the species.

Advancing this process of ideologization and broadening the concept in the sense of Karl Mannheim (1969) in Tessin (2008), the entire external world, in the way an individual perceives it, is a function of the learning process, and as such an ideological product. Urban green space, which are seen as an ideological product, produces a practical-functional level as well as an aesthetical-symbolic level. The latter level allows the green or rather the nature to

be brought into the city. A dimension of the other, as opposed to the built-up area, in the urban society is developed. Nature is no longer the usual environment and presents somehow a connection to the past a connection to somewhere else rather than the usual grey environments. Out of this notion urban green spaces are spaces that give a feeling of being in the nature again, being away from the usual.

Public urban green spaces represent places where such feelings are possible. Places of physical regeneration, places where only unconscious perception is needed, and places that allows for a feeling of being away (Tessin 2008).

Kaplan and Kaplan (1989) introduce these aspects in their four requirements for restorative environments. Such a setting should represent the feeling of being away, physically or mentally. To fulfil this feeling a certain extent or a connectedness must exist, again physically or perceptually. Another important aspect is the aspect of fascination. Fascination calls for involuntary attention and is needed to involve the visitor of the space and occupy his thoughts, but it can only be part of a larger picture. The study of Berman et al. (2008) concurred that the ability of urban green spaces to invoke involuntary attention leads to experience of a peaceful and quiet environment. Furthermore, action and compatibility is required for a restorative environment, representing a compatibility of the human and the environment. In addition is the context of importance and experiencing a natural setting achieved the highest approval within the analysed studies (Kaplan and Kaplan 1989):

- The feeling of being away
- Extent
- Compatibility
- Fascination

The aesthetical expectations of a population towards urban green spaces comply with the criteria of the aesthetics of the pleasant. Most people visiting public urban green spaces wish for a stay that is pleasant, that gives a relaxing comfortable feeling. Public urban green spaces are mainly pleasant and are not exciting or thrilling (Tessin 2008).

Six aspects were found to be crucial for deciding which space to visit. These aspects comply with the aspects identified by Gobster and Westphal (2004) in their interrelated study of an urban greenway, the Chicago River corridor.

Accessibility

An important aspect of a pleasant stay is accessibility. As a general rule it can be said that the nearest urban space suitable for the required purpose is visited. Convenience provides for a pleasant stay at least in the everyday visit of a public urban green space (Tessin 2008). Green spaces need to be close to home in order to be used frequently (Sanesi et al. 2011). In the case of a special attractiveness or a higher purpose for a visit, spaces further away are considered (Tessin 2008).

Safety, tidiness and maintenance

Another important aspect is safety, tidiness and maintenance. Safety is a prerequisite for a pleasant stay. The latter two are attendant phenomena; a tidy maintained space gives the impression of a secure place.

Equipment

Equipment increases the practical-functional level of a space and is also an important factor in considering which space to visit. The equipment of a space contributes to convenience and usefulness of a space.

Function and use

Function and use is an important criterion, a pleasant space allows for everything the visitor would like to do. This includes a physiological component, the physical well-being. Implying on the one hand enjoyments like sun or weather (Tessin 2008) and observation of nature (Kaplan and Kaplan 1989) and on the other hand the own physical rest and simply the enjoyment of movement itself or the performance of the individual action. The aesthetics by doing so concentrates purely on doing whatever the user likes to do (Tessin 2008). The usage also goes beyond any physical involvement and is related simply to the knowledge that a green space exists and the imagination of the activities that can be performed in it (Kaplan and Kaplan 1989).

Nature

Nature is the basis and the precondition for the ability of an urban green space to provide recovery of the mind. Nature and landscape are considered the classical spaces for refuelling

the inner mind, the so-called restorative environments (Tessin 2008). Naturalness is the core dimension people relate to in an ecosystem (Gobster and Westphal 2004). The green space as a symbol for refuge or paradise is ingrained within cultural histories of humans (Thompson 2002).

THE FEELING OF BEING AWAY

The last aspect is the feeling of being away. Spaces please in the way they represent the feeling of being away. An urban green space should invite to escape the everyday life (Tessin 2008).

5 METHODS

This chapter introduces the case study approach used in the present thesis. Within this approach the fieldwork contained participant observations and qualitative interviews. The Blue Green Factor and the Structural Diversity Tool are explained and the field assessment measurements are described. Lastly, ethical consideration and the limitations of this study are introduced.

5.1 CASE STUDY APPROACH

Public urban green spaces vary enormously throughout an urban environment and to assess perceived values, a deeper understanding of the use of the selected green space is of importance. In order to gain an insight into the importance of these spaces to urban dwellers a qualitative research design was adopted.

The present research focuses on two public urban green spaces. These spaces have a physical demarcation, a bounded entity as described in Baxter and Jack (2008). Leading the research are questions concerning "how" and "why" urban dwellers use this space. Therefore the background of the respondents is of great importance. These elements require a case study approach (Baxter and Jack 2008). In addition, the exploration of a small number of occurrences is favourable in order to explore a deeper understandings or meaning of the green space for urban dwellers. The need to research the selected green spaces in more detail, to explore in depth variations and the influences of the context (Baxter 2010) indicate the usability of the case study approach.

A case study "allows investigators to retain the holistic and meaningful characteristics of real-life events" (Yin, 2009: p.4). This statement corresponds with the research objective, to gain insight into the perceived values and to question users of the green space in their everyday life situations. These interviews give an understanding of the usage of those specific spaces by the users. This will also allow for experiencing the perceived values of the respondents (Yin 2009).

The applied case study approach focuses on a single case with multiple units of analysis. The case implies the analysis of urban green spaces and the selected green spaces are the units of analysis. The research is of a descriptive type aiming to report what is going on in a typical

situation scenario, in order to capture circumstances and conditions of an ordinary place situation (Yin 2009).

5.2 OBSERVATIONS

The case study approach integrates observations into the research. Participant observations in particular allow the researcher to gather general constructs about the activities within the green spaces (Crang and Cook 2007). Participant observations were carried out before the interviews were performed, to gather a general impression of the use of the green spaces. The observations were continoued during the interview phase.

5.3 THE QUALITATIVE INTERVIEW

The qualitative interview aims to acquire descriptions of the "life world of the respondent" concerning their interpretation and valuation of the researched areas (Kvale 2008: p.10). The method of qualitative interviews is used to research a specific topic, an urban green space, with the purpose of gaining qualitative knowledge verbalized in language and at the same time remaining open to unexpected phenomena. The interview is used to produce knowledge through a conversation with the respondents and will be guided by simple questions written down in the interview guide (Kvale 2008). The interview guide led the interview and helped the interviewee to keep track of the topics that were supposed to be addressed. The theoretical considerations about green spaces build the basis for the interview guide. The guide was arranged considering the important aspects that lead to a visit and is presented in Appendix 13. The questions can be rearranged, so that the interviewee can react on new dimensions given by the respondents.

The interview situation is kept as close to a regular conversation as possible and any needs of the respondents are respected. The interviewee is not contributing with her position to the conversation in order to produce systematic knowledge about the green urban space with respect to the position of the respondent. The interview guide includes demographic questions that are posed at the beginning and at the end of the interviews. The starting questions are concerned with the place of residency as well as amount of visits, at which time a year and what days are regular visiting days. The second set of questions is open-ended, aiming to find the services that are important to the respondent and to find the values the respondent has towards the selected green space. Further questions are aiming to identify

disservices perceived by the different users and to identify a place attachment to the case area or any other green area in Oslo. Each of these questions can be followed up by further questions, depending on the flow of the conversation. These follow-up questions are used to clarify and extent the interview statements (Kvale 2008). The last set of questions follow-up the demographic questions posed at the beginning. These questions are concerned with age, material status, education, background and income per year per household before taxes.

5.3.1 RESPONDENTS

The respondents were urban dwellers observed in the area, on-site users, with an affiliation to the area. Urban dwellers are usually visiting a park if it is within a three to five minute walking distance (Thompson 2002) and increasing distance is decreasing the likelihood of a visit (Payne et al. 2002). Hence, residents are expected to be the most frequent users. Nevertheless, on-site users might not be residents and their perception of the park can vary to those that are nearby neighbours. Their use of the park can contribute to the range of activities in the park (Gobster and Westphal 2004).

Growing diverse societies have different preferences and values towards urban parks and the residential location or spatial context is of importance (Payne et al. 2002). This socio-cultural diversity is taken into consideration through the random sampling technique that allows the researcher to reach a variety of respondents within the selected areas. The variety of interview times, morning to evening, and days, weekday and weekends, and the participant observation will contribute to this wider selecting technique. The interviews are conducted in late summer (August) since a majority of people is expected to use the green spaces within this time period.

INTERVIEWS CONSTRUCTED GREEN SPACE (BJERKEDALEN PARK)

The participant observation showed an almost empty park at all the days of observation. The interview phase was limited to respondents claiming to only passing through the park, elderly and other visitors that were not willing to reply in English. These circumstances limited the interview phase within the constructed green space significantly.

INTERVIEWS NATURAL GREEN SPACE (SVARTDALEN)

The interviews were conducted Wednesdays, Thursdays and Saturdays within a time frame varying from morning to evening. The earliest interview was carried out at 10:10 am and the latest at 6:50 pm, with exception of one telephone interview that was carried out at 8:30 pm. The weather conditions on these particular days have been a mixture of rain, sunshine and occasional storms, offering a less pleasant weather composition. The interviewee moved around within the green space to neutralize possible interviewer biases.

A total of 21 interviews were accomplished, including six interviews with a group of people or a couple, ten male and six female respondents. The age of the respondents ranged between 26 and 70 years and most were Norwegians citizen, with the exception of three respondents (one from Brazil, a couple from Canada and one from Poland). Almost all interviews, with the exception of two, were carried out at different places within the natural green space. One of the exceptions was a respondent on a field trip with a kindergarten group who agreed to a phone call the same evening and one respondent on a running interval, whose interview was carried out at his house. All respondents were approached in Norwegian language and then asked if English as the interview language would be fine. The length of the interviews varied from 2:39 minutes to 18:51 minutes. All recordings were taken after the respondents gave their consensus. Hence, the recording time is not including demographic questions posed at the beginning of each interview as well as the classification questions at the end. Not all respondents wanted to state their postal code, but 16 respondents were from the nearest city part of Gamle Oslo, one respondent from the city part of Alna and one respondent from the city part of Østensjø. All these parts are close to the case area. The respondents with the highest travel time from their home to the natural space are the couple from Canada, although they were staying at a hotel in the centre at the time, and one respondent from Nordre Aker.

5.4 BLUE GREEN FACTOR (BGF)

The BGF is a method to calculate the amount of green in an area. It basically evaluates an urban space considering its greenness and blueness.

The main objective the developers of the BGF were following was to allow for a strengthening of the green and blue structures within the urban environment. The purpose of the BGF is to set a minimum demand of green and blue within building projects. In this sense

the loss of green space through a building project can be compensated with a specified amount of green within that project. In Norway the BGF will be used in connection to the municipality plan (*kommuneplan* or *kommunedelplan)* to ensure a minimum provision of green space within a building project.

Oslo and Bærum municipality developed the BGF that is used in the present study. The BGF builds upon the biotope area factor, which was developed in Germany and a green outdoor factor (*Grönytefaktor*) developed in Sweden. The BGF is however adapted to the Norwegian environment.

The BGF bases its scoring system on a building site level and using the BGF in this setting will lead to a factor within a scale of 0 – 1. An area with water surface, vegetation connected to subsoil and permeable surfaces will get a high value and a low value is achieved through little green and blue surfaces. An area that scores a BGF for example of 0.5 is represented by fifty per cent of green or blue in the area. Grey spaces are targeted with an amount of green blue surfaces of thirty per cent (BGF score of 0.3) and in general urban environment should achieve seventy per cent of blue green surfaces, which equals a BGF score of 0.7 (Clavier, K. 2014).

The BGF is calculated accessing blue green surfaces as well as additional green and blue qualities. All three components are described as the ecological effective surface of the area (Ardila and de Caprona 2014a; Ardila and de Caprona 2014b):

Figure 8: BGF composition

The individual indicators are calculated by multiplying their area in square meters by the value given for each indicator. The total BGF score is than calculated by dividing this area value through the total plot area:

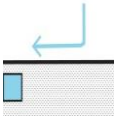
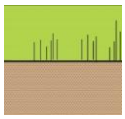
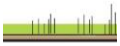
$$BGF = \frac{(individual\ value * blue\ green\ surface\ area\ [m2])}{total\ plot\ area\ [m2]}$$

The BGF is structured in two main categories, blue green surfaces and additional qualities. Within the additional qualities a separation is made into blue additional and green additional qualities.

Blue green structures are represented by nine indexes divided into two classes concerning grey surfaces and their handling with water and green vegetated surfaces and their connection to soil or bedrock. Additional qualities are divided into two subcategories concerning blue and green additional qualities. Blue additional qualities are represented by two indexes and green surfaces are described by five indexes concerned with three height and five indexes concerned with other green structures. The additional within the additional qualities indicates that these indexes are accounted for in addition to the existing blue and green structures. Thus, the scale system can be exceeded, presenting an actual higher ecological effective surfaces area as the surface area of the physically existing green space.

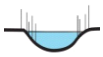
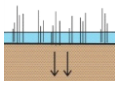
Within the category of blue green surfaces a separation is made between grey surfaces and surfaces that are green (Table 2). Grey surfaces are scored based on their permeability and the index for an open permanent water surface that can receive rainwater is given the highest individual value of one. Impermeable surfaces with drainage to a local closed storm water drainage are valued with an individual value of 0.1. Green surfaces are valued considering the depth of soil beneath the vegetated area. Surfaces with vegetation associated with subsoil or bedrock are given the highest individual value of one. The four indexes following this green surface are staggered after the connection of the surface to soil, bedrock or groundwater. This is important in connection to the build environment; an elevated area with enough soil to allow for trees to grow (over 80 centimetres) is given a higher score than a soil thickness that only allows low vegetation to grow (5 to 20 centimetres). These areas are important for flood regulation as well as to preservation of biodiversity. They are also considered important in connection to aesthetics.

Table 2: Blue green surface qualities

	Open permanent water surface that can receive rainwater		Impermeable surfaces with drainage to a local closed storm water drainage
	Surfaces with vegetation associated with soil or bedrock		Surfaces with vegetation, not associated with soil 5 -20 cm

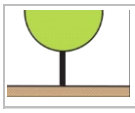
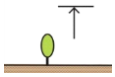
Additional blue qualities that add to the green urban outdoor space are described through the indexes of natural water edges and rain bed or equivalent and are shown in Table 3. The first-mentioned is accounted for if the water edge is planted or natural rock formations are found. Theses extra qualities are accounted for since natural edges to water surfaces provide important habitats and are hence considered important for biodiversity. Rain bed or equivalent is important to diffusion and infiltration processes. Both indexes are valued with 0.3.

Table 3: Additional blue qualities

	Natural edges to water surfaces		Rain bed or equivalent

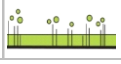
Green additional qualities describe individual trees, divided into newly planted and existing trees and the expected height of those trees. This separation is made to consider the advantages an old tree gives in comparison to a newly planted tree. Trees are counted individually and then multiplied by 25 (for trees over or expected to grow ten meters height), reflecting the footprint or the zone around the tree that represents the tree crown and the root system. Smaller trees are multiplied with a factor of 16, reflecting the smaller footprint of those trees in the same way. Tree counts are made individually, multiplied by the value and the 25 or 16 meter zone respectively and then divided by the total area. The index of existing trees > 10m is given the highest individual value and the lowest value of 0.5 is given to newly planted trees expected to grow 5 – 10 meter (Table 4).

Table 4: Additional green qualities

	Existing large trees > 10 m		Newly planted trees that are expected to be 5 - 10 m

Further additional green qualities are native vegetation with the highest value given in this category of 0.6, hedges, bushes, and, multi-stemmed trees with an individual value of 0.4, green walls with a value of 0.4 and perennials and other ground cover with a value of 0.3. These structures are accounted for in square meters and shown in Table 5. If the total green surface area is continuous and is exceeding 75 m^2 an additional value score of 0.1 on the total blue green surface area is given. A last score of 0.05 is added if a connectivity of elements within the existing blue and green structures exists to blue or green structures outside of the area. In the given BGF a connection value is given if the connection is obvious (Ardila and de Caprona 2014b).

Table 5: Other additional green qualities

	Native vegetaion		Hedges, bushes and multi-stemmed trees
	Green walls		Perinnials and other ground cover
	Contiguous green areas over 75 m2		

The area measurements needed for the BGF indexes were assessed through images from Finn.no as well as aerial photographs from Finn.no. These images were georeferenced and processed using geographical information software (ArcGIS 10.2). Individual tree counts as well as the verification of the polygons were realized through fieldwork. The BGF was calculated for both areas through the area measurements derived from the images and the individual tree counts collected within the field assessments. The comparison is based on the results calculated by using the original BGF to ensure a compatibility with previous

calculated BGF scores. A further evaluation of the use of the BGF within green spaces and the adaptations performed are shown in chapter 6.3.1.

5.4.1 GIS AREA ANALYSIS CONSTRUCTED GREEN SPACE (BJERKEDALEN PARK)

Four map-images have been georeferenced using the coordinate system WGS84 UTM32. These map images are the basis for the area calculations. The aerial images could not be used since the recent updates of the area are not yet present as images. Through fieldwork observation, sketches and measurements the area was redefined and elements were added. The original BGF could be used for this area and individual tree counts were feasible. The resulting map is presented in Appendix 3. The measurements of the individual elements are shown in Appendix 8 and 9, including the tool used within the geographical information software.

Natural water edges were defined using a one-meter buffer as an average, with flat edges and a dissolving buffer type. These edges varied throughout the park and the spaces in between the bridges and beside the basketball court, are accounted for in the measurements.

Pathways were estimated as a three-meter average width and created through a one and a half meter buffer around the line features with flat ends. Pathways and the beach are within the class of permeable surfaces with drainage to an open area.

Stairs as well as bridges were created using the rectangle tool with a predefined three-meter width. Stairs, bridges, the theatre area and the cement block at the northern end are accounted for within the class of impermeable surfaces.

The planted slope areas in the northern part together with flowerbeds and the low vegetation areas are accounted for in the class of other ground cover.

5.4.2 GIS AREA ANALYSIS NATURAL GREEN SPACE (SVARTDALEN)

Six map as well as six aerial images and the area assessment by Bendiksen and Bakkestuen (2000) build the basis for the areas analysis of this natural green space.

The river Alna within the green space has been measured through the given watercourse in the images. Two corrections to the river course have been made according to fieldwork

observations. The river changed its course naturally at the middle of the Etterstad part. The old riverbed dried out and a new arm was created, which was, at the time of the fieldwork, the new course of the river. The old arm is still visible and is accounted for in the calculations as partially permeable surfaces. Transported material seems to gradually block the originated arm but water is still able to pass through. In the same sense a new arm was created constructing a new island within the river, since the old arm is still part of the river course. Furthermore, corrections have been made to the natural water edges in areas where the river edges are not natural, such as under the train tracks, at western Svartdalen where the river is directed into a pipe and some reinforcements within the park area. Appendix 6 and 7 demonstrate the area measurements of the individual indexes of the BGF. Furthermore, the elements contributing to the indexes as well as the tool used within GIS are shown.

Impermeable surfaces, with drainage to vegetated areas or an open drainage magazine, are barely present in the case area and only one cement block at lower Svartdalen. Partially permeable surfaces include all pathways as well as the dried riverbeds and bridges. Pathways have been created using a three-meter width estimate for the entire area. The positions of the line features are estimated through fieldwork notes and sketches. To establish a constant three-meter pathway a buffer with one and a half meters on each site of the line was created, using flat endings and all as the dissolve type. The latter ensures that all buffers are dissolved together into one single feature, removing any overlap (Esri ArcGIS Resources 2014). Bridges were created using the rectangle function in the editor, so that a constant three-meter width is ensured. All vegetation that is present, is connected to soil or bedrock (including the entire area, excluding river, pathways, bridges and natural water edges). Four elements are not represented within the case study area, represented by vegetation that is not connected to subsoil in different depths.

The category of additional blue qualities includes two indexes, natural water edges and rain bed. The latter includes all permeable surfaces with connection to subsoil and this includes all areas with vegetation. Both classes are used within the calculations of the BGF. Natural water edges were calculated using a one-meter buffer around the river, with flat ends and no overlap of the buffer.

The approach of identifying each tree individually is not feasible within a forest. In order to account for all trees, the different forest types have been identified using the field assessment by NINA. The park and sport department of Oslo municipality requested this report and

commissioned NINA to map the botanical value, including mushroom species and lichen, alongside parts of the watercourse. The fieldwork of this report was carried out in the months of August to October in 1998 as well as in May to November in 1999 (Bendiksen and Bakkestuen 2000). In order to assess all trees of all different forest types individually a representative five by five meter area of each forest type was chosen to count trees within this area. Some areas of the same forest type were significantly different in their tree composition and several squares were assessed within different terrains of the entire area.

Those individual tree counts were used, together with the calculated area measurements, to estimate the amount of trees for the entire area of each forest type. Lastly all the individual tree counts were added together. An overview over the identified tree types and the areas were the field assessments took place and are given in Appendix 1 and 2. The five by five meter individual tree counts are indicated with red stars. The identified forest types as well as the tree species identified within the field assessment are given in Appendix 4.

The element of native vegetation (other green additional qualities category) is realized through the forest types of heather-pine forest (A2), blueberry-spruce forest (A4) and the natural vegetated meadow (I2). Hedges are not present exactly within the green space although the surrounding plots delimit their property with hedges. Perennials and other ground cover are represented through within the fieldwork identified low vegetated areas within the forest area and the meadows characterized by native vegetation. Park areas are not accounted for within this index. The walls of the valley represent green walls. Here the walls are too steep for trees to grow and mosses as well as smaller grasses grow on these walls. This area represents a natural grown green wall and two patches are classified as such green walls. Polyphonic trees were not assessed within the present space, accounting for each individual tree and their area in square meters were not realizable. The additional point for green areas that cover and area over 75 meters square is given in the present green space.

Even though some issues emerge the BGF was calculated with its original components to ensure comparability with other calculations. The changes needed to adopt the BGF to natural environments are discussed within chapter 6.3.1.

5.5 STRUCTURAL DIVERSITY TOOL (SDT)

Voigt et al. (2014) developed a tool to assess the setting of a park in structural dimensions. The tool accesses the structural diversity of a park by identifying three dimensions: (1) biotic factors, (2) abiotic site conditions and (3) infrastructure facilities. Voigt et al (2014) assumes that regular users of urban parks identify structural levels easier than individual species, since they pre-dominate the park and single units do not need to be identified. In addition the tool allows for comparisons between different vegetation zones (Voigt et al. 2014). Tessin (2008) confirms an approach that focuses on structural dimensions within stating that the sensory and information overload in a city increases the flow within the nervous system, leading to a distance of the person to the environment, indicating that people in an urban environment recognize their environment selectively. The perception is determined by the individual needs, experiences and knowledge as well as the position or role of the person in that specific situation (Tessin 2008).

In total thirty-three indexes are used to describe the six categories which in turn are used to score the normalized values for the three dimensions. The indexes range from a minimum of four to a maximum of eight indexes. These elements were selected through a literature review and research on park mapping instruments.

Within the dimension of biotic features two categories are realized, with a total of thirteen indexes for the categories of tree/forest aspects and ground vegetation. Tree/forest aspects account for age and size of trees, diversity of species and elements such as hedges and bushes are considered. A further score is given for nature-like dense wood areas. The factor ground vegetation accounts for diverse vegetation patterns and extensive or intensive maintenance of lawns.

The dimension of abiotic site conditions includes two factors: water elements and topography. The water element factor consists of five indexes and differentiates between natural or manmade elements. The latter factor concentrates on hill, slope and view aspects.

The third dimension of infrastructure contains elements for active recreation, like designated bicycle paths, sport or athletic fields and diverse playgrounds among others. Infrastructure refers also to relaxation/amenities elements, such as benches, pick nick tables, public sanitation and some more. In total twelve indexes are realized within this dimension. Each

available feature will be assigned a score of one and non-existing features a score of zero. The amount of the elements present is not of importance within the tool and only one single feature will give a full score. The scores will be normalized so that comparisons are feasible.

Figure 9 shows the conceptual interpretation of the Structural Diversity Tool, extended through a social and management dimensions. Following the ROS both dimensions are of great importance whilst valuing green spaces. Well-maintained vegetation increases attractiveness and perceived safety of urban green spaces (Bjerke et al. 2006).

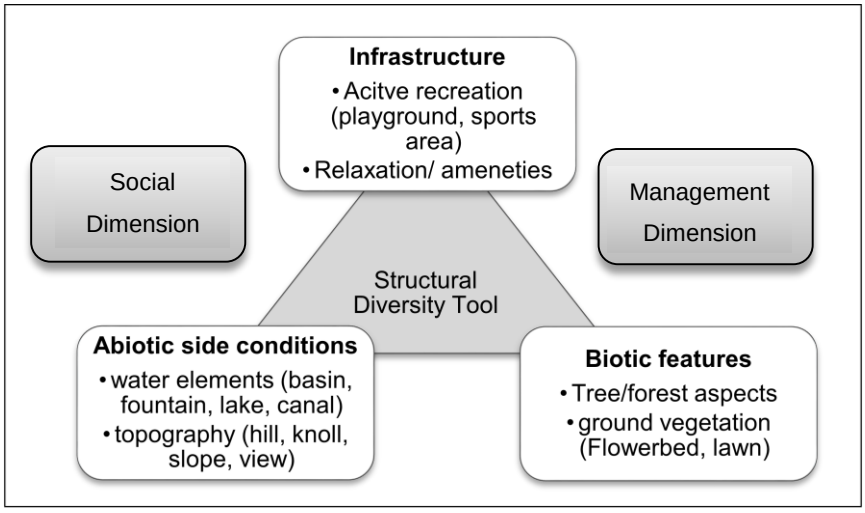


Figure 9: Conceptual interpretation of the structural diversity of urban parks (edited)
Source: Voigt et al. (2014)

Social and management dimension are not simply put into numbers and the approach is to observe the social dimension and research the management dimension, both during fieldwork and before. These dimensions will be discussed rather than added to the structural layout. The Structural Diversity Tool is used with the same elements in both areas. Some of the elements are quite intuitive, such as benches, distinct bicycle path or solitary tress, others are difficult to express and need to be defined in order to allow comparisons.

5.6 ETHICAL ASPECTS

Within the concept of ecosystem services the valuation of the services derived is inherent and unavoidable, as Bastian et al. (2013) and de Groot et al. (2002) point out. Scientific findings are transformed into human driven values. This inevitable valuation is considered within the present study and a critical perspective is taken.

The concept of critical reflexivity, a process of constant, self-conscious, scrutiny of the self as researcher and of the research process (Dowling 2000: p.28), is followed in the present study. This concept is given a special caution whilst in the field where the interviewee is neither supposed to influence the respondents at any time nor to lead the respondents to answers. In addition an inevitably power position is given to the interviewee and his/her knowledge of the field (Kvale 2008). This position of power is not anticipated to cause any complications within the fieldwork in a high-developed country and so is the positionality of the interviewee. In such a setting it is likely for the researcher to even approach higher qualified respondents as the researcher him/herself. So, the personality of the researcher is the key quality to engage with possible respondents (Moser 2008).

The conducted observations of on-site users within a public space are within the scope of privacy of the users and no user was put into any harmful situation. Events of the days were noted down and used to reflect the positioning of the researcher within the case areas and with the interaction with respondents (Dowling 2000). Through these notes the position of the researcher towards the respondents was reflected upon and adjusted if needed. The respondents were protected in their privacy within the interview process. No names were noted and also notes within the interview stayed anonymous. Posed questions were simple and not aiming to deep into the private lives of the respondents. In this sense no harm was brought to the respondent through the interviews. Nevertheless, questions were asked carefully and valued within each interview individually.

Respondents were approached in the Norwegian language in order to cross the borders of the outsider position of the researcher. In this sense the fear or respect that might exist whilst talking to strangers may have been overcome. During this introduction respondents were enlightened about the purpose of the interview and the use of their responses. The researcher and his/her background was introduced as well as the time frame of the interviews (Dowling 2000). Any further questions of the respondents were answered to the best knowledge of the interviewee.

5.7 LIMITATIONS OF THE STUDY

A variety of disciplines are taken into consideration within the field of ecosystem services, leading to a manifold of approaches. The relative novelty of the field accounts for varying approaches on differing scales and fields of sciences. This leads to the use of the selected

tools that are not especially developed to research ecosystem services and especially not cultural ecosystem services and the urban setting. Time limitations allowed only the integration of a limited number of green spaces, thus, limiting the comparison and valuation of those. Literature, focusing on the two selected spaces, has been in Norwegian and hence limited the use of this background information.

INTERVIEWS

Language difficulties were obvious within the interview process, on the one hand within approaching people and on the other during the interviews. Considering the respondents a bias is obvious whilst interviewing within a specific area, since on-site users have an affiliation to the urban green space they are using. Furthermore, the urban setting was selected for the respondents and there was no control over what the respondents is judging within the green space. In addition, the weather conditions were not optimal during the interview process and the chances of bad weather might influence people's decisions of visiting a green space and cause them to develop other plans.

BLUE GREEN FACTOR

The BGF is laid out to describe landscape in an urban context and to score this space according to the best possible greenness. Green spaces have not been assessed with the tool and adjustments during the process made the description of these places difficult and different to the scores achieved with spaces connected to the building site level.

STRUCTURAL DIVERSITY TOOL

The Structural Diversity Tool is specifically laid out to value urban green spaces and not to value natural green space.

6 RESULTS

This chapter present the results of the participant observations in Bjerkedalen Park and then the natural green space, the results of the interviews in both green spaces and the results achieved within the BGF and the SDT.

6.1 PARTICIPANT OBSERVATIONS

Participant observations were carried out in both spaces prior to the interview phase. These observations demonstrated quite distinct patterns of usages. Throughout the interview phase participant observation was continuously carried out and confirmed the prior observed usages. The public urban green spaces selected were used differently. Throughout the observation and interview phase the weather conditions were modest; mixed weather with occasional rain, strong winds and now and then some sun.

6.1.1 CONSTRUCTED GREEN SPACE (BJERKEDALEN PARK)

Observations were carried out Fridays and Sundays, and on those days the participant observations showed a park that was little in use.

Two on-site users were observed, using the park to exercise, although one of these users was observed passing through the area running alongside the river. The other on-site user was observed running or rather walking small laps around the park. Most observed activities were walking through the area, walking a small round with the dog and mostly fathers with their babies strolling within the area. The latter seems to be connected to the residential area surrounding and the kindergarten adjacent to the park. Furthermore, some elderly visitors were observed sitting within the park. Within the entire observation phase two kids were playing basketball at the designated area. Events connected to the pavilion within the park were not observed. Nevertheless, a sign at the door of the pavilion indicated weekly held exercise groups.

Even though the observed social dimension indicates a secure neighbourhood green space, where humans of all age groups pass through, the usage of the constructed green space is not as expected for a park. The usage was reduced to people passing through the park, carrying groceries or using the park to walk through to other areas.

This little use of the park might be related to the weather conditions, to the novelty of the park or the experienced smell connected to the river in the opening year.

6.1.2 NATURAL GREEN SPACE (SVARTDALEN)

The participant observations introduce a different usage pattern than within the park. The activities, as captured in the interviews and observation respectively, are day and evening depending. During the day activities include people of different age groups exercising. Exercising describes not only sportive exercise, like running, but also a more casual exercising. Casual exercise includes movements such as walking in all kinds of variations, being out with children and chat with friends or taking the dog out. Weekend usage of the area differs a bit from weekday usage, more families engage in outdoor activity. In the evening the park is avoided, people interviewed stated that they observed drug abuse and homeless people. Also the absence of illuminated paths leads to a lower usage of the area. In winter, activities are limited not only but mainly due to paths that are frozen over and the light situation. This pattern of usages is in line with the results found by Hansman et al. (2007), presenting physical activities as predominant in forest environments.

The social dimension within the natural green space is diverse and day and evening or night time depending. Visitors during the day are people of all age classes that are engaging physically throughout the green space. The clientele in the evening, after it is dark, was described by some of the respondents as prostitutes, thieves and homeless people. Observations do not confirm these statements, however further research within the green space was avoided, due to the lack of illuminated pathways and the caution of the researcher.

6.2 INTERVIEWS

6.2.1 CONSTRUCTED GREEN SPACE (BJERKEDALEN PARK)

Possible respondents commented mostly that they were just passing through or they had no time to answer. Two approached respondents also commented that they don’t speak English and declined therefore to participate.

Deducing form the participant observations and statements of the respondents the interview study could only be carried out within the natural green space.

6.2.2 NATURAL GREEN SPACE (SVARTDALEN)

The responses are related to the aspects of importance of the aesthetics of the pleasant and in addition to the six central dimensions identified by Gobster and Westphal (2004). Furthermore, the experience of nature is considered within some aspects.

ACCESSIBILITY

Access to the area is an important aspect found within the responses of all interviews. Most respondents emphasize the importance of an easy access whilst commenting on the question: why are you visiting especially this green space? As followed:

- *"…its close so I don't have to plan all day"*
- *"It's close I live just up here, it's the closest park"*
- *"I can walk from my home its important I don't need to take transport"*
- *"We live in the neighbourhood…"*

The importance of accessibility is immanent in these responses. This importance is also evident in the stated post numbers of the interviewees. Only two of the total respondents were not living within walking distance of the area. Of these two the couple from Canada stayed within the city centre and their comment to why they are visiting this area was simply the word convenient. This response is in line with the other responses. The visit of the other respondent, not living in proximity to the space, was more than a simple pleasant stay. The area was found online and chosen for its uniqueness of inhabiting a near natural forest. This is in accordance with the statement of Tessin (2008) that a special purpose for a visit or a special attractiveness of the green space influence the time a visitor would spend to get to the green space (Tessin 2008).

Access or proximity to a green space is found to be essential as well within Kaplan and Kaplan (1989). A green space needs to be accessible in terms of physical distance but also the perceived distance is of importance. A green space that lies across a major road without any close possibility to cross over can be perceived as far away. Davis et al. (2011) promotes the idea that close proximity to a green area even encourages physical activity.

Gobster and Westphal (2004) consider access on the hand as access to the area but on the other as a better visual access. Kaplan and Kaplan (1989) support this statement in stating that an inborn preference for a certain degree of open landscapes exists within humans in order to provide a view or perspective (Kaplan and Kaplan 1989). The same aspect was found in some of the respondents answers, intertwined with the aspects of cleanness or tidiness of the area.

- *"… take a little bit out of the trees I think it's too heavy I need a little bit more space"*
- *"I wish the park was a bit tidier because now it is very dark… they could thin out some of the trees"*

SAFETY, TIDINESS AND MAINTENANCE

Safety, tidiness and maintenance are united under one important aspect for a visit. This importance is reflected in the responses given in the present study. As the aspect of access introduces, tidiness is closely connected to safety issues. Gobster and Westphal (2004) consider two dimensions of safety, personal and physical safety. The issue of safety is gender depending in the present study, which is supported by (Bjerke et al. 2006). Mainly women mentioned personal safety as an issue connected to the present green space. Kaplan and Kaplan (1989) reveal the existence of fear connected to large undeveloped spaces in which attacks can take place. Densely vegetated areas, i.e. forests, decrease the perceived feeling of security (Schroeder and Anderson 1984). Furthermore, such green spaces can provide the feeling of being in a green space that is too large to be comfortable in. The extent of a green space must not be large to be generally better (Kaplan and Kaplan 1989). In connection to the affiliated loneliness or in the respondents cases rather isolation of the area women responded to the issue of safety

- *"I don't like this too much it's scary for me a little bit you never know you have to look often over your shoulder… I don't want to meet… the wrong kind of people"*
- *"I don't feel secure here I've never seen police drive past or anything so you don't feel that safe you have to watch out"*
- *"… after dark it's too remote its nothing here really you walk alone…"*

Most women commenting on safety connected subconsciously the untidiness of the forest to safety or respectively the use of the area in their responses. The thick forest does not allow

for any light in the area and therefore most respondents are not visiting during sundown. This is in line with the aspect of safety given by Tessin (2008) that a tidy space gives the impression of a safe space and the aspect by Schroeder and Anderson (1984), stating that a sufficient field of view throughout an open understory allows for a higher perceived safety. With growing density of the forest perceived safety is lowering (Bjerke et al. 2006). One male respondent directed the attention to the safety issue in connection to his wife and daughter. He mentions that the green space is too dark and narrow and that there used to live people form the Traveller community in the area, leading to his belief that his family doesn't want to go to the area alone.

Physical safety was a great concern by respondents with small children. The unsecured natural water edges present for them a danger of slipping and falling into the river. Another aspect mentioned was frozen pathways in winter.

Overall respondents were not extremely concerned with safety issues whilst using the green space. A great concern by almost all respondents was given to the issue of non-existing lights. Although this issue is an issue within the aspect of equipment, it was mentioned in concern with safety and exercising. Without lights, the use of the area is limited, since it is difficult to see where to run especially in a natural-like green space.

As before mentioned cleanness and tidiness was recognized in the untidiness of the area, as some of the respondents named it. Responses were especially concerned in connection to the untidiness of the forest.

- *"I don't like the rubbish … they could have done more to… all the trees falling down…"*
- *"Maybe a bit untidy in some places… a bit lot of trees lying around its untidy I guess…"*
- *"… but they need to clean it up a little bit … now since all the trees are falling…"*

These responses indicate that an area left with minimal maintenance is not as much accepted by the respondents. The same dislikes towards trees was found in the study of Camacho-Cervantes et al. (2014). Here urban dwellers perceived the garbage of trees as negative. Nature is highly appreciated but it has to be managed to some degree. Bonaiuto et al. (1999) confirms this statement, urban dwellers appreciate a green space more if it is well maintained

by the government. Supporting this is also the study of Camacho-Cervantes et al. (2014). Gobster and Westphal (2004) refer to this issue as the neatness of an area as one aspect of a clean environment. People don't see the purpose of a wild space, where cutting down trees or cleaning things up are not necessarily the best solutions for diversity. One of the respondents considered and elaborated this issue, concluding that

- *"It's a fine line between doing too much and doing too little"*

Litter lying around was a minor issue. Rubbish bins seemed to be distributed to the satisfaction of most respondents, in contrast to the observations made in the area. Some respondent however criticised the litter that was found around the green space. One respondent, who took up the issue, was using the green space beyond the most regular use of running and walking on the designated paths. Due to the dog the pathways are often left aside and most of the litter is found along the river out of sight form. This is in line with the statement of one respondent mentioning rubbish along the river close to the adjacent houses.

One respondent addressed the aspect of cleanness and maintenance related to the river. The respondent stated that it smelled weird: "somewhat like cloak". Connected to this aspect one respondent mentioned the sighting of rats in the area. Furthermore, one respondent mentioned the existence of mosquitos and expressed his disliking of the same. All presenting some kind of disservices perceived within the natural green space.

The concerns of the respondents related to the aspects of tidiness and safety are leading into the intertwined issue of maintenance. Even though maintenance is not directly mentioned the issues addressed are a concern of the maintenance and hence management of the area. Litter reflects a problem with maintenance and abuse of the green space and this is lowering perceived safety and also the aesthetics of the space (Schroeder and Anderson 1984).

Some respondent mentioned the work the municipality has done at this green space, concerning the former use of the area but also the structural changes of the area. These respondents agreed that the changes made at the green space improved the reputation of the area. In addition the building project of Kværnerbyen is also seen as helping the social surrounding of the natural green space.

- *"The commune has done a lot… like ten years ago it was filled with drug addicts and prostitutes… that camped out in the shrubs here…"*
- *"if you go on the other side of the river… there were like 40 50 people living there, of course illegal and they were walking around and doing burglary…"*
- *"…they have used quite a lot of money to build this park here now because before you couldn't walk the distance… there was no path at this side all the way up to Bryn"*
- *"…some years ago you couldn't walk further up there… they made some extent you can walk all through the area"*

It is evident that most respondents are not commenting or rather can't think of anything when directly asked about management and social surrounding.

EQUIPMENT

Another aspect of importance, whilst choosing a green space to visit, is the aspect of equipment. The equipment of the natural green space is rather sparse which is also reflected within the Structural Diversity Tool. Some respondents commented on the lack of the area to encourage to play, as one of the respondent put it

- *"I like something that encourages play something like this which feels like there… you can climb on something, doing something, you can actually play on something"*
- *"… if it was like some more activities for kids… some adventures…"*
- *"… more for children like playgrounds or something in the nature… obstacles and things to climb…"*

Most respondents seemed satisfied with the area as it is. This is in line with the use of the green space, as rather an area for walking, running, cycling than an area for resting and taking the children to play. Importance was given from some respondents to the suspension bridge in between the two area parts, as an element that you can jump on and an element that is nice to look at. Here the bridge is transformed to an aesthetical object, a memory is connected to it and therefore the bridge comes into mind whilst asked about aspects in the green space. The third factor of the ROS describes these modifications, if they are done in compliance with the area they are situated in, these modifications can improve the setting of the green space.

Some more equipment aspects were mentioned concerning stairs and the connected lack of access to higher parts of the area. Dog owning respondents mentioned the advantages of a dog fence. But the most important element of equipment that was mentioned by almost all respondents was the issue of light. The green space is too dark for usage after the sun went down. Nevertheless lights stand in contrast to the naturalness of the area as some respondent stated to the idea of having lights in the area

- *"At the same time the moment you put light there it doesn't feel like… I'm not sure if I want to have light…"*
- *"It's not right to have light, I like it, when it is dark it is dark"*

NATURE

One aspect for visitation is nature or naturalness respectively. Most respondent greatly appreciated the existing natural wild features and the wild nature is seen as the key aspect of importance within the responses.

The responses are reflected in the literature, nature is seen as the classical space for refuelling the inner mind. Nature provides the preconditions of the ability of an urban green space to provide recovery of the mind. Urban green spaces can represent a restorative environment (Tessin 2008) and at the same time are seen as the fundamental provider of nature in the neighbourhood (Gobster and Westphal 2004):

- *"We live here and this is like the only green lung…"*
- *"It's like this green oasis…"*
- *"...I just enjoy that it is green and a little bit wild... not like a regular park"*
- *"It feels like it's in the middle of the woods… because it's quite wild"*
- *"What I really like about this park is that you have the green, the grass are in the front and then walking form that area straight into this wilderness"*

Some respondents don't exaggerate the aspect of "refuelling the inner mind", they simply state that the other possibility would be to walk beside the road. Walking in a natural setting instead of walking in the surrounding streets is more favourable (Chenoweth and Gobster 1986). It is purely nicer to walk in a green space. Although the wild green of the area is a cynosure the blue within the green space is also highly appreciated. The river serves as a

playground for dogs and for children, throwing stones into it, watching and listening to the flowing water. Appreciation is also found within respondents without children. Listening to the sounds of the river and to the sounds of the waterfall is welcomed.

The area is an aesthetic feature in itself whilst changing its appearance during the seasons. Some of the respondents stated to visit the area in all seasons the see the change of colours, to see the seasons change. Gobster and Westphal (2004) define an own dimension for beauty and scenery that is captured in the aesthetics of the pleasant within the aspect of aesthetics (Gobster and Westphal 2004). These aesthetic features allow for a pleasant fascination, as defined by Kaplan and Kaplan (1989) and needed for a restorative environment.

THE FEELING OF BEING AWAY

The feeling of being away is an aspect considered highly by the respondents that mentioned the need for getting away from the everyday live. In their responses the remoteness of the area was highly appreciated. One respondent even stated that the place through its remoteness felt a bit "magical" and special when you find it. The research on public parks by Thompson (2002) further indicates that people are visiting public urban green space for privacy. Corresponding with these statements, one group of friends responded that this space is almost like their secret place, not being crowded as other spaces. In the words of some respondents:

- *"It's a green quiet area… relaxing to go through… away from the city"*
- *"... it's not so long but it's enough to get away"*
- *"It feels like something like a refuge… it's easy to forget what's going on just up the hill there is cars and everything is normal but here you have the noise of the stream all the way"*
- *"…you really have the feeling that you are outside of the city"*
- *"…feels a bit magical its enchanted woods or something"*

Aspects that contribute to the feeling of being away are most certainly the sounds and smells of the natural elements. Respondents indicated that they were listening to the sounds of the forest and the water. The smell was however not explicitly mentioned.

Nevertheless for some respondents the natural green space would not be enough to experience the feeling of being away. Tyrväinen et al. (2007) states that close bonds between

Norwegians and nature exist and that they are accustomed to using and experiencing wide ranging forest areas. This inherent experience might lead to some responses where the present urban green space just isn't large enough:

- *"... if I want to get more out of it for myself... I travel further away"*

FUNCTION AND USE

Function and the use of the green space are important aspects for a visit. In the present green space the main use of the interviewees was walking in the green space. The observations support this statement, although more users were observed doing some kind of physical exercise than the interviewees divulge. Gender seems to play a role within the execution of physical activity and more male respondents stated to exercise than female respondents. Age seems to influence the factor of engaging in physical activity, of the respondents stating that they are exercising age ranges from the age of 26 to the age of 45. Older male respondents stated the use of the green space as a space for walking or rather passing through to the other side instead of using the built-environment. Older female respondents stated their use to include walking and social interacting. This is in line with the research form Payne at al. (2010) stating that with the increase of age the involvement in physical activity and general outdoor recreation decreases. Four of the male respondents stated that they are using the area for running. In fact two of them were interviewed during or after their exercise session. Only one of the female respondents stated to go sometimes for a run in the area. All group respondents stated some kind of social interacting whilst walking and families added to their activities within the green space some kind of activity for their children. This included play with the children, listen to the sounds of the green space and making the children tired. One respondent was approached whilst walking with a group of kindergarten kids and the response to the issue of activity was stated as teaching the children in everything connected to the green space.

- *"We talk about plants…and if we find some insects we talk about them too… we explore things... "*

Other respondents supported the statement that the area was used for teaching activities, including projects in the green space of the surrounding schools. But also families

- *"…our kids go to school at Vålerenga and they use the park a lot… they do it when they have naturfag, nature science… they have different tasks they do here…"*
- *"… they look for stuff and study the plants and camp they can spent all day and they built bird cages and have different projects they come back to visit and see how it is going"*

The main use of the area, activities related to physical outdoors activities, is in line with the theoretical considerations. Nevertheless many physical activities are performed outside but are not inherently connected to the green space they are performed in. Activities such as walking and picnicking show a greater connection to the environmental setting but can also be circumstantial. One respondent stated his use of the area as the walk to the pub on Saturdays to watch football. Nevertheless his choice including the inherent judgement he made to walk in the natural setting instead of the surrounding streets. Another important use mentioned by the respondent was observing. As aforementioned several on-site users visited the green space to observe the colours change, observe the seasons change. Kaplan and Kaplan (1989) see observations as an important entanglement with nature, "much of the pleasure that people derive from nature comes from such occasions to observe (Kaplan and Kaplan 1989: p.156). Another use that was mentioned in lines with the imagination of use by Kaplan and Kaplan (1989), one respondent was excited of the prospect of going running in the area in the future.

The perceived values of the respondents are in line with the values described in the literature (Gobster and Westphal 2004; Kaplan and Kaplan 1989; Tessin 2008) and the respondents perceive the green space in a similar way. Most mentioned adjectives that were used to describe the green space were nice, green, quiet, peaceful, beautiful and wild. These statements are in correspondence with the adjectives used within the theory of Tessin (2008), a regular green space provides for a pleasant stay and qualities perceived by users are not special. Important to human beings in an urbanized and growing society are some peace and quietness (Kaplan and Kaplan 1989).

Some respondents perceive the natural green space as a space to refuel their inner mind, as a space that allows for stimulation.

- "*… when I need to think for myself and reset myself it's a very nice place"*

- *"... you come here and it's like a piece of nature away from the city I need it for my soul if not I go crazy"*
- *"... if I just walk in the street it gives me nothing but here it gives me energy..."*

This is in line with the statements in Kaplan and Kaplan (1989), green areas allow for forgetting the worries, regaining calmness and mental health but also to enjoy solitude.

Other respondents are not aware of the satisfaction or benefits they derive from nature. This is in correspondence with Kaplan and Kaplan (1989); it seems difficult to put in words what it means for the individual to be in a natural setting.

Overall perceived values of respondents indicate a tendency to a more connected network of green spaces.

- *"... but even more connected would be a good idea..."*
- *"... I was wondering if I could have a horse... and I was thinking if it was connected... you have a perfect path straight into Østmarka from here"*
- *"If it was better to go along the river all the way up it would be very good"*
- *"Not so long in the future it will be easy to come into the forest ... you can also do that today but then you have to know the way"*

The values perceived by the respondents represent the aspects of importance for a visit of a green space. It is evident that the aspects of a restorative environment are intertwined within those aspects, thereby supporting the hypothesis.

The question aiming to identify the knowledge of respondents towards the concept of ecosystem services, which services the green space provides, was largely not answered or misunderstood.

KEY FINDINGS

In summary important aspects that lead to the choice of visiting this green space instead of another include accessibility and proximity to the area, but far more important is the compatibility of the green space with the needs of the visitor as Kaplan and Kaplan (1989) describe it. This interconnection is graphically presented in Figure 10. This is in accordance with Tessin's (2008) statement that humans seek the nearest green space fulfilling their

needs, if no special occasion or attraction is given. If proximity is given, as it is for most of the respondents, the four aspects of the restorative environment come into play. The natural green space is visited because of its extent, allowing for the desired use. The green space provides a fascination such as nature, water and sounds so that further exploration is possible. Furthermore, the space is visited since it provides a feeling of being away. The given safety, tidiness and maintenance allow for such a use of the area.

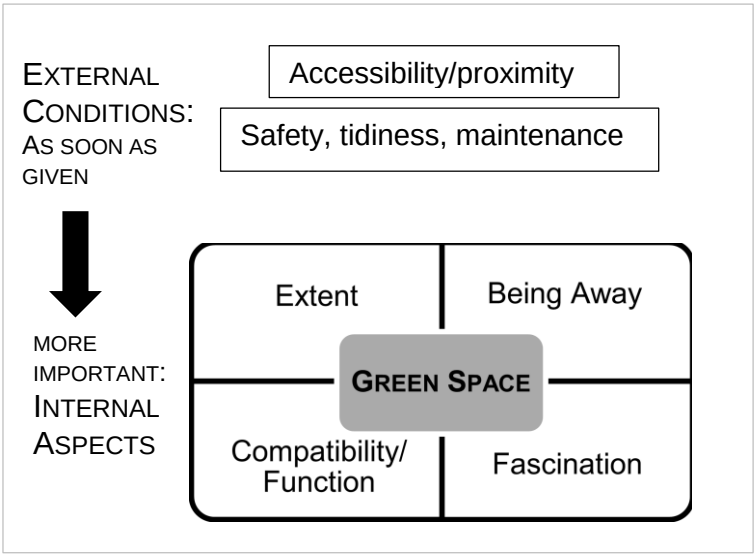


Figure 10: Graphical overview of the aspects that are most important for a visit of a green space

6.3 Blue Green Factor

The natural green space achieves a substantially higher score than the constructed green space (Figure 11). The score reached by the natural green space (5.45) is almost five times higher than the score reached by the park (1.19). This results supports the hypothesis.

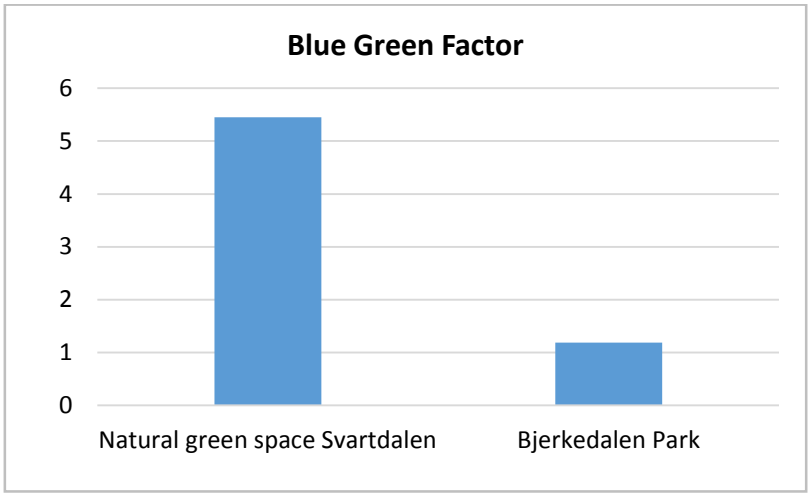


Figure 11: BGF final score comparison

Comparing the composition of both BGF scores, gives an insight into the contributions of the individual categories and attributes. The contributions are based on the individually calculated BGF scores of each attribute (Appendix 6 and 7 and Appendix 8 and 9). The influences of the different attributes to the total score are significantly different for the researched green spaces

Standing out is the influence of the individual tree aspects scores to the total score for the natural green space (Figure 12). The aspect of inhabiting a near-natural forest is crucial. Hence, the strongest aspects influencing the total score are existing trees >10m and trees that are expected to grow 5 – 10m. The latter contributes to almost one third of the total score. Existing trees larger than ten meters alone contribute to half of the BGF score. Third and fourth most influential aspects are surfaces with vegetation connected to soil or bedrock and rain bed or equivalent, contributing with around one fourth of the total BGF score.

In the category of blue green surfaces, the attribute of open permanent water surfaces influences the total score only with one per cent and the attribute of impermeable surfaces is

negligible. Partially permeable surfaces are contributing significantly higher with their area contribution than impermeable surfaces to the total area. The attribute of the category of additional blue qualities, natural water edges is negligible. Additional green qualities that have a minor influence on the total score are native vegetation with three per cent and perennials and other ground cover with one per cent. The attribute of green walls is also of minor importance.

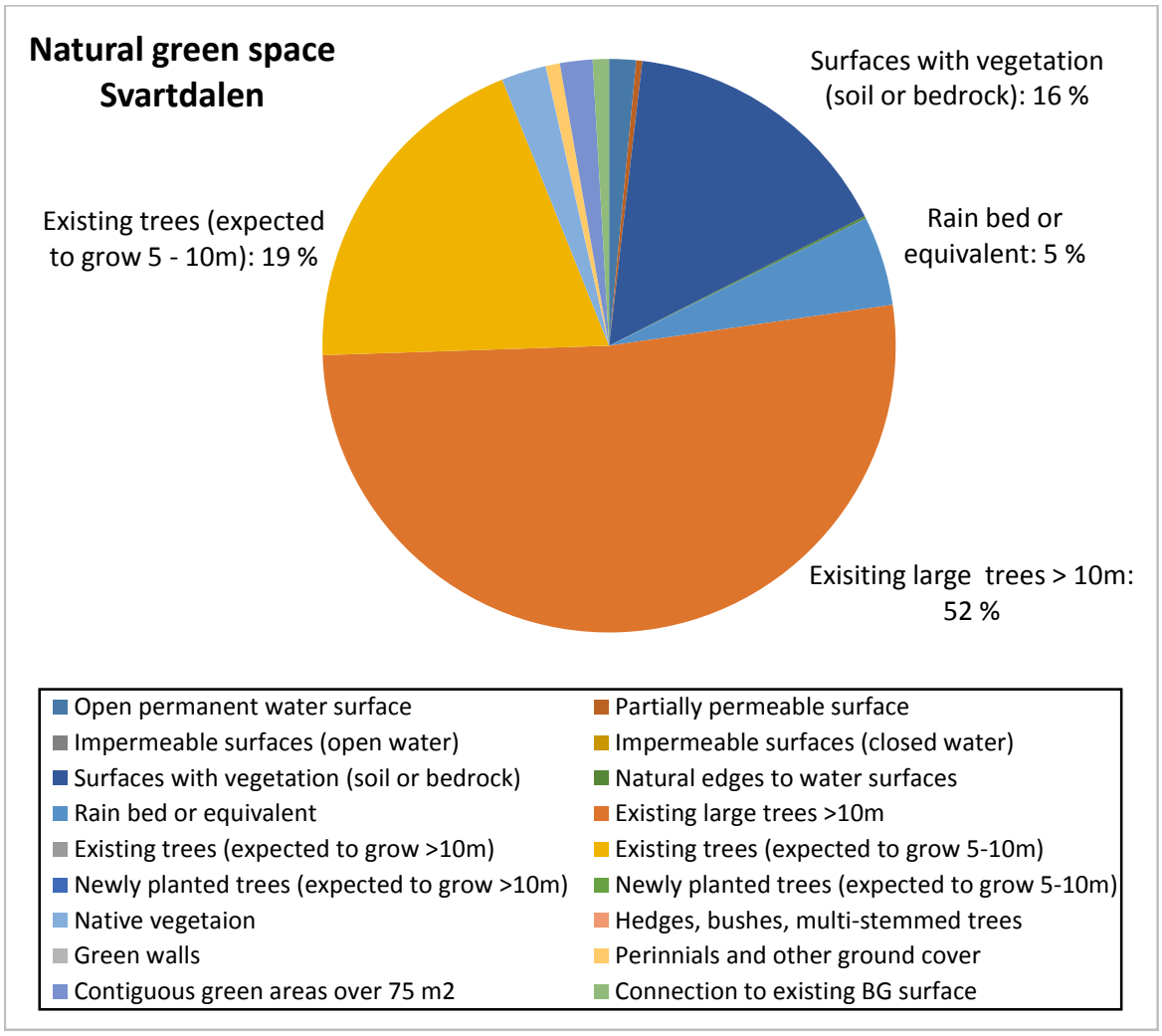


Figure 12: Composition of the BGF score for the natural green space Svartdalen

The total score is hence mostly influenced by additional qualities. The only actual surface score that is influencing the total score is the vegetated area of the green space

Bjerkedalen Park shows a different composition of blue green factors (Figure 13). Here the contribution of trees is almost negligible and all individual tree aspects contribute with only

four per cent to the total score. The highest influence to the total BGF score is made by surfaces with vegetation connected to soil or bedrock and rain bed or equivalent. These factors contribute more than three fourth of the total BGF score. Vegetated surfaces alone account for more than half of the total BGF. The third highest contributing aspects are open permanent water surface and partially permeable surface with each representing six per cent of the total score. The last attribute of the category of blue and green surfaces that is represented by the park, impermeable surfaces, influences the total score with only two per cent. Besides the attribute of rain bed or equivalent the second attribute of the category of additional blue qualities, natural edges to water surfaces is of minor influence to the total score.

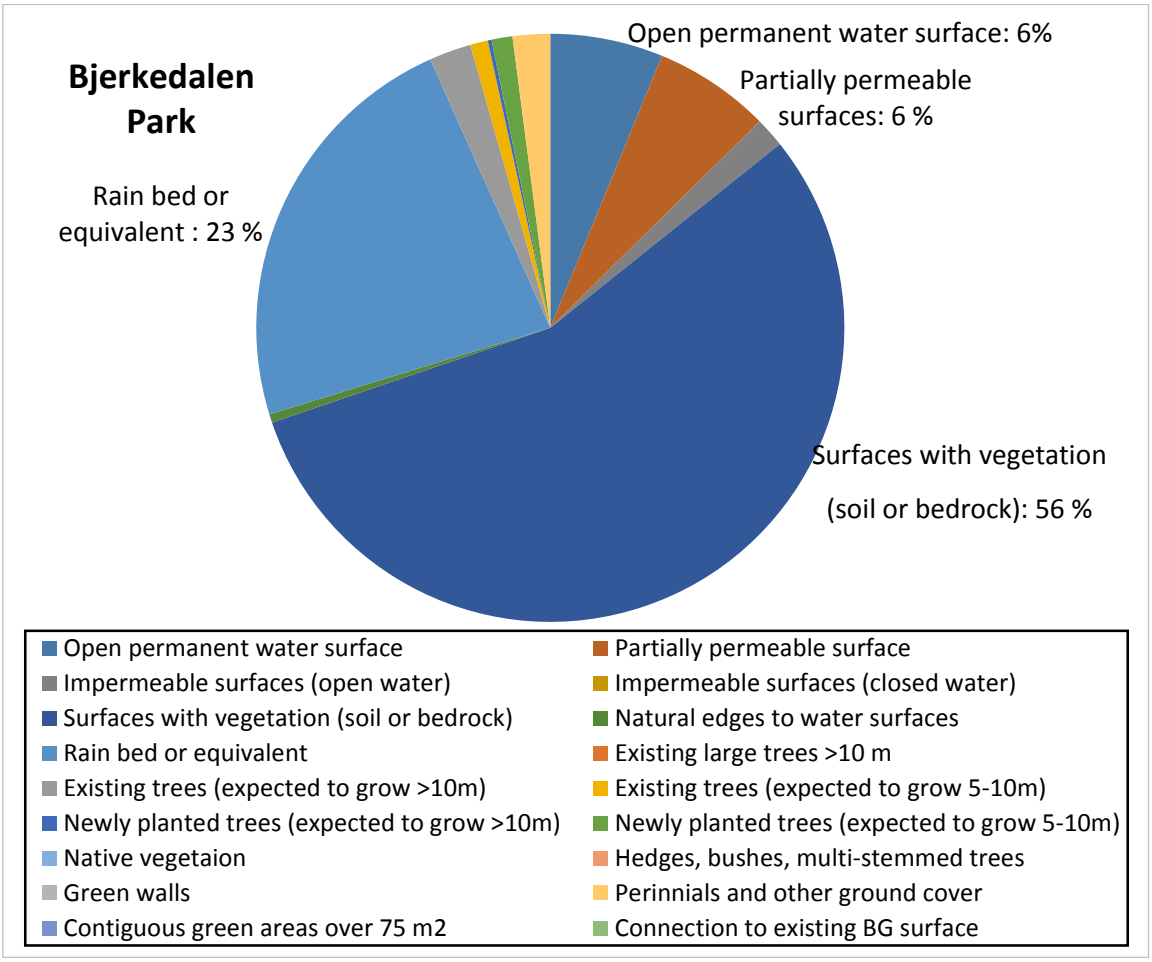


Figure 13: Composition of the BGF score for Bjerkedalen Park

The total score of Bjerkedalen Park is determined by the actual surface that is present. Nevertheless the additional qualities, especially the index rain bed or equivalent, is raising the score considerably.

Comparing only the actual blue green surface indexes, the difference between the green spaces is clear (Figure 14). Vegetated areas are the main contributor in both green spaces. Bjerkedalen Park has a higher amount of impermeable as well as permeable surfaces in relation to the total surface area. This fact is not surprising in a constructed green space. In the park the index of impermeable surfaces includes: stairs, bridges, the basketball court and the area for community activity. So, this index contributes with nine per cent to the total surface area. The natural green space contains however almost no impermeable surfaces and two per cent of the total area are partially permeable surfaces, such as pathways and dried out river beds. Both green spaces would certainly show another pattern if the surrounding houses were included. An interesting element is the surface area of open permanent water. In both green spaces nine per cent of the space is occupied by water. Bjerkedalen Park contains a near-natural pond that takes over a great part of the surface area and the natural green space the natural flowing watercourse.

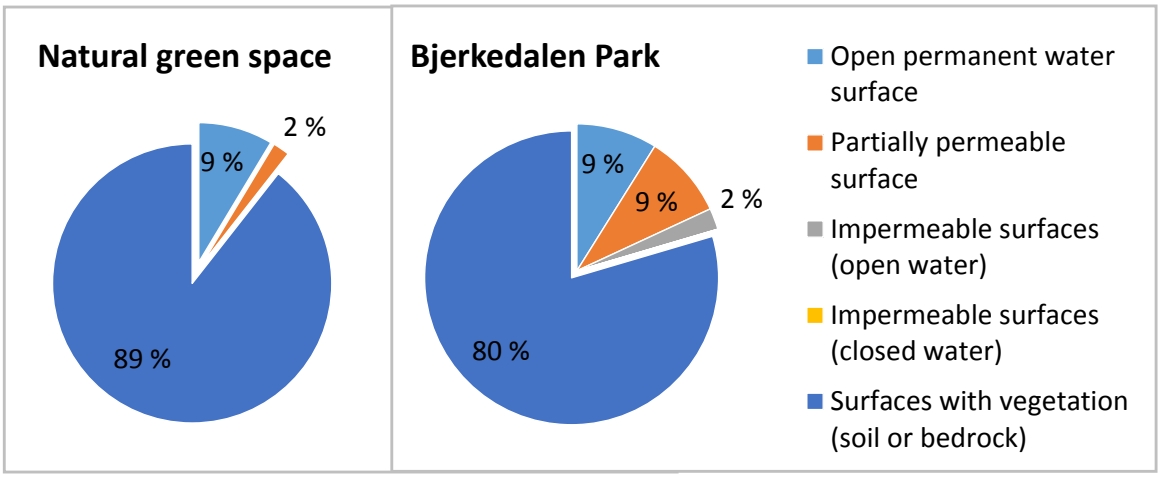


Figure 14: Blue green surface compositions

Comparing the additional qualities detached form the actual surface features allow for a clearer picture (Figure 15). It is evident that existing trees >10m are significantly influencing the additional qualities within the natural green space. Obvious is also the contributions of

trees that are expected to grow 5 – 10m of height and native vegetation that contributes with three per cent to the additional quality score.

On the other hand existing trees >10m are not significant within the total score of Bjerkedalen Park. Rain bed or equivalent contributes the most to the total as well as to the additional quality compositions. Surprising is the index of existing trees (expected to grow > 10m) within the additional qualities, here this element accounts for eight per cent.

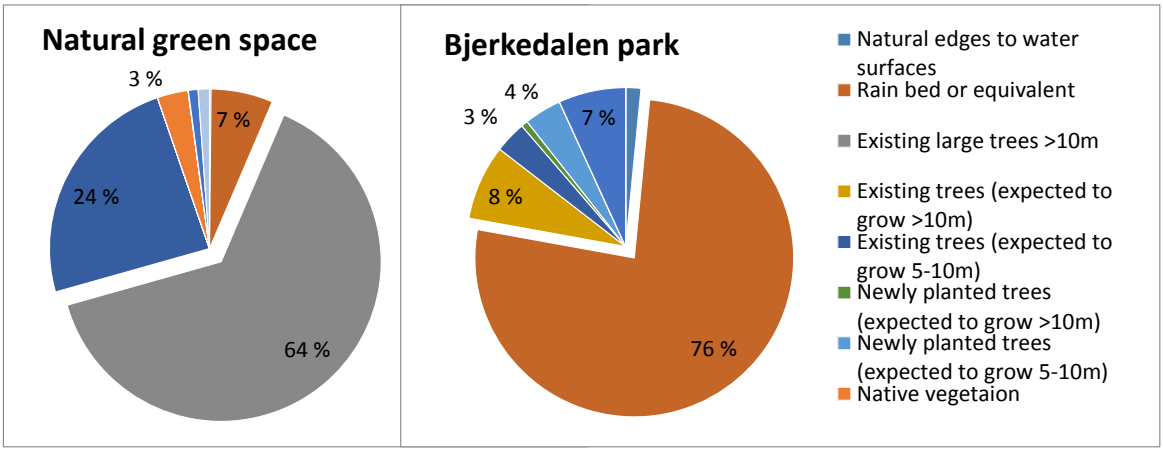


Figure 15: Additional blue and green quality compositions

These comparisons illustrate clearly the difference between the selected green spaces. The natural green space is characterized by its greenness and thus is natural vegetation. The pathways, the flowerbeds and other ground cover are however characterizing Bjerkedalen Park. In that regard it is plausible that the natural green space achieves a higher score than Bjerkedalen Park within the tool that evaluates greenness and blueness.

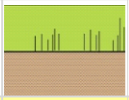
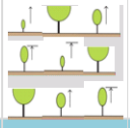
6.3.1 BGF ADAPTATIONS

At this point it is of importance to reconsider the use of the original BGF and the individual categories. As before mentioned, each individual counted tree accounts for an extra area of $25m^2$ for existing trees or trees expected to grow higher than ten meters, or $16m^2$ respectively for trees expected to grow five to the meters of height and trees that are five to ten meters of height. In a more dense vegetated area several trees grow with a 25 m^2 square around one tree, leading to the high BGF results for the natural green spaces. One solution would be to account for the total area containing trees instead of individual tree counts. This approach

excludes the area accounted for the footprint of the tree and is less prone to mistakes caused by fieldwork assessments and the estimation of individual tree numbers.

An area totally covered with forest, excluding any other additional quality, reaches a score of two. The individual categories considered within such a calculation are shown in Table 6. Other categories are then given a zero score. Of course additional scores will be given in a natural environment that will increase the total score. In this sense the category of rain bed or equivalent will most likely always be given and raise the total BGF score to 2.3.

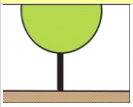
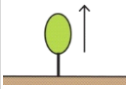
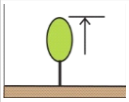
Table 6: BGF calculated for an area completely covered with forest

Value	Symbol	Factor	Area in m2	BGF
		Study Area	1000	
1		" Surfaces with vegetation connected to subsoil or bedrock "	1000	1
		Tree Cover		
1		"Continuous tree cover" (% of total area)	100 %	1,00
		TOTAL BLUE GREEN FACTOR		2

Using this approach for the natural green space Svartdalen, a BGF of 2.4 is achieved. The total area covered by forest accounts for about 85% of the total area, leading to an individual BGF for the tree cover element of 0.85. The other scores are kept the same, excluding the individual tree counts. Accounting for the area covered with trees instead of the individual trees is one appropriate approach. Nevertheless this approach excludes the opportunity to account for differences within forest types.

Another approach is to exclude the footprint area and only use the individual tree count for trees that are in a dense environment, such as forests. In the case of single, isolated trees the individual footprint area can be applied as long as other trees do not interfere with this area. This approach allows for mistakes imported from the fieldwork based estimations, but allows for the BGF to be used within park areas as well and building projects where individual counts are feasible. Furthermore, a more specific tree assessment can be made. The individual BGF scores for the tree count element are shown in Table 7.

Table 7: BGF calculations with and without individual tree footprint area

Value	Symbol	Green additional qualities, Points below (trees) should be filled in as a number	Number	BGF without footprint factor	BGF with footprint factor
1		Existing large trees > 10 m	16823	0,113	2,821
0,8		Existing trees that can be expected to grow to over > 10 m	0	0,000	0,000
0,6		Existing trees that can be expected to grow to be small to medium, 5 - 10 m	16460	0,066	1,060

It is evident that especially the scores for the natural green space Svartdalen are changed significantly. Using these scores without the footprint area leads to BGF scores lower than tow for both spaces. In doing so, the individual trees are given less importance within the BGF since their share is significantly lower than before. Nevertheless high scores compared to the building project scores are achieved by both green spaces. It is appropriate, according to the score calculated for an area covered with only forest, to introduce a new threshold for natural spaces, leading to a score of two for natural spaces within the BGF.

The natural green space Svartdalen achieves a total score of 1.74 and is hence quite close to a total natural space. Bjerkedalen Park reaches, without the footprint area, a score of 1.05. However, Bjerkedalen Park has a small area of more dense standing trees and it is appropriate to account for this area. Hence Bjerkedalen Park reaches the original score

calculated of 1.19. Considering these alternative compositions it is of importance to assess the individual compositions. As the composition of Bjerkedalen Park is not changed, only the new contributing factors to the total score of the natural green space Svartdalen are presented in Figure 16.

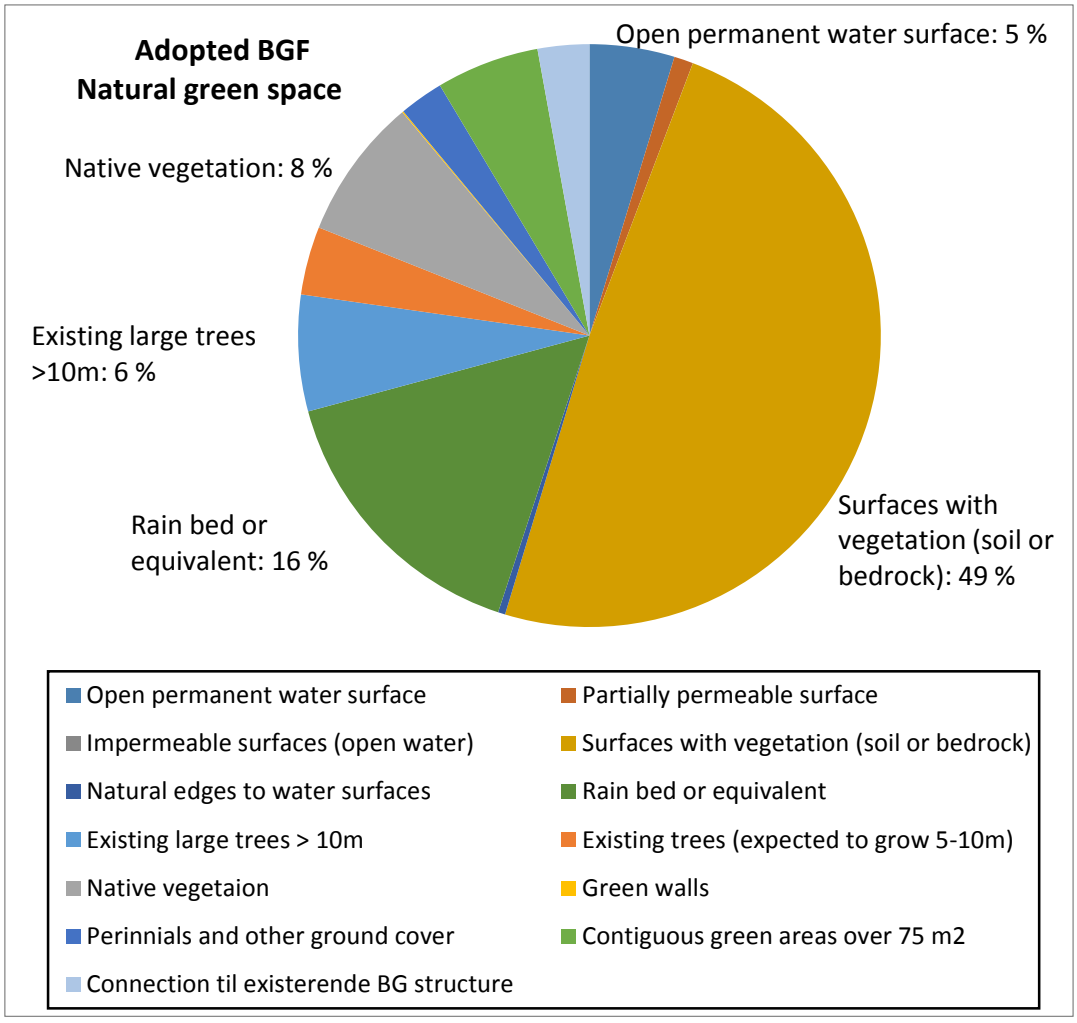


Figure 16: Adapted BGF calculation for the natural green space Svartdalen

The alternative composition reveals a composition that is closer to the composition of Bjerkedalen Park. Surfaces with vegetation associated with soil or bedrock is contributing the highest to the total score, followed by rain bed or equivalent. The overwhelming tree scores are moderated and contribute all together with ten per cent to the total score.

Applying this approach the element of native vegetation contributes more significantly to the total score and that should certainly be in the focus of valuing urban green spaces. Introducing the threshold for natural spaces (2), the recommended BGF values for grey

spaces (0.3) and the recommended values for urban areas (0.7) (Claviar, K. 2014). The scores for Bjerkedalen and the natural green space Svartdalen seem appropriate and a graphical overview is presented in Figure 17.

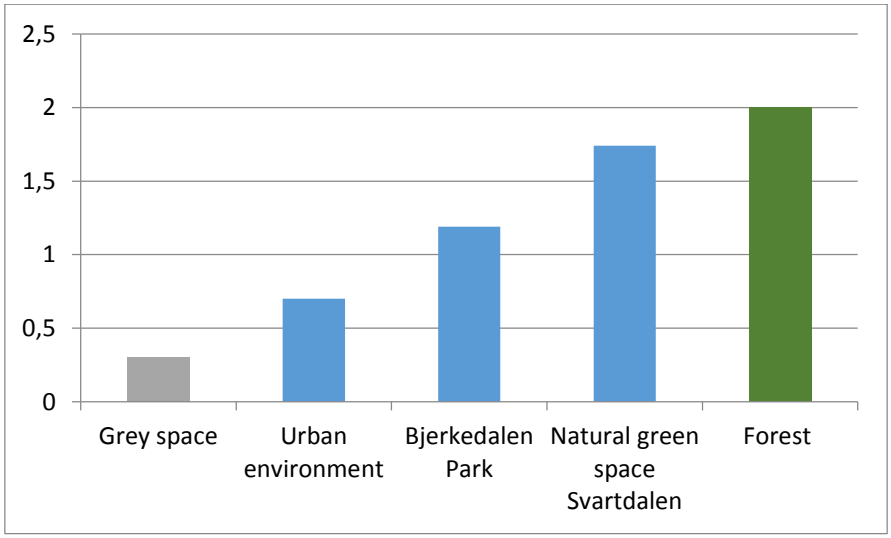


Figure 17: Adapted BGF comparison and new threshold score

Further adjustment can be made to integrate a better valuation of CES. These adjustments are discussed within the discussion chapter 7.2.

6.4 Structural Diversity Tool

The Structural Diversity Tool was computed for both areas and the total scores are quite similar. The natural green space Svartdalen achieves a total score of 0.536 whilst Bjerkedalen Park reaches 0.521. This result negates the hypothesis; the natural green space Svartdalen scores slightly higher than Bjerkedalen Park.

An overview over the achieved scores in the individual categories is given in Figure 18. Nevertheless, both green spaces score significantly different within the individual categories and a comparison of the individual compositions gives an insight into the different contributions to the total score. The individual SDT scores for the natural green space are shown in Appendix 11 and for the park in Appendix 12.

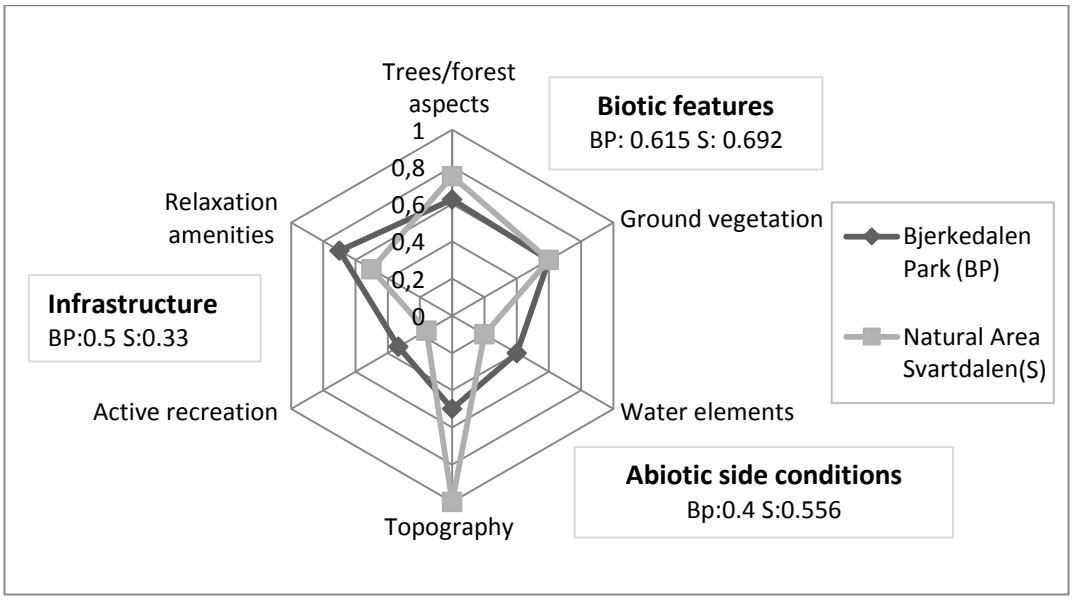


Figure 18: Structural diversity scores comparison

The total biotic feature dimension score for Svartdalen reaches 0.692, which is higher than the score for Bjerkedalen with 0.615. Within this dimension in the category of trees/forest aspects, solitary trees big/old are present neither at Bjerkedalen nor at Svartdalen. Solitary trees small/young are accounted for if trees are below ten meters of height and those are present in both cases, but only once in the natural green space. In both cases one row of trees is present and tree species diversity is given. Tree/forest aspects achieve a score of 0.75 in

Svartdalen and Bjerkedalen achieves a score of 0.625. In both cases hedges are found only in connection to adjacent houses and are therefore not accounted for. Shrub (densely vegetated area with bushes and/or higher grass) is present in both spaces.

The category ground vegetation consists of five indexes. Extensive lawns, as opposite to intensive lawns, are accounted for if an area is maintained on a regular basis but with a minimum of input. This is the case in the natural green space, the lawn is kept short but not intensively. On the other hand the lawn of the constructed green space is kept intensively. Flowerbeds are only present at Bjerkedalen. The category of ground vegetation achieves a lower score (0.6) than the category of tree/forest aspects in both green spaces.

Table 8: Biotic features Bjerkedalen Park (BP) and Svartdalen (S)

Dimension	Category	Element	BP	S
Biotic features	Trees/forest aspects	Tree species diversity (5 species/0.5 ha)	1	1
		Solitary trees big/old	0	0
		Solitary trees small/young	1	1
		Group of trees	1	1
		Row of trees/tree-lined path	1	1
		Hedge (trimmed or untrimmed)	0	0
		Shrub	1	1
		Nature-like, dense wood area (trees, under bush)	0	1
Normalized score			0,625	0,75
	Ground vegetation	Diverse spontaneous vegetation (herbs, tree, seedlings)	0	1
		Diverse water edge (wetlands plant)	1	1
		Grassed areas/lawn extensive (meadow area)	0	1
		Lawn intensive (open access)	1	0
		Flowerbed	1	0
Normalized score			0,600	0,600
Total dimension score			0,615	0,692

The natural green space achieves a score of 0.556 in the category of abiotic side conditions. Bjerkedalen Park achieves a score of 0.44. Within the water element category a water basin is seen as an element that is obvious artificial and as such none of the cases score for a water basin. Fountains are neither found at Bjerkedalen Park nor at Svartdalen. However, natural or near-natural lake/pond as well as a flowing watercourse are present and accounted for. Diverse water elements are quite sparse within the natural green space (0.2) and also

Bjerkedalen reaches only a score of 0.4 since water basin, fountain and a dominant water element in the neighbourhood are not present.

Nevertheless, all topography scores are reached for Svartdalen, leading to the highest score possible. Within Bjerkedalen, half of the elements are present and a score of 0.5 is reached. The index for an attractive view is considered looking from inside the area to the outside and in this sense only the natural green space Svartdalen allows for an attractive view. A slope is accounted for if only one side of a hill is within an area; only the slope is accessible. A complete hill is accounted for if a hill within the area can be ascended and descended. The latter is present at the natural green space Svartdalen but not at Bjerkedalen Park. On the other hand a slope is present in both cases.

Table 9: Abiotic site conditions Bjerkedalen Park (BP) and Svartdalen (S)

Dimension	Category	Element	BP	S
Abiotic site conditions	Water elements	Water basin	0	0
		Fountain	0	0
		Natural or near-natural lake/pond	1	0
		Flowing watercourse in the park	1	1
		Dominant water element in neighborhood	0	0
Normalized score			0,4	0,2
	Topography	Attractive view	0	1
		Hill	0	1
		Slope	1	1
		Artificial surface lowering elevation (stairs)	1	1
Normalized score			0,500	1,000
Total dimension score			0,444	0,556

The total infrastructure dimension score for Svartdalen reaches only 0.33, Bjerkedalen scores a total of 0.5. Within this dimension the category of active recreation, distinct bicycle paths, table tennis court, large diverse playgrounds for kids and an explicit dog park are neither present at Bjerkedalen Park nor at Svartdalen. However, sport or athletic fields are present in both areas and Bjerkedalen Park inhabits in addition a basketball court. Hence the elements within the category of active recreation are sparse in the natural green space, and a score of 0.167 is reached. Sport related elements are present within Bjerkedalen, but these elements are not diverse and the score for the category reaches 0.33.

Within the category of relaxation/amenities, sitting features and picnic table, are features are fulfilled in both cases. The feature of gastronomy, animal compound/ petting zoo and historical, artistic or educational landmark is fulfilled in both areas even though different elements contribute to the realization of this feature. In addition, Bjerkedalen has lights around their main paths together with the possibility for gastronomy or an area where events can be hosted as well as sitting features, the park reaches a score of 0.7. Public sanitation, drinking fountain and lighting is not present in Svartdalen but the area allows for sitting and picnicking facilities and the score reaches 0.5. Table 13 depicts the infrastructure of both spaces.

Table 10: Infrastructure Bjerkedalen Park (BP) and Svartdalen (S)

Dimension	Category	Element	BP	S
Infrastructure	Active recreation	Distinct bicycle path	0	0
		Designated sport or athletic fields (e.g., with goals for football)	1	1
		Street or basketball court	1	0
		Table tennis table	0	0
		Large/diverse playground for kids (5 elements)	0	0
		Dog park	0	0
Normalized score			0,3333	0,167
	Relaxation/amenities	Sitting features: bench, seat wall	1	1
		Picnic table, shelter, pavilions	1	1
		Historical (NAS) Gastronomy (BP)	1	1
		Drinking fountain	0	0
		Public sanitation	0	0
		Lighting (of main paths)	1	0
Normalized score			0,667	0,500
Total dimension score			0,5	0,333

It is evident that despite the similarity of the final scores, some of the individual scores are significantly different. The natural green space provides for a full topography score but the constructed green space however doesn't allow for a full score within this category. Also the tree/forest aspect achieves a higher score in Svartdalen than Bjerkedalen. The park however scores higher on relaxation amenities and surprisingly in the category of water elements.

7 COMPARATIVE DISCUSSION

Green spaces in urban areas are of key importance for human well-being. However, green spaces vary from almost pristine spaces to totally constructed spaces with hardly any biodiversity. The recreational opportunity spectrum is used to differentiate and discuss the selected green spaces, based on the BGF, the Structural Diversity Tool, the interviews and observations. Both green spaces are spaces within the urban opportunity spectrum scale of the ROS and so this chapter firstly compares the green spaces based upon the ROS followed by the linkage of the blue green settings to the cultural ecosystem concept. Lastly, a brief evaluation of the tools is given.

7.1 THE URBAN OPPORTUNITY SPECTRUM COMPARISON

FACTOR 1: ACCESS

Both green spaces are easy enough accessible and present spaces for the nearest neighbours and thus public transport is of minor concern for access.

Bjerkedalen Park is easy accessible for those living in the area and the surrounding houses allow for an access on almost all sides of the area. Due to the surrounding houses, parking is given, but no designated parking for the area is available. Direct subway transport is not given but bus stops are available around the area.

Nevertheless, the natural green space is considered more remote, access through public transport is not direct, descriptions of the area are not widely available and no designated public parking is available. On-site users are primarily neighbours to the green space. This is in line with the literature; an urban green space has to be close in order to be used frequently.

FACTOR 2: NON-RECREATIONAL USE CHANGES AND FACTOR 3: ON-SITE MANAGEMENT

The second factor of non-recreational use changes is not definable since no baseline is available. Both areas however encountered onsite management decisions through the upgrades made.

Bjerkedalen was developed in 2013 when properties such as trees, plants, and bridges were added. Final elements were opened in 2014. The relaxation amenities within the park include

an area for community engagement, benches, tables, and lights. These elements are valued comparably high with a score of 0.7. Nevertheless observations are not reflecting the intended use of the green space and the upgrades of the area seem not to engage people to use the area. The low active recreation score (0.3) and the observations are supporting this statement. The BGF reflects the relaxation amenities within the blue green surface category. Here, contributing elements to the impermeable surfaces index are the features stairs, bridges, basketball court and the area for community engagement. The permeable surfaces index is represented through the pathways throughout the area. Both aspects stand for eleven per cent of the total blue green surface area, indicating a higher built up area within the constructed green space as within the natural green space.

The natural green space was upgraded to ensure a higher connectivity. The interviews show a high appreciation of the connectivity extension, also the added suspension bridge in a non-artificial manner was object of interest and the area seems to invite for use. The area allows only for half of the relaxation amenities indexes (0.5) and the active recreation score is extremely low (0.167). These scores stand in contrast with the observations made. The area is mostly used for physical outdoor activities and active recreation is high. The BGF confirms the Structural Diversity Tool findings within the blue green surfaces category. Here only a non-significant impermeable surface amount exists and only two per cent of the area stands for partially permeable surfaces represented through pathways, stairs, dried out riverbeds and bridges. However the activities people engage in, do not need the designated areas used by the Structural Diversity Tool to score the spaces.

The abiotic site conditions of the green spaces have been integrated in the spaces by previous onsite management decisions. These conditions are as such representations of the chosen setting.

The dimension of abiotic side conditions within the SDT represents water elements. Three out of five elements are directly connected to an artificially constructed element. This results in only one countable element within the natural green space, achieving a score of 0.2. Bjerkedalen inhabits both elements representing natural features and achieves a score of 0.4. The BGF confirms the SDT scores and the total water surface accounted for in Bjerkedalen contributes with six per cent to the total score, were it is only two per cent contribution within the natural green space. A distinction has to be made, since the additional qualities are so overwhelming in the natural green space and taking only the blue green surfaces into

consideration, the contribution of water to the score increases to nine per cent for both areas. Generally the element of water was highly valued by the visitors.

The topography category allows for the only full score within the overall scores of the SDT, achieved by the natural green space. The element of topography is not directly reflected by the BGF, the tree counts however are influenced by the topography, since fewer trees are counted within a steep slope area. Furthermore, the topography of the natural green space seems of minor concern to the respondents, only some expressed themselves in concern of the view of the natural green space. The issue of topography might be of more obvious concern if adjacent houses were more visible or the built-up environment would influence the green space in any other way. Nevertheless, the surroundings are considerably influencing the aspects of the restorative environment and hence the view or rather the total topography category is of importance within this aspect. This statement is confirmed by the topography of Bjerkedalen. Bjerkedalen does not allow for a complete hill and an attractive view, achieving a score of 0.5 in the SDT. The BGF does not reflect any of the topography scores given within the Structural Diversity Tool.

FACTOR 4: SOCIAL INTERACTION

Neither the natural green space nor Bjerkedalen Park represents extremely crowded areas. Both green spaces are remote, in the sense of the possibility of a great crowd gaining access to the areas. In contrast, the famous sculpture park (*Vigelandsparken*) allows for a considerable crowd of people, which could be expected in this park.

Bjerkedalen is more remote, in the sense of geographical location, than the natural green space. But the extent and the surrounding houses place the park in a setting of high possible social interaction. The natural green space is seen as remote or even isolated and for some respondents the space represents the feeling of being away, the feeling of their secret spot, hidden away from the usual everyday environment. This places the natural green space in a setting that is not laid out for high social interaction. The narrow pathways, the dense forest and the topography support this statement.

FACTOR 5 AND 6: ACCEPTABILITY OF VISITORS IMPACTS AND REGIMENTATION

An urban setting represents the highest impact by human to nature. This opportunity dimension is connected to the use of the area.

Bjerkedalen is a clean urban green space and the impacts of visitors are considered. The green space is used similar during day and evening. The natural green space however allows regular visitors to follow the designated paths. Nevertheless, non-regular use includes the throwing away of rubbish, which happens off the beaten path. Furthermore, hints of drug abuse and hints of homes of homeless people are visible when leaving the designated pathways. Luckily these impacts are not visible to the regular user and they seem not to influence the usage of the green space during the day. Most visitors stated to not engage in activities when it is dark, which was also confirmed by the observations.

Both green spaces provide basic green outdoor opportunities for the nearest neighbours. The urban opportunity spectrum indicates that the researched green spaces are situated at different ends of this spectrum:

- The constructed green space presents a park with appropriate access possibilities for the nearest neighbours, onsite management decisions allowing for a diversity of elements and a high possibility of social interaction. The impact of the visitors is acceptable and the park is kept clean and tidy.
- The natural green space presents the opposite side of the spectrum, a natural-like urban green space with an easy but limited access, low social interaction, an appropriate onsite management and a partly acceptable impact to nature by the visitors.

The use of the green spaces is different, which is indicated through the opposite placement of the selected spaces within the urban opportunity scale. Nevertheless, Bjerkedalen Park should experience a higher usage than the natural green space. So, other factors have to influence the decision of visitors to visit the green space.

The aspects that were found within the interview study are in line with the literature. These aspects are connected to the restorative environment aspects attached to the naturalness of the

setting and the use of the green space. The aspects that create a restorative environment are connected to the important aspects that lead to a visit of green spaces.

A green space needs to be easy accessible. This aspect is completely true for the green spaces, but an easy accessible green space that doesn't allow for other aspects seems not to be perceived as a green space to use.

Considering safety, tidiness and maintenance, the natural green space is used during the day as an inviting green space. This aspect is given during the day, but in the evening the space represents another usage pattern. Nevertheless, visitors use the green space for a variety of activities. Bjerkedalen presents a safe and tidy space but is however not used accordingly. These statements are evident in the observations and the discussion of both green spaces. So, other aspects have to influence the decision of visiting a green space and these aspects were found to be connected to the aspects for a restorative environment. The natural green space is presented first, since the interview study is based on this green space and only the observations made can be related to the park.

THE FEELING OF BEING AWAY

The feeling of being away stands for the involvement of oneself in something different than the usual. In an urbanized context nature is not the usual surrounding and allows for such a feeling. For the urban green spaces selected the feeling of being away is one of the challenges. The interviews indicate that the natural green space allows for such a feeling for most of the respondents. The results of the BGF confirm an extraordinary greenness that lets the everyday surrounding disappear and naturalness was one of the aspects highly valued by the respondents.

The BGF indicates that Bjerkedalen is not as green as the natural green space. The setting allows for the visibility of the surrounding houses and the feeling of being away from the usual is physically not given, the houses stand for a constant reminder of the urbanized environment.

EXTENT

The scope of the natural green space allows for a feeling of experiencing more, it allows for excitement and mystery. Furthermore, the space allows for interrelatedness, it allows for a

certain connectedness. Although an even more connected space, in a recreational or cultural way is desirable. Together these elements built the aspect of extent, and extent is certainly represented by the natural green space. In addition a higher level of connectedness, in the sense of connecting to another world, is provided by the green space. The old forest gives the feeling of something real, "some sort of intuition of the way things ought to be" (Kaplan and Kaplan 1989: p.191). These natural elements were essential for our early ancestors and their survival (Ulrich et al. 1991).

Bjerkedalen however seems not to fulfil the needs of those in search for a nearby green space. This is most likely connected to the need of getting away from the usual but also the fact of the bond between Norwegians and the forest (Tyrvåinen et al. 2007) can play into this incompatibility. The park simply doesn't allow for a scope and connectivity as the natural green space does. The extent is not given and the area does not provide a feeling of experiencing more, the feeling of excitement. Kaplan and Kaplan (1989) put forward that even a small space could provide for extent, an extent within the person. Such an extent can only be assessed throughout interviews.

NATURE AND FASCINATION

Nature is of great importance, since a "functioning in a natural setting seems for many people to be less effortful than functioning in more civilized setting" (Kaplan and Kaplan 1989: p.193). Such an effortless functioning is basis for an improved direct attention. Nature provides an improved cognitive functioning (Berman et al. 2008; Miljødirektoratet 2014).

The results of the BGF show a difference in the blue green settings of the selected spaces. A high greenness is accounted for the natural green space and even though Bjerkedalen Park scores a high BGF, compared to building projects, the score is significantly lower. In accordance with the BGF, the SDT indicates high scores for both green spaces within the biotic feature category, although the natural green space scores even higher. These high scores within the SDT are related to the single element count within the tool, a small amount of an instance will score the same as a high amount and hence the score will be significantly higher. This means for example that one tree counts as much as thousand trees and even though the BGF indicates the difference within the tree count in the areas, the SDT does not account for this. Furthermore, the tool is built to assess more park-like urban spaces, such as

Bjerkedalen Park, and seems not so representative for natural green spaces (Voigt et al. 2014). This is reflected in the similar results of the tool for both green spaces.

Analysing the individual tree number accounts for both areas elucidate the statement made. The tree count of the natural green space accounts for over seventy per cent of the total score and is hence the determining element of the area. In line with the BGF, the category of tree/forest aspects within the Structural Diversity Tool achieves a score of 0.75, only solitary old trees and hedges are not present. Within Bjerkedalen the individual tree elements account together for only four per cent of the total score. This is in contrast to the score achieved within the tree/forest aspects in the SDT. Here, a score of 0.625 is achieved; only hedges, old solidary trees and the natural-like dense wood areas are not accounted for. One line of trees accompanies one of the pathways, one smaller patch allows for a group of trees and solitary young trees are the newly planted trees alongside the path.

The natural space provides pleasant fascination as shown in the interviews, the process of changing colours in the seasons, the listening to the sound of flowing water, the attraction of the sounds of the waterfall and even the bridges you can jump on provide a pleasant fascination. This fascination allows for an involuntary attention, where the mind can refuel and in the words of one respondent: "think for myself and reset myself".

Bjerkedalen seems however not to provide such fascination features. Most likely such features are not yet found in such a young park or the existing features are yet not discovered or accepted by the on-site users.

USE AND COMPATIBILITY

The use of the Svartdalen is quite different to the use of Bjerkedalen. The performance of all kinds of physical activities is predominant in the natural green space. Little to non-physical engagement characterizes however Bjerkedalen Park.

Within the restorative environment the aspect of compatibility is brought forward. This human nature compatibility is reflected in Tessin's (2008) aspect of visitors seeking the nearest green space allowing for their needs. The visitors of the natural green space find what they seek in the green space. Whether it is taking the dog for a walk or engaging in outdoor

activity. This is not reflected within Bjerkedalen. The pavilion facility has however not been observed in use and might show a different picture of the compatibility aspect.

The process of perception building is influenced by many factors, as shown in the theory and not all visitors are using the natural green space for its restorative function, in fact some visitors would not even recognize what a natural environment provides for them. This statement is in line with the theory, "the satisfaction they derive from nature are not self-evident" (Kaplan and Kaplan 1989: p.158).

Furthermore, the high BGF score, might also indicate that the natural green space is too natural. Many of the respondents argued about the tidiness of the forest that it is simply too unorganized, too much left to itself. Another issues was the density of the forest in connection with the light situation. The dense forest doesn't allow sunlight to light up the pathways. Some respondents take this even further and describe the density of the forest as providing a feeling of not being secure in the green space. Taking this even further, some respondents articulated a feeling of fear. All the trees allowing for the mystery, also allow for places to hide for attackers. This feeling is strengthened by the narrowness of the paths and the surrounding inclining terrain. These issues indicate an environment where direct attention is needed, a constant mindfulness whilst entering the green space. Some respondents with children mentioned also this mindfulness in connection to recreationist. The inattentive use of the green space by some cyclist calls upon extra attention of parents, so their children are not in danger.

Despite the similar scores within the SDT, the compositions of the green spaces are different as shown in the BGF. The comparison shows that the natural green space is perceived as a natural green space. It provides the aspects and possibilities for a restorative environment, which is not evident with the scores of the SDT. Bjerkedalen seems not as a park that is perceived as providing a restorative environment, in fact, against the indications of the ROS; the park seems not yet to be accepted as a nearby-green space. This might be related to the relative novelty of the area or the experienced smell that accoutred in 2014. Further insight can only be assessed through interviews. These statements support the hypothesis indicating that the natural green space is valued higher than the park.

These results of the researched green spaces cannot simply be generalized to other natural green spaces and parks. The lack of any component within the green spaces can change the

feelings experienced. The difference within the respondents concerning the feeling of being away and the restorative effect of the space is to some extent related to the different activities the green space was used for. Most respondents mentioning these feelings were exercising, walking the dog or especially choose the area for their walk. Respondents that didn't experience these feelings carried out activities such as moving through the space as a more pleasant way of getting from one to another place.

7.2 CULTURAL ECOSYSTEM SERVICES

In order to have a cultural function, the existence of different green spaces in cities is irrevocably needed. It is important to identify the CES associated with different green spaces and to identify which potentials could be associated with the different blue green structures.

Despite this, the contingent nature of cultural ecosystem services proposes the unlikeliness that a simple, common list of services can represent the services provided by ecosystems regions (Haines-Young and Potschin 2010) and even green spaces in proximity to each other. The cultural ecosystem services perceived or observed in the selected cases are different. The natural green space and the interviews built the basis for the connection of the CES concept to the properties provided by the blue green structures, the observations of Bjerkedalen area are taken into consideration to support statements made. The assessment of CES on a local scale by Szücs et al. (2015) is used to verify the connections made. The indicators used are not exclusively for one CES, and can be used to support several services.

The interview study showed that the natural green space is a venue promoting physical outdoor activity and associated services. Furthermore, the green space provides a restorative environment and five relevant cultural subservices were identified. In addition also tourism services were identified but these were of minor importance.

- Recreational services (stress relief)
- Social interactions
- Educational services
- The feeling of being away
- Aesthetical services

RECREATIONAL SERVICES

The most recognizable CES within the physical and intellectual interactions is without doubt recreational services. Such services are somewhat recognizable within the BGF and are partially completed by the SDT. The natural green space provides for a minimal amount of partially permeable surfaces within the BGF, specifically pathways. These pathways allow for physical activities, such as running, hiking, bicycling and so on. This indicates that a minimal amount of partially permeable surfaces provides the potential for recreational services.

In the case of the natural green space Svartdalen, the element of permeable pathways accounts for two per cent of the total area within total blue green structures; whilst in Bjerkedalen nine per cent of the total area are pathways. The SDT does not indicate a recreational use connected to running or hiking, and an index for valuing such activities could be added. Supporting this connection is Szücs et al. (2015). In their assessment of CES at a local scale, roads and their number, length and density are used as indicators for recreational services. These infrastructural indicators are represented within the SDT, however only indicating their presence and absence is thus not sufficient to present recreational services.

Furthermore, both tools allow for the recognition of sport fields and designated areas for sportive activity, as it is for the SDT. Within the BGF such fields are simply represented by areas covered with low vegetation, park-like areas. Here activities such as team sports but also playing with the dog can be carried out. The respondents within the natural green space mentioned these activities. Observations within Bjerkedalen are in line with these statements, and pathways were used for physical activities. Nevertheless the carried out activities were far less within Bjerkedalen, and running as well as hiking was negligible. These differentiations within the recreational service provided could indicate that a maximum amount of permeable surface should be introduced to still allow for enough greenness and blueness. However, more research on green space settings is needed to confirm such a connection. Contiguous with the provision of recreation services by permeable surfaces, an appropriate amount of impermeable surfaces could indicate recreational services, if a differentiation between surfaces designated for sport fields and build-environment is made. This differentiation is not made within the BGF and a further division of the impermeable surface element might indicate the potential of such services. Szücs et al. (2015) uses furthermore a visual dimension as indicators for recreation, more precisely the ratio between

open landscapes and forest. This is supporting the statement that an appropriate amount of green should be present to provide for recreation. Furthermore, the diversity of landscape and the presence of spectacular, unique or iconic elements and landmarks are within the visual indicator dimension. Such elements are however not given within the case study areas.

Accessibility of an area is an indicator for recreation, which is reflected within the interviews. This could be integrated within the BGF by adding a social connectivity dimension or cultural dimension to the existing connectivity score. This index of connectivity to existing BG structures could be further developed to indicate how the existing structures are connected to the green space of interest. Connectivity was valued highly and connections throughout bridges or underpasses are more suitable than pedestrian crossings or lights. Bridges allow for a direct connection to other green structures and also children do not need to be watched while crossing. Such a perceived distance is of importance, a green space that is geographically close is not necessarily close for visitors, if it is difficult to gain access to the area (Kaplan and Kaplan 1989).

Furthermore, one respondent choose to walk in the natural green space to ease a stressful situation at home. Green spaces might hence reduce stress, but the low respondents' rate cannot demonstrate such a service in the researched green space. Hansmann et al. (2007: p. 222) however proved that the visit of a green space "effectively reduce subjectively experienced acute stress".

SOCIAL INTERACTION

Social interaction is definitely of importance within the responses, for humans and also for their dogs. The provision of such a service is highly depending on the social surrounding and the individual person. In an urban green space social interaction is most certainly given (Clark and Stankey 1979), but difficult to assess by using the tools.

EDUCATIONAL SERVICES

Educational services were recognizable within the interviews. An indication of this service could be connected to the amount of native green space and the amount of tree cover. This connection is supported by Szücs et al. (2015) by using the presence of spectacular, unique or

iconic elements and landmarks as an indicator for educational services. Such elements would include native vegetation or the existence of an old forest.

Furthermore, the existence of old habitat trees and the number of special element attractions (streams, water bodies, and deadwood) is used as an indicator. These elements are given within the natural green space and could be assessed with the BGF and the field assessment. Existing large trees are already included, but a further subdivision could account for old habitat trees and an index for deadwood could be added.

Within the BGF calculations, three per cent of the total area is accounted for as native vegetation and the forest covers almost 85% of the green space, thus allowing for a connection between these indexes and the educational CES. None of the above is given within Bjerkedalen Park and no educational activity was observed. Nevertheless, these elements do not generally imply an educational service. The issue of proximity is a very important factor to this service. Schools and kindergartens have to be within an appropriate proximity to the green spaces that provides for a native forest. This is evident within the interviews and several respondents confirmed an educational use of the natural green space. Therefore at least a potential exists for education services if those green space settings coexist with surrounding schools or kindergartens.

THE FEELING OF BEING AWAY AND AESTHETICAL SERVICES

The service of being away connected with the aesthetical service of the green space is valued highly by the respondents. The feeling of being away, described by some respondents as imagining themselves in another place, relaxation of the mind and refuelling the inner self, is one of the most perceived values within the natural green space.

The BGF accounts for native areas and the amount of trees as well as for water surfaces. The latter two elements are highly valued by the respondents and latently the native vegetation of the area is also highly valued, even though it was hardly recognized by the respondents. These elements of an urban green space setting, point out the potential for providing aesthetical services. Szücs et al. (2015) uses the shape diversity, the ratio between open landscapes and forests, the diversity of landscapes and the presence of spectacular, unique or iconic elements and landmarks as indicators for aesthetic values. Furthermore, natural elements are indicators for aesthetic values: Number of special element attractions and

existence of old habitat trees. These elements are valued within the native vegetation index and could be assessed with and additional index for deadwood and old habitat trees. Shape diversity is a landscape attribute that indicates the complexity of a space. This indicator is of importance for the respondents and evident within the extent aspect of the restorative environment. All these landscape attributes add to the dimension of the spirit of the space or the uniqueness of the space in creating a visual image that inspires, invites, gives identity and allows for familiarity (Tveit et al. 2006). All these feelings allow for a connection of the person towards the space. The shape diversity would be given with the existence of a variety of elements within the green space.

The element of water is connected to spiritual contemplation (Davis et al. 2011) and one of the respondents valued highly the sounds of the waterfall, thus a minimum amount of water can indicate the provision of aesthetical services. Within the natural green space nine per cent of the basic blue green structures are composed of water. This is however also true for Bjerkedalen and hence the nature surrounding the element of water have to be considered and the extent has to be accounted for in some way in order to assess the provision of aesthetical services. The BGF and the integrated mapping of the green space allow for an assessment of the extent as well as the greenness and blueness, and the potential for aesthetical services could be identified. Nevertheless, the aspect of compatibility of the visitor with the environment and the feeling of being away are individual perceptions of the on-site user.

TOURISM SERVICES

Tourism services were not identified through the tools. The interviews revealed that one of the responding couples was visiting the green space as tourists and another small group of respondents visited the area because of its special attractiveness. These services are not tangible and quite difficult to identify in an area that is not especially attractive as Tessin (2008) described such spaces. A green space laid out for tourism is most likely to also provide the potential for such a service. Nevertheless, such a potential exists within the natural green space, connected to its uniqueness of inhabiting an old forest and connected to the history of the area. To further improve this service, a higher recognition of the area is needed. However a greater visitor number is highly likely to destroy the restorative function of the space. Such services could be identified with an additional index of unique elements or elements that indicate a special attractiveness.

In close connection to the tourism service provision, is the provision of cultural heritage services. These services are available through the connection to the history of Kværner Brug. Nevertheless, most respondents were not aware of the cultural heritage of the area and even though there is a reminder of the former use within the area, the service is not evident within the responses. Similar results were found in the study of Chen et al. (2009). For cultural heritage to be evident it has to be more obvious for the on-site visitors that this is a cultural heritage site and a connection to the place has to be built. One respondent mentioned this cultural heritage connection for a small park in one of the oldest city parts of Oslo. This space, according to the respondent, is included in songs. Through this inclusion a cultural heritage connection is more obvious and so the legacy of this space is preserved for future generations. Cultural heritage associations with specific biotic features are different for different societies and thus this service is in need of an understanding of the cultural and the ecological context (Daniel et al. 2012).

7.2.1 DISSERVICES

Disservices mentioned by the respondents are individually perceived and cannot be accessed by the tools. The social dimension is of importance whilst accounting for such services (night vs. day use). In this way the management of the area is of importance to ensure the feeling of being secure, ensure the cleanness of the area, which in turn provides for the restorative environment.

7.3 EVALUATION OF THE TOOLS

STRUCTURAL DIVERSITY TOOL EVALUATION

Despite the selective recognition of environments by humans, the structural levels identified by Voigt et al. (2014) seem not to represent natural green spaces in a way that seems adequate enough to describe or rather classify such green spaces. The actual usage of the natural green space is not reproduced.

The SDT seems not an appropriate measure for assessing the perceived values of green spaces. Many of the elements connected to use are available at Bjerkedalen and are still not valued by on-site users. Another indicator for the inappropriateness of the tool to identify CES potentials is the similar scores achieved between the natural green space Svartdalen and

Bjerkedalen Park. Similar scores indicate a similar perception by users but the green spaces are perceived quite differently. Interviews might however reveal a different picture than the observations.

BLUE GREEN FACTOR EVALUATION

The BGF framework, as it is, is restricted and does not allow assessing for values such as recreational services, social interactions, educational services, the feeling of being away and aesthetical services.

The BGF is a tool that assesses blue green structures and could assess the potential for CES, but besides further research to confirm the potentials connected to the perceived values, it is necessary to adapt the tool. Adapt the tool in order to assess building projects and green spaces. The BGF adaptions suggested could allow for an overall possibility to assess BG structures in the entire city.

Further suggestions for adaptation are made within the CES discussion and could provide an assessment for the provision of CES within BG structures. Further research is however needed to confirm the connections made.

8 CONCLUSION

Pleasant urban nearby green spaces can allow for involuntary attention and fascination, thus providing spaces for the exploration of thoughts. The cultural ecosystem services provided by the green spaces are however inevitably connected to humans perceiving those values. Such values are often created throughout the entire experience of the green space and are not a product of one single value.

The cultural value perceived depends considerably on blue green structures but also on abiotic side conditions: the social environment and the maintenance of the space. Thus, it is of importance to assess such CES on-site or else theses services would be left out.

The following concludes the examined hypotheses

(1) The natural green space is given a considerably higher BGF score than the constructed green space. This is even true for the BGF scores calculated with the adaptations.
(2) In contrast to the hypotheses, the natural green space achieves a slightly higher Structural Diversity Tool score than the constructed green space.
(3) The important aspects that lead to a visit of the respondents of the natural green space are in line with the aspects found in the aesthetics of the pleasant and the restorative environment.
(4) The respondents value the natural green space higher than indicated for the constructed green space.
(5) The blue green structures in urban environments are of high importance for providing the potential for cultural services, but abiotic side conditions have to be considered in order to account for all cultural ecosystem services.

It is evident that urban green spaces are of importance to an urbanized society. Numerous benefits, extending the CES mentioned, are derived by urban green spaces and an introduction of preserving or restoring urban green spaces into local management is inevitable. The concept of ecosystem services is a concept that can strengthen the importance of those services within society and decision-making. Beyond the benefits provided by natural green spaces, it is necessary to ensure a variety of urban green spaces. The theory described the process of perception building and this is evident within the responses. People

have diverse opinions and values and are in need of diverse green spaces to satisfy these needs. Natural forestry spaces seem to invite for more physical activities, the need of playgrounds mentioned by families demonstrates that such spaces are also of importance in an urban context and parks have the potential to provide social environments that invite for relaxation.

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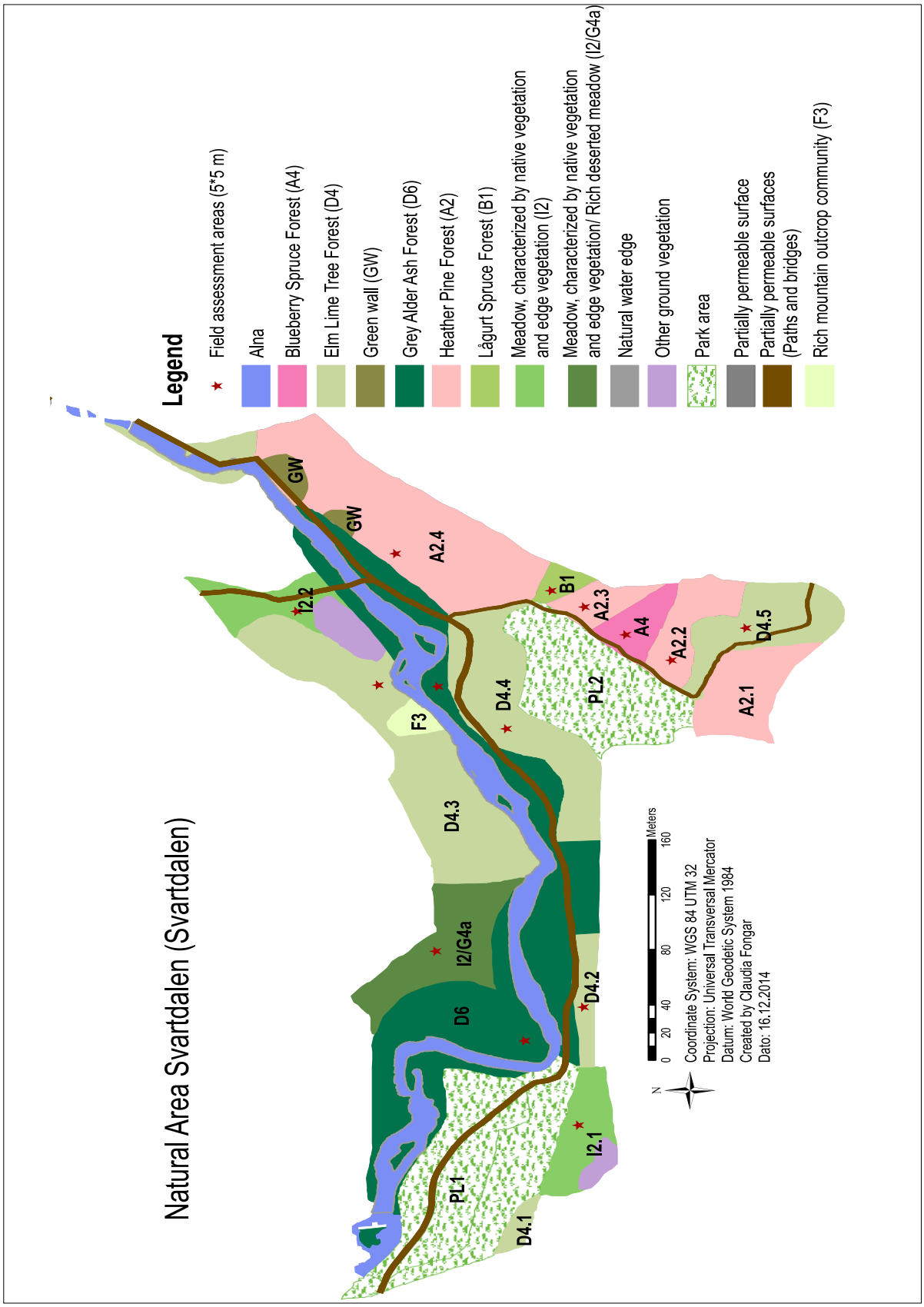
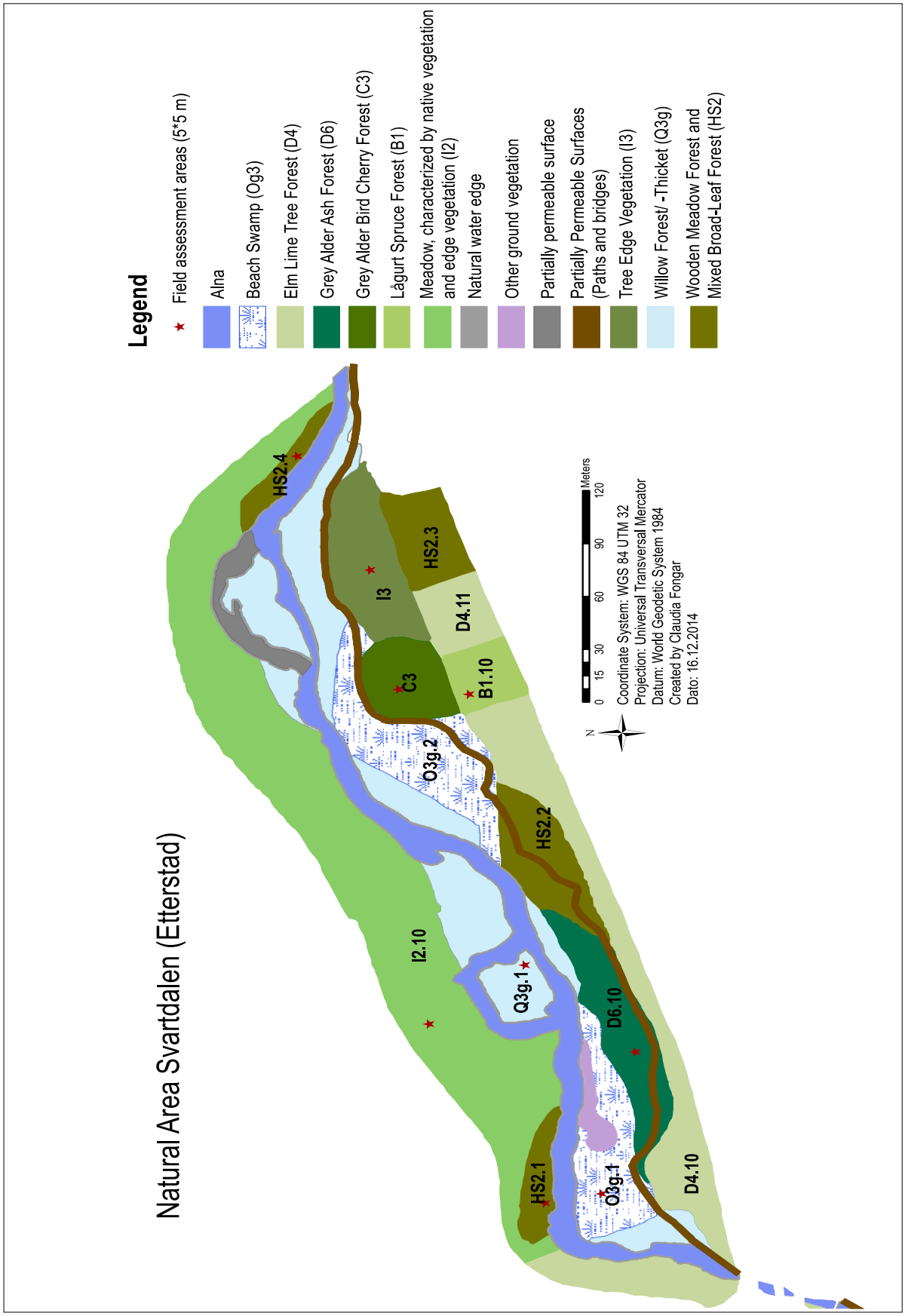
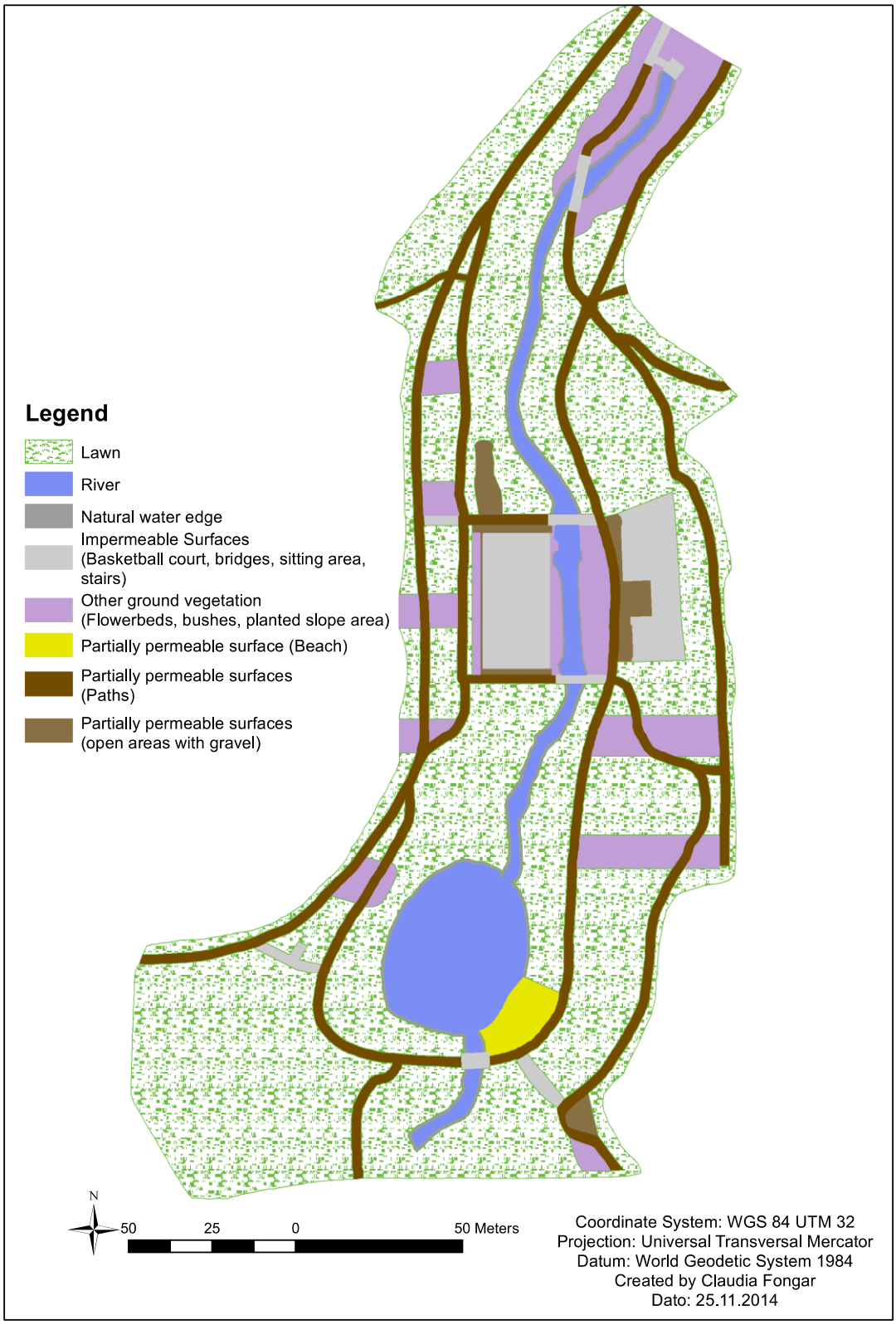
APPENDIX 1 OVERVIEW NATURAL GREEN SPACE SVARTDALEN (SVARTDALEN)



APPENDIX 2 OVERVIEW NATURAL GREEN SPACE SVARTDALEN (ETTERSTAD)



APPENDIX 3 OVERVIEW BJERKEDALEN PARK



APPENDIX 4 FIELD ASSESSMENT: FOREST TYPES

The forest types are translations of the forest types identified by the report of Bendiksen and Bakkestuen (2000) and are as such direct translations. The Norwegian name and a short symbol are mentioned in brackets.

The report identified in total fourteen different forest types with different distributions and occurrences throughout the area. The forest classification system used is based on the vegetation types in Norway (*Vegetasjonstyper i Norge*). The descriptions are arranged in three levels: groups, types and design. The 24 main vegetation types are represented in the highest level. For example is forest gathered in the groups A-F, swamp forest is within the group E, forest on firm ground within the groups F-I. Cultural influenced areas are under the group G and so on (Fremstad, 1997).

The tree species are named with their local name and Latin names are given once, in some cases only the genus is mentioned, since the species cannot clearly be identified. The forest types found in the area are explained using these short abbreviations and are numbered form the western Svartdalen part to the north-eastern Etterstad end. First, all forest types are listed, situated in both parts of the area, followed by types only found in the Svartdalen part and then forest types within the Etterstad part.

TYPES OF FOREST PRESENT IN BOTH AREAS

LÅGURT SPRUCE FOREST (B1; LÅGURTGRANSKOG)

Lågurt spruce forest is a species rich and high productive forest (Oslo Kommune, 2013). Spruce (*Picea*) and pine (*Pinus*) are the main species identified with smaller elements of birch (*Betula pubescens*) and maple trees (*Acer*). This type is found twice in the area. The first is situated at the edge of the plateau at the middle of Svartdalen and lies on an inclining terrain. This area is accessible through a rudimentary wooden staircase but also through an inclining path just beside the stairs. From this plateau the forest types A2, A4, B1 and D4 are reaching up until Svartdalsveien. The whole area is difficult to assess, and only a pathway is leading through the area up to the city part of Manglerud. Spruce trees and smaller elm trees are dominating in this part of the area. Elements of bare rocks are visible and moose and fern form the most part of the groundcover. The second area is situated at the northern end of

Etterstad. Birch and spruce are dominating within this part. Lots of small trees (under five meters) have been identified. These trees will obviously not grow to their full potential and are excluded from the calculations.

ELM LIME-TREE FOREST (D4; ALM-LINDESKOG)

Elm lime-tree forest (D4) was identified in five parts of Svartdalen. This forest type takes over a great part of the area. The areas D4.1 and D4.2 are accounted for together due to their similarity in composition and slope. Elm lime-tree forest is a warmth-loving, lush vegetation type. Major tree species are several types of broad-leaf trees with a dominance of elm trees (Larsson, 2000). Lime-trees (*Tilia*) as well as maple trees can be presented in such kind of forest. The understory is composite of hazelnut (*Corylus*) and ash trees (*Fraxinus excelsior*), but also Bird cherry trees (*Prudus padus*) are common for this forest type (Fremstad, 1997). Two of the areas (D4.3-4) appear in close connection to the river and the vegetation type of grey alder ash forest (D6) occurring exclusively adjacent to the river. This part shows elements of chestnut (*Castanea*; D4.4) and willow (*Salix*) elements close to the river (D4.3). The third area (D4.3) is situated in a terrain that is difficult to assess not only because of the slope but also through environmental pollution. At this area further away from the path injection needles have been found placed precisely under a tree that made further exploration not feasible. The area count took therefore place closer to the path. The fifth (D4.5) area is situated at the plateau reaching up the inclining terrain in between heather pine forests. This area is highly diverse and composes pine and spruce trees as well as birch and elm. A small stream is running through the inclining terrain in this area.

GREY ALDER ASH FOREST (D6; GRÅOR-ASKESKOG)

Grey Alder Ash Forest is dominating the entire area with thirteen identified areas within the park. Grey alder (*Alnus incana ssp. incana*) and Ash are the dominating species in this forest type but elements of elm (*Ulmus*) and maple can be found (Bendiksen and Bakkestuen 2000). This forest type appears only in close connection to the river and is similar distinctive in each part and are therefore only described once. Almost all small islands within the river are classified as grey alder ash forest and their area in square meters is accounted for in the calculations. Svartdalen area represents a great amount of ash trees, smaller elements of alder and maple trees and the understory consists of fern as well as moose and death woods. Etterstad area is similar distinctive but willows are present.

MEADOW, CHARACTERIZED BY NATIVE VEGETATION AND EDGE VEGETATION (I2; URGRASPREGET ENG- OG KANTVEGETASJON)

Edge vegetation (I2) was identified at three parts of the entire area. This vegetation is a natural, wild growing area along the river course up to flood-protected areas. That is why this type consists of a variety of tree species. Hence, width and compilation defer depending on location (Oslo Kommune Bymiljøetaten, 2013). The first edge vegetation (I2.1) is situated at the lower end of Svartdalen, counting several elm trees as well as small maple trees. The second edge vegetation (I2.2) area is situated at an entrance point to the park at the north-eastern end, connecting the street level with the river in the valley. Here a private building, a scrapyard an old run-down factory building are bordering the park area. In between these buildings and the edge vegetation a wooden rudimentary staircase leads down to the river. That stair is connecting the park to the street (Arnljot Gellines vei) and some apartment buildings. Elm trees and acer are the prevailing species. The acer trees present are quite small and are not expected to grow taller than ten meters height. An area with native grass vegetation is found close the river and is excluded from the calculations for the forest type. The third area (I2.3) takes over almost the whole northern side of the river in the Etterstad. Elm trees as well as dog rose (*Rosa canina*) are the dominating species; nevertheless most of the area is covered with native grass vegetation and smaller bushes.

PARK AREAS AND GREEN SPACES (PL; PARKOMRÅDER OG GRØNTANLEGG)

The area, as defined by Blindheim and Bendiksen (2000), comprises four park areas or green spaces. All the green areas consist of meadows that are regularly cut. The first green area (PL1) is the actual Svartdalensparken at the western end of the area. This area is used as a dog park and dog meetings are hosted on a regular basis. At the time of the study two table bench combinations have been found in the area. Birch trees (22 individual trees) have been planted in a regular pattern around one side of the park. The second area (PL2) is situated in between a housing estate in Etterstad and hence the boundaries are difficult to precisely define. This part is also separated by a fence to the adjacent forest and will therefore not be included into the calculations. The third park area (PL3) is situated on the mentioned plateau in the middle of Svartdalen. This area is accessible not only by the mentioned stairs but also by an adjacent road and some houses. Here two soccer goals are providing some kind of entertainment for children. The fourth park area (PL4) is situated at the eastern end. This park serves as a green view for the adjacent office building. The subway station is located at this

end and is accessible through, at the time of the study, an overgrown muddy inclining pathway or around the office building using some stairs. No benches are situated at this green area. This area is also excluded from the calculations to stay within the scope of study from Bendiksen and Bakkestuen (2000).

Types of forest present in Svartdalen

Heather pine forest (A2; Lyng-furuskog)

Heather pine forest was found in four parts of the research area of Svartdalen. The first two areas (A.2.1 and A2.2) are found at the plateau area in the middle of Svartdalen. Pine and birch trees are the dominating species. The understory consists of smaller birch and elm trees that are not expected to grow taller than 10 meters. Several herbs are presenting the ground cover. The third area (A2.3) is also situated at the plateau but shows a different composition due to its location at a steep slope. Birch and elm trees are identified in a smaller amount and a pine tree was also identified. The fourth area (A2.4) is situated at the steep walls of the narrow river valley close to the train track crossing. Pine and ash trees are dominating the area. The entire area is classified by the report from NINA as a heather pine forest. Nevertheless, two smaller areas are only covered by mosses and would not represent the tree count appropriately. These areas are represented as green walls within the BGF scheme.

Blueberry-spruce forest (A4; Blåbærgranskog)

Blueberry-spruce forest was found once in the entire area at the higher elevation level in the middle of Svartdalen. This type is situated on the inclining terrain in the middle of the mentioned plateau area. This forest is poor in species with spruce as the dominant tree species identified, but also elements of birch and pine can be found. The ground cover is represented by herbs as well as mosses (Norsk institutt for skog og landskap 2014) an bare rocks can be identified.

Rich mountain outcrop community (F3; Rikt bergknaussamfunn)

The area of the mountain outcrop in the area is situated within the wide ranging area of D4.3 and as mentioned couldnt be reached. The vegetation is characterized through open and low growing leaf succulents, perennial herbs or graminoids, with elements of perennial spring plants. The ground cover varies from isolated moose to areas covered with moose. The soil is

mostly thin or just bare rocks are present (Fremstad, 1997). Hence this area will not count into the calculations for trees and will be excluded.

MEADOW, CHARACTERIZED BY NATIVE VEGETATION AND EDGE VEGETATION (I2/G4A; URGRASPREGET ENG- OG KANTVEGETASJON / RIK ØDEENG)

This type is a mixture of native vegetation situated at edges of forest close to pathways or roads. Small bushes and high grass vegetation as well as dog rose were identified.

TYPES OF FOREST PRESENT IN ETTERSTAD

GREY ALDER BIRD CHERRY FOREST (C3; GRÅOR-HEGGESKOG)

Grey alder trees and willow trees with elements of birch and ash trees dominate this forest type. The area gives the impression of a total natural part of forest with dead trees on the ground and a dense grass development as understory. Several small trees are present but these are no expected to grow taller than ten meters of height. A less developed herb cover presents the ground cover (Fremstad, 1997).

WOODEN MEADOW FOREST AND MIXED BROADLEAF FOREST (HS2; VARMEKJÆR HAGEMARKSKOG/ LAUVBLANDINGSSKOG)

The hagemarkskog is difficult to properly translate. As a result of an extensive usage by human and animals, a mixed forest type originated. This led to the development of plants adapted to such an environment. Hence a variety of different species is inhabited in such a forest. Generally birch trees, spruce or any deciduous tree species will dominate the overstory. The understory is covered with grass and some herb species. In the research area the influence of human and animals decreased enormously and hence the type of a wooden meadow forest is transforming into a mixed broad-leaved forest. This type was identified at four parts of the area. The first area (HS2.1) identified is situated just at the beginning of the Etterstad area. Here the forest type covers a small area between the river and the adjacent edge vegetation situated on a steeper slope than the forest itself. Willow and elm trees are the dominating species in this area. The other three areas are of similar composition and are accounted for together.

TREE EDGE VEGETATION (I3; TRÆKANTVEGETASJON)

This type is only found once in the entire area and is situated at the end of Etterstad between the river and the pathway. Mostly birch trees are covering this area and the ground cover shows elements of nettle (*Urtica dioica*) and grass vegetation. Hidden within the area a tent was found, apparent signs led to the conclusion that someone is living there permanently.

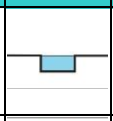
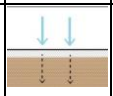
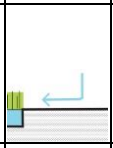
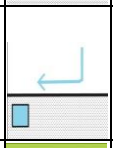
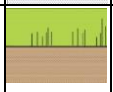
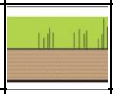
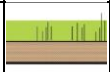
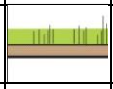
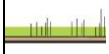
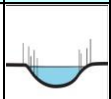
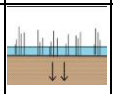
BEACH SWAMP (O3G; STRANSDSUMP)

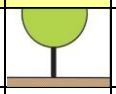
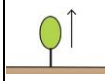
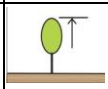
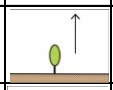
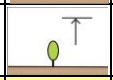
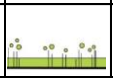
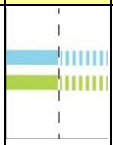
Willow trees and elements of birch and elm trees are situated within this area. Dead trees as well as nettle and several small trees that are not expected to grow taller than ten meters are covering the ground.

WILLOW FOREST/- THICKET (Q3G; PILESKOG/-KRATT)

Dominant specie is willow but elements of bird cherry trees can be found. The ground cover shows elements of nettle.

APPENDIX 5 ORIGINAL BGF

			Blue Green Factor (BGF) 29.05.2013 Developed for Bærum og Oslo municipalities by Dronninga landskap, COWI and CF Møller		
Value	**Symbol**	**Factor**	**Description**	**AREA**	**BGF**
		Plot Area (including the built area)		0	
		1.BLÅGRØNNE FLATER			
1		**Open permanent water surface that can receive rainwater**	Permanent water surface supplied rainwater from the site, regardless of whether this is a channel with concrete bottom stream with green banks or other type of water surface. Only the water surface is considered	0	0
0,3		**Partially permeable surface like gravel, crushed stone, and reinforced grass surface**	Hard surfaces with permeability, providing infiltration. For example, grassy areas reinforced with concrete, gravel or crushed stone. Not surfaces of underlying hard covers if the soil depth is less than 80 cm.	0	0
0,2		**Impermeable surfaces with drainage to vegetated areas or an open drainage magazine**	Eg. concrete, asphalt, roofs and paving stones. Calculated for the area corresponding to the size of the vegetation surface that accepts water. The drainage magazine must have the capacity according to municipal requirements for discharges to official sewer system (ie it holds about 20 to 30 l / m² runoff area)	0	0
0,1		**Impermeable surfaces with drainage to a local closed storm water drainage**	Eg. concrete, asphalt, roof surfaces with runoff led to a closed facility for retention and purification of the water. This also applies to underground solutions combined with irrigation of trees. The whole area counts assuming drainage magazine is according to municipal requirements for discharges to off. sewer system (ie it holds about 20	0	0
1		**Surfaces with vegetation associated with soil or bedrock**	Vegetation growing in soil and has contact with the soil below. Beneficial for the development of flora and fauna and storm water can be pulled down to ground water. The point also applies to natural rock outcrops and cliffs.	0	0
0,8		**Surfaces with vegetation, not associated with soil > 80 cm**	Vegetation growing in soil on minnimum 80 cm depth, but not in contact with the earth / ground below, eg. on top of a garage or roof. The depth is great enough that larger trees can grow.	0	0
0,6		**Surfaces with vegetation, not associated with soil 40 - 80 cm**	As above, but with 40-80 cm ear so that hedges, large bushes and small or medium trees can grow.	0	0
0,4		**Surfaces with vegetation, not associated with soil 20 - 40 cm**	As above, but with 20-40 cm earth for that perennials and small bushes can grow.	0	0
0,2		**Surfaces with vegetation, not associated with soil 5 -20 cm**	As above, but with 5 - 20 cm earth that is enough for grasses, herbaceous plants and other ground cover can grow.	0	0
		2. Additional qualities	Blue and Green additional qualities that give extra points. The same area can therefore be counted a number of times below		
		Blue additional qualities			
0,3		**Natural edges to water surfaces**	Water surfaces that are counted above, can also be counted in this category there is access for flora / fauna at ground level to a natural substrate and edge (riparian) zone. Eg: stream, canal and pond with green edges The area to be considered is the width of the water surface.	0	0
0,3		**Rain bed or equivalent**	Vegetation area that serves as rain bed or similar planted infiltration that collects, diffuses and infiltrates rainwater into the soil / ground. This does not apply to permanent water surfaces and diffusion basin counted in blue surfaces above.	0	0

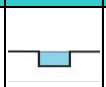
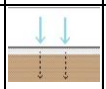
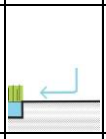
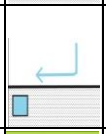
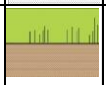
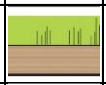
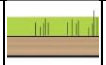
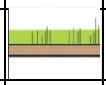
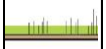
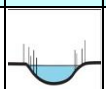
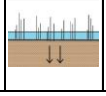
			Green additional qualities, Points below (trees) should be filled in as a number	Number	
1		**Existing large trees > 10 m**	Existing large trees; over 10 m. factor is 25 m2/tree .	0	0
0,8		**Existing trees that can be expected to grow to over > 10 m**	Existing trees that can be over 10 m tall. Forest trees, hardwood deciduous trees and park trees, eg, elm, ash, birch, oak, linden, maple, chestnut, pine and many more. It is expected that the tree should have enough soil to grow (min 100 cm). Factor: 25 m2/tre (x 0.8).	0	0
0,6		**Existing trees that can be expected to grow to be small to medium, 5 - 10 m**	Existing trees that are 5-10 m tall. Ornamental trees and fruit trees, e.g., apples cherry, magnolia, pear, locust and many more. Also applies to pruned trees. It is expected that the tree should have enough soil to grow (min 60 cm). Factor: 16 m2/tree (x 0.6).	0	0
0,7		**Newly planted trees that are expected to be > 10 m**	Trees that will be over 10 m high. Species: see the field listed above. It is expected that the tree will have enough soil to grow (min. 100 cm). Factor: 25 m2/tre (x 0,7).	0	0
0,5		**Newly planted trees that are expected to be 5 - 10 m**	Trees which will become 5-10 m high. Species: see the field above. It is expected that the tree will have enough soil to grow (min 60 cm). Factor: 16 m2/tre (x 0.5).	0	0
		Points below should be filled in as m2		**Area m2**	
0,6		**Native vegetaion**	Establishing or protection of surfaces with a large content of valuable plant species that are a part of the local, historical natural and cultural landscape.	0	0
0,4		**Hedges, bushes and multi-stemmed trees**	Hedges, bushes and multi-stemmed trees with a height over 3 m. Calculated for a maximal area corresponding to the drip zone of (crown of the tree) m2/tree.	0	0
0,4		**Green walls**	For climbing plants and other green walls, the factor is calculated for the wall area that can be expected to be covered over the course of 5 years (a maximum of 10 m height for climbing plants).	0	0
0,3		**Perinnials and other ground cover**	Does not apply to lawn grasses	0	0
0,1	75m2	**Contiguous green areas over 75 m2**	Contiguous green area that is larger than 75 m2, as for example large grassy lawns, pllanted areas, or others.	0	0
					0
		Points below are filled in with the number 0,05		**0,05**	
0,05		**Connection til existerende Blue-green structure.**	If the blue and / or green elements in the area can be connected to the existing structure outside the area in question. The connection should be obvious. For example, a stream opening, a link to the existing channel or water surface, drainage, the extension of an alley or a grove, merging of several courtyards with free movement between them. This provides a general increase of 0.05 in BGF.	0	0
		TOTAL BLUEGREEN FACTOR (BGF)			**####**

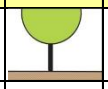
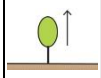
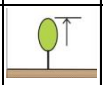
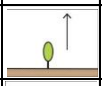
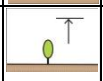
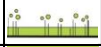
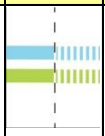
APPENDIX 6 BGF INDIVIDUAL CALCLATIONS NATURAL GREEN SPACE

BGF category	Element	Area [m2]	Tool
TOTAL AREA		149085,98	
BLUEGREEN SURFACES			
Open permanent water surface that receives rainwater	river	12297,32	Polygon
Partially permeable surface	paths, stairs, water edges buffer, dried river bed	9238,46	Buffer/ 1.5m both sides
Impermeable surfaces with drainage to an open channel	cement block and bridges	43,04	Rectangle
Surfaces with vegetation connected to subsoil or bedrock	all surfaces without river, impermeable and partially permeable surfaces	127507,15	Polygon
ADDITIONAL BLUE QUALITIES			
Natural edges of water	water edges buffer	3459,30	Buffer/ 1m both sides
Rain bed or equivalent	all surfaces without river, impermeable surfaces	136745,61	Polygon
OTHER GREEN STRUCTURES			
Native Vegetation	native forest types (A2/A4/I2)	34146,35	Polygon
Green Walls	green walls	456,41	Polygon
Hedges	N/A	0,00	
Perennials and other ground cover	low vegetation areas	21325,85	Polygon

BGF category	Area [m2]	Total area [m2]	Individual trees >10	Individual trees <10
ADDITIONAL GREEN QUALITIES				
B1.1	549,44		2	9
B1.10	1087,50		3	0
Total B1		1636,94		
D4.2 (D4.1;D4.5;D4.6;D4.7)	5420,75	5420,75	1	3
D4.3	8338,60	8338,60	6	1
D4.4	5375,90	5375,90	5	3
D4.5 (D4.8;D4.9;D4.10;D4.11)	10902,92	10902,92	2	3
Total D4		30038,17		
D6	13990,97	13990,97	6	3
D6.10	2327,38	2327,38	2	9
Total D6		16318,35		
I2.1	1983,15	1983,15	8	13
I2.2	1565,21	1565,21	6	0
I2.10	15423,22	15423,22	3	3
Total I2		18971,58		
PL		15772,17		
A2.2 (A2.1)	4456,32	4456,32	8	6
A2.3	992,07	992,07	5	6
A2.4	8456,97	8452,70	1	13
Total A2		13905,36		
A4		1269,40	2	1
I2/G4a		3885,50	1	1
C3		1601,83	2	1
HS2.1	853,51	853,51	2	2
HS2.4	7436,88	7436,88	3	0
Total HS2		8290,39		
I3		2676,78	13	0
O3g.1		5514,69	2	3
Q3g		7625,97	3	4
SUM		127507,15	86	84

APPENDIX 7 BGF NATURAL GREEN SPACE SVARTDALEN

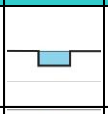
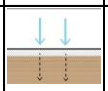
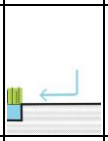
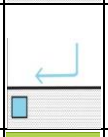
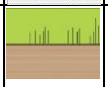
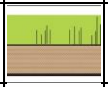
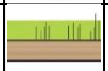
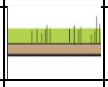
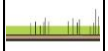
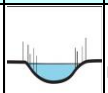
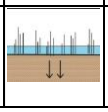
			Blue Green Factor (BGF) 29.05.2013 Developed for Bærum og Oslo municipalities by Dronninga landskap, COWI and CF Møller		
Value	**Symbol**	**Factor**	**Description**	**AREA**	**BGF**
		Plot Area (including the built area)		149085	
		1.BLÅGRØNNE FLATER			
1		**Open permanent water surface that can receive rainwater**	Permanent water surface supplied rainwater from the site, regardless of whether this is a channel with concrete bottom stream with green banks or other type of water surface. Only the water surface is considered	12297	0,082483147
0,3		**Partially permeable surface like gravel, crushed stone, and reinforced grass surface**	Hard surfaces with permeability, providing infiltration. For example, grassy areas reinforced with concrete, gravel or crushed stone. Not surfaces of underlying hard covers if the soil depth is less than 80 cm.	9238	0,018589395
0,2		**Impermeable surfaces with drainage to vegetated areas or an open drainage magazine**	Eg. concrete, asphalt, roofs and paving stones. Calculated for the area corresponding to the size of the vegetation surface that accepts water. The drainage magazine must have the capacity according to municipal requirements for discharges to official sewer system (ie it holds about 20 to 30 l / m² runoff area)	43	5,76852E-05
0,1		**Impermeable surfaces with drainage to a local closed storm water drainage**	Eg. concrete, asphalt, roof surfaces with runoff led to a closed facility for retention and purification of the water. This also applies to underground solutions combined with irrigation of trees. The whole area counts assuming drainage magazine is according to municipal requirements for discharges to off. sewer system (ie it holds about 20		0
1		**Surfaces with vegetation associated with soil or bedrock**	Vegetation growing in soil and has contact with the soil below. Beneficial for the development of flora and fauna and storm water can be pulled down to ground water. The point also applies to natural rock outcrops and cliffs.	127507	0,855263776
0,8		**Surfaces with vegetation, not associated with soil > 80 cm**	Vegetation growing in soil on minnimum 80 cm depth, but not in contact with the earth / ground below, eg. on top of a garage or roof. The depth is great enough that larger trees can grow.	0	0
0,6		**Surfaces with vegetation, not associated with soil 40 - 80 cm**	As above, but with 40-80 cm ear so that hedges, large bushes and small or medium trees can grow.	0	0
0,4		**Surfaces with vegetation, not associated with soil 20 - 40 cm**	As above, but with 20-40 cm earth for that perennials and small bushes can grow.	0	0
0,2		**Surfaces with vegetation, not associated with soil 5 -20 cm**	As above, but with 5 - 20 cm earth that is enough for grasses, herbaceous plants and other ground cover can grow.	0	0
		2. Additional qualities	Blue and Green additional qualities that give extra points. The same area can therefore be counted a number of times below		
		Blue additional qualities			
0,3		**Natural edges to water surfaces**	Water surfaces that are counted above, can also be counted in this category there is access for flora / fauna at ground level to a natural substrate and edge (riparian) zone. Eg: stream, canal and pond with green edges The area to be considered is the width of the water surface.	3459	0,006960459
0,3		**Rain bed or equivalent**	Vegetation area that serves as rain bed or similar planted infiltration that collects, diffuses and infiltrates rainwater into the soil / ground. This does not apply to permanent water surfaces and diffusion basin counted in blue surfaces above.	136745	0,275168528

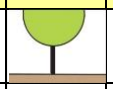
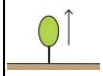
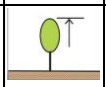
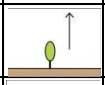
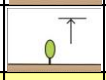
			Green additional qualities, Points below (trees) should be filled in as a number	Number	
1		**Existing large trees > 10 m**	Existing large trees; over 10 m. factor is 25 m2/tree .	16823	2,821041688
0,8		**Existing trees that can be expected to grow to over > 10 m**	Existing trees that can be over 10 m tall. Forest trees, hardwood deciduous trees and park trees, eg, elm, ash, birch, oak, linden, maple, chestnut, pine and many more. It is expected that the tree should have enough soil to grow (min 100 cm). Factor: 25 m2/tre (x 0.8).	0	0
0,6		**Existing trees that can be expected to grow to be small to medium, 5 - 10 m**	Existing trees that are 5-10 m tall. Ornamental trees and fruit trees, e.g., apples cherry, magnolia, pear, locust and many more. Also applies to pruned trees. It is expected that the tree should have enough soil to grow (min 60 cm). Factor: 16 m2/tree (x 0.6).	16460	1,059905423
0,7		**Newly planted trees that are expected to be > 10 m**	Trees that will be over 10 m high. Species: see the field listed above. It is expected that the tree will have enough soil to grow (min. 100 cm). Factor: 25 m2/tre (x 0,7).	0	0
0,5		**Newly planted trees that are expected to be 5 - 10 m**	Trees which will become 5-10 m high. Species: see the field above. It is expected that the tree will have enough soil to grow (min 60 cm). Factor: 16 m2/tre (x 0,5).	0	0
		Points below should be filled in as m2		**Area m2**	
0,6		**Native vegetaion**	Establishing or protection of surfaces with a large content of valuable plant species that are a part of the local, historical natural and cultural landscape.	34145	0,137418251
0,4		**Hedges, bushes and multi-stemmed trees**	Hedges, bushes and multi-stemmed trees with a height over 3 m. Calculated for a maximal area corresponding to the drip zone of (crown of the tree) m2/tree.	0	0
0,4		**Green walls**	For climbing plants and other green walls, the factor is calculated for the wall area that can be expected to be covered over the course of 5 years (a maximum of 10 m height for climbing plants).	456	0,001223463
0,3		**Perinnials and other ground cover**	Does not apply to lawn grasses	21325	0,042911762
0,1	75m2	**Contiguous green areas over 75 m2**	Contiguous green area that is larger than 75 m2, as for example large grassy lawns, pllanted areas, or others.	149085	0,1
					5,401023577
		Points below are filled in with the number 0,05		**0,05**	
0,05		**Connection til existerende Blue-green structure.**	If the blue and / or green elements in the area can be connected to the existing structure outside the area in question. The connection should be obvious. For example, a stream opening, a link to the existing channel or water surface, drainage, the extension of an alley or a grove, merging of several courtyards with free movement between them. This provides a general increase of 0.05 in BGF.	0,05	0,05
		TOTAL BLUEGREEN FACTOR (BGF)			**5,451023577**

APPENDIX 8 INDIVIDUAL CALCULATIONS BJERKEDALEN PARK

BGF category	Elements	Area in m2	Tree count	Tool
TOTAL AREA		34301,08		
BLUEGREEN SURFACES				
Open permanent water surface that receives rainwater	river	2636,88		Polygon
Partially permeable surface like gravel crushed stone, or reinforced grass	paths/ beach/ water edges buffer/ flowerbeds + other ground cover/	9076,07		Buffer/ 1.5m both sides
Impermeable surfaces with drainage to vegetated areas or an open drainage magazine	stairs/ bridges/ basketball court/ sitting area	1921,75		Rectangle/ 3m width
Surfaces with vegetation connected to subsoil or bedrock	all other green spaces	20666,38		Polygon
ADDITIONAL BLUE QUALITIES				
Natural edges of water	buffer	660,62		Buffer
Rain bed or equivalent	all surfaces without river, impermeable	32656,40		
ADDITIONAL GREEN QUALITIES				
Existing big trees >10m			0	
Existing trees that will be >10m			49	
Existing trees that will be 5-10m			43	
Newly planted trees that will be >10m			5	
Newly planted trees that will be 5-10m			61	
OTHER GREEN STRUCTURES				
Native Vegetation	N/A	N/A		
Multi-stemmed trees	N/A	N/A		
Green Walls	N/A	N/A		
Perennials and other ground cover	flowerbeds/ slope area with other	2913,96		Polygon

APPENDIX 9 BGF BJERKEDALEN PARK

Value	Symbol	Factor	Description	AREA	BGF
		Plot Area (including the built area)		38777	
		1.BLÅGRØNNE FLATER			
1		**Open permanent water surface that can receive rainwater**	Permanent water surface supplied rainwater from the site, regardless of whether this is a channel with concrete bottom stream with green banks or other type of water surface. Only the water surface is considered	2636	0,067978441
0,3		**Partially permeable surface like gravel, crushed stone, and reinforced grass surface**	Hard surfaces with permeability, providing infiltration. For example, grassy areas reinforced with concrete, gravel or crushed stone. Not surfaces of underlying hard covers if the soil depth is less than 80 cm.	9076	0,070216881
0,2		**Impermeable surfaces with drainage to vegetated areas or an open drainage magazine**	Eg. concrete, asphalt, roofs and paving stones. Calculated for the area corresponding to the size of the vegetation surface that accepts water. The drainage magazine must have the capacity according to municipal requirements for discharges to official sewer system (ie it holds about 20 to 30 l / m² runoff area)	3484	0,017969415
0,1		**Impermeable surfaces with drainage to a local closed storm water drainage**	Eg. concrete, asphalt, roof surfaces with runoff led to a closed facility for retention and purification of the water. This also applies to underground solutions combined with irrigation of trees. The whole area counts assuming drainage magazine is according to municipal requirements for discharges to off. sewer system (ie it holds about 20	0	0
1		**Surfaces with vegetation associated with soil or bedrock**	Vegetation growing in soil and has contact with the soil below. Beneficial for the development of flora and fauna and storm water can be pulled down to ground water. The point also applies to natural rock outcrops and cliffs.	23580	0,608092426
0,8		**Surfaces with vegetation, not associated with soil > 80 cm**	Vegetation growing in soil on minnimum 80 cm depth, but not in contact with the earth / ground below, eg. on top of a garage or roof. The depth is great enough that larger trees can grow.	0	0
0,6		**Surfaces with vegetation, not associated with soil 40 - 80 cm**	As above, but with 40-80 cm ear so that hedges, large bushes and small or medium trees can grow.	0	0
0,4		**Surfaces with vegetation, not associated with soil 20 - 40 cm**	As above, but with 20-40 cm earth for that perennials and small bushes can grow.	0	0
0,2		**Surfaces with vegetation, not associated with soil 5 -20 cm**	As above, but with 5 - 20 cm earth that is enough for grasses, herbaceous plants and other ground cover can grow.	0	0
		2. Additional qualities	Blue and Green additional qualities that give extra points. The same area can therefore be counted a number of times below		
		Blue additional qualities			
0,3		**Natural edges to water surfaces**	Water surfaces that are counted above, can also be counted in this category there is access for flora / fauna at ground level to a natural substrate and edge (riparian) zone. Eg: stream, canal and pond with green edges The area to be considered is the width of the water surface.	660	0,00510612
0,3		**Rain bed or equivalent**	Vegetation area that serves as rain bed or similar planted infiltration that collects, diffuses and infiltrates rainwater into the soil / ground. This does not apply to permanent water surfaces and diffusion basin counted in blue surfaces above.	32656	0,252644609

			Green additional qualities, Points below (trees) should be filled in as a number	Number	
1		**Existing large trees > 10 m**	Existing large trees; over 10 m. factor is 25 m2/tree .	0	0
0,8		**Existing trees that can be expected to grow to over > 10 m**	Existing trees that can be over 10 m tall. Forest trees, hardwood deciduous trees and park trees, eg, elm, ash, birch, oak, linden, maple, chestnut, pine and many more. It is expected that the tree should have enough soil to grow (min 100 cm). Factor: 25 m2/tre (x 0.8).	49	0,025272713
0,6		**Existing trees that can be expected to grow to be small to medium, 5 - 10 m**	Existing trees that are 5-10 m tall. Ornamental trees and fruit trees, e.g., apples cherry, magnolia, pear, locust and many more. Also applies to pruned trees. It is expected that the tree should have enough soil to grow (min 60 cm). Factor: 16 m2/tree (x 0.6).	43	0,010645486
0,7		**Newly planted trees that are expected to be > 10 m**	Trees that will be over 10 m high. Species: see the field listed above. It is expected that the tree will have enough soil to grow (min. 100 cm). Factor: 25 m2/tre (x 0,7).	5	0,002256492
0,5		**Newly planted trees that are expected to be 5 - 10 m**	Trees which will become 5-10 m high. Species: see the field above. It is expected that the tree will have enough soil to grow (min 60 cm). Factor: 16 m2/tre (x 0,5).	61	0,01258478
		Points below should be filled in as m2		**Area m2**	
0,6		**Native vegetaion**	Establishing or protection of surfaces with a large content of valuable plant species that are a part of the local, historical natural and cultural landscape.	0	0
0,4		**Hedges, bushes and multi-stemmed trees**	Hedges, bushes and multi-stemmed trees with a height over 3 m. Calculated for a maximal area corresponding to the drip zone of (crown of the tree) m2/tree.	0	0
0,4		**Green walls**	For climbing plants and other green walls, the factor is calculated for the wall area that can be expected to be covered over the course of 5 years (a maximum of 10 m height for climbing plants).	0	0
0,3		**Perinnials and other ground cover**	Does not apply to lawn grasses	2913	0,022536555
0,1		**Contiguous green areas over 75 m2**	Contiguous green area that is larger than 75 m2, as for example large grassy lawns, pllanted areas, or others.	38777	0,1
					1,195303917
		Points below are filled in with the number 0,05		**0,05**	
0,05		**Connection til existerende Blue-green structure.**	If the blue and / or green elements in the area can be connected to the existing structure outside the area in question. The connection should be obvious. For example, a stream opening, a link to the existing channel or water surface, drainage, the extension of an alley or a grove, merging of several courtyards with free movement between them. This provides a general increase of 0.05 in BGF.	0	0
		TOTAL BLUEGREEN FACTOR (BGF)			**1,195303917**

APPENDIX 10 ORIGINAL STRUCTURAL DIVERSITY TOOL

Dimension	Category	Element	Value
Biotic features	Trees/forest aspects	Tree species diversity (5 species/0.5 ha) Solitary trees big/old	
		Solitary trees big/old	
		Solitary trees small/young	
		Group of trees	
		Row of trees/tree-lined path	
		hedge (trimmed or untrimed)	
		shrub	
		Nature-like, dense wood area (trees, underbush)	
Normalized score			
	Ground vegetation	diverse spontaneous vegetation (herbs, tree, seedlings)	
		diverse water edge (wetlands plant)	
		grassed areas/lawn extensive (meadow area)	
		lawn intensive (open access)	
		flowerbed	
Normalized score			
Normalized dimension score			
Abiotic site conditions	Water elements	Water basin	
		Fountain	
		Natural or near-natural lake/pond	
		Flowing watercourse in the park	
		(visual) dominant water element in neighborhood	
Normalized score			
	Topography	attractive view	
		Hill/knoll	
		Slope	
		Artificial surface lowering er elevation (stairs)	
Normalized score			
Normalized dimension score			
Infrastructure	Active recreation	Distinct bicycle path	
		Designated sport or athletic fields (e.g., with goals for football)	
		Street or basketball court	
		Table tennis table	
		Large/diverse playground for kids ([5 elements)	
		dog park	
Normalized score			
	Relaxation/amenities	Sitting features: Bench, seat wall	
		Picnic table, shelter, pavilions	
		Historical, artistic, or educational landmark Animal compound/petting zoo Gastronomy	
		Drinking fountain	
		Public sanitation	
		Lighting (of main paths)	
Normalized score			
Normalized dimension score			

APPENDIX 11 STRUCTURAL DIVERSITY TOOL NATURAL GREEN SPACE SVARTDALEN

Dimension	Category	Element	Value
Biotic features	Trees/forest aspects	Tree species diversity (5 species/0.5 ha) Solitary trees big/old	1
		Solitary trees big/old	0
		Solitary trees small/young	1
		Group of trees	1
		Row of trees/tree-lined path	1
		hedge (trimmed or untrimed)	0
		shrub	1
		Nature-like, dense wood area (trees, underbush)	1
Normalized score			0,75
	Ground vegetation	diverse spontaneous vegetation (herbs, tree, seedlings)	1
		diverse water edge (wetlands plant)	1
		grassed areas/lawn extensive (meadow area)	1
		lawn intensive (open access)	0
		flowerbed	0
Normalized score			0,6
Normalized dimension score			0,692
Abiotic site conditions	Water elements	Water basin	0
		Fountain	0
		Natural or near-natural lake/pond	0
		Flowing watercourse in the park	1
		(visual) dominant water element in neighborhood	0
Normalized score			0,2
	Topography	attractive view	1
		Hill/knoll	1
		Slope	1
		Artificial surface lowering er elevation (stairs)	1
Normalized score			1
Normalized dimension score			0,556
Infrastructure	Active recreation	Distinct bicycle path	0
		Designated sport or athletic fields (e.g., with goals for football)	1
		Street or basketball court	0
		Table tennis table	0
		Large/diverse playground for kids ([5 elements)	0
		dog park	0
Normalized score			0,167
	Relaxation/amenities	Sitting features: Bench, seat wall	1
		Picnic table, shelter, pavilions	1
		Historical, artistic, or educational landmark Animal compound/petting zoo Gastronomy	1
		Drinking fountain	0
		Public sanitation	0
		Lighting (of main paths)	0
Normalized score			0,500
Normalized dimension score			0,333

APPENDIX 12 STRUCTURAL DIVERSITY TOOL BJERKEDALEN PARK

Dimension	Category	Element	Value
Biotic features	Trees/forest aspects	Tree species diversity (5 species/0.5 ha) Solitary trees big/old	1
		Solitary trees big/old	0
		Solitary trees small/young	1
		Group of trees	1
		Row of trees/tree-lined path	1
		hedge (trimmed or untrimed)	0
		shrub	1
		Nature-like, dense wood area (trees, underbush)	0
Normalized score			0,625
	Ground vegetation	diverse spontaneous vegetation (herbs, tree, seedlings)	0
		diverse water edge (wetlands plant)	1
		grassed areas/lawn extensive (meadow area)	0
		lawn intensive (open access)	1
		flowerbed	1
Normalized score			0,6
Normalized dimension score			0,615
Abiotic site conditions	Water elements	Water basin	0
		Fountain	0
		Natural or near-natural lake/pond	1
		Flowing watercourse in the park	1
		(visual) dominant water element in neighborhood	0
Normalized score			0,4
	Topography	attractive view	0
		Hill/knoll	0
		Slope	1
		Artificial surface lowering er elevation (stairs)	1
Normalized score			0,5
Normalized dimension score			0,444
Infrastructure	Active recreation	Distinct bicycle path	0
		Designated sport or athletic fields (e.g., with goals for football)	1
		Street or basketball court	1
		Table tennis table	0
		Large/diverse playground for kids ([5 elements)	0
		dog park	0
Normalized score			0,333
	Relaxation/amenities	Sitting features: Bench, seat wall	1
		Picnic table, shelter, pavilions	1
		Historical, artistic, or educational landmark Animal compound/petting zoo Gastronomy	1
		Drinking fountain	0
		Public sanitation	0
		Lighting (of main paths)	1
Normalized score			0,667
Normalized dimension score			0,5

APPENDIX 13 INTERVIEW GUIDE

Name/ Synonym: ***Date:*** ***Time:***

Weather condition: ***Gender:***

Do you live in this neighborhood?	Postal number		**How long have you lived here?**		
How many times a week are you visiting this park?					
Summer	daily	4-6 times	2-3 times	once	less
Winter	daily	4-6 times	2-3 times	once	less
Spring/autumn	daily	4-6 times	2-3 times	once	less
What days are you visiting the park	weekdays	weekend	random	all	
How long are planning to stay this visit?					

What kind of activities are you doing in this park and why?

What is important for you at this park and why especially this?

What do you get out of visiting this park?

Outdoor recreation/ stress reduction/ mental health/ contact with nature/ peacefulness/ health

What don't you like about this park?

Have you been in a scary situation in this park before?

A moment/event/story you associate with this park?

People you have been with/ the event itself/ the fitting landscape

Could you think of any benefits/services the area provides?

How does your ideal park look like?

Social surrounding/ biological features/ management issues

What is your favorite green area in Oslo and why?

Need to know a little about you to classify your answers…

Age					
Material status	Single	Living together	Married	Children (age)	
Level of education	Barneskole	Ungdomsskole	Videregående	University	
Background/ Ethnicity					
Income per year per household before taxes	0 - 200 000	200 - 400 000	400 - 600 000	600 - 800 000	>800 000

Is there anything you would like to say/comment?