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Urban forests in city development and planning

– A case study in Oulu, northern Finland

Tättortsnära skogar i stadsutveckling och
planering

– En fallstudie i Uleåborg, norra Finland

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Urban forests in city development and planning — A case study in Oulu, northern Finland

Tättortsnära skogar i stadsutveckling och planering — En fallstudie i Uleåborg, norra Finland

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Abstract

Urban forests in urban environments are under pressure in Finland. The urban expansion causes a loss of urban forests. Urban forests have been increasingly studied, and their properties of improving e.g. air quality, noise reduction and recreational benefits have become more and more valued. In the case of Finland, the urban forests are often existing forests, which have become enveloped by growing amount of urban development.

The necessity of having urban forests in an urban environment has recently been justified with the growing adaptation of the ecosystem services. Ecosystem services can be described as benefits gained for human beings from ecosystems in general, combined with a more economical assessment. In regards to urban forests the ecosystem services include matters such as climate management, storm water management and recreation. Urban forests have also been studied as a way to complement traditional forestry. This new approach to forestry is called urban forestry, and it has been coined as a way to go about the growing urbanization and the ever more urban forest amenities. In urban forestry urban forests can serve other functions, not only production. These alternative functions can be of those of recreation etc.

This thesis studies three cases in northern Finland, in the city of Oulu. These cases are residential development areas that are different in size, but they share similarities such as housing type and location in the peripheries. It is the aim of this study to observe how urban forest amenities are treated in a planning stage. The availability of forest amenities in northern Finland is predictably high, but the treatment of urban forests is a feature that has not got much attention. The urban forests are studied in this thesis with an analysis of both their ecosystem service, and their landscape quality. Results from this study show that increasing attention has been paid to urban forests in Oulu. However the true potentials of the urban forests are not made use of in these three case studies.

In the concluding discussion, points in relation to urban forests will be made based on the study, and certain aspects for improvement are described. The understanding of urban forests and their amenities, in the case of Oulu, are explored. Differences between the case studies will be discussed and the cohesion and the need for urban forests are discussed.

Table of contents

1.Introduction	1
1.1. Background	1
1.2. Aim	4
1.3. Research questions	4
1.4. Method	4
2.Literature review	6
2.1. Landscape and urban forests	6
2.2. Urban forestry	11
2.3. Ecosystem services	11
2.3.1. Ecosystem services of urban forests	14
3.Planning in Finland	18
3.1. Land use planning system in Finland	18
4.Land use planning in Oulu	20
4.1. The regional plan for Oulu	21
4.2. Comprehensive municipal plan of Oulu	24
4.2.1. The green and recreational area plan	25
4.3. The local detailed plans	26
5.Urban forests in Oulu	28
5.1. Urban forest maintenance	28
5.2. Ecosystem services provided by forests in Oulu	31
6.Case studies	33
6.1. Case Hiukkavaara	34
6.1.1. History of Hiukkavaara and current plans	35
6.1.2. Analysis of the plans	38
6.1.2.1. Urban forests in Hiukkavaara	38
6.1.2.2. Ecosystem services of urban forests in Hiukkavaara	42
6.2. Case Ritaharju	44
6.2.1. History of Ritaharju and current plans	45
6.2.2. Analysis of the plans	47
6.2.2.1. Urban forests in Ritaharju	47
6.2.2.2. Ecosystem services of urban forests in Ritaharju	49
6.3. Case Metsokangas	51
6.3.1. History of Metsokangas and current plans	52
6.3.2. Analysis of the plans	54
6.3.2.1. Urban forests in Metsokangas	54
6.3.2.2. Ecosystem services of urban forests in Metsokangas	56
6.4. Case study synthesis	58
7.Discussion	60
Bibliography	65

1. Introduction

1.1. Background

The forest has provided livelihood, shelter, religious places and recreation throughout history for human beings. The forest provided the pre-agricultural hunter-gatherers subsiding in northern Europe necessities for living: food by process of hunting, collecting e.g. berries and materials for building. In Finland due to population growth in the Late Stone age and early Bronze age the boreal forests began to be felled with the slash-and-burn method, which was used to create small agricultural fields. The edible plants found in forests were only available in short periods, and at times did not provide enough nourishment for growing populations. However the forest provided the necessary substances to grow the sown crops—and thus sustain the needs of the people (Taavitsainen et al. 1998, pp. 205-208).

In Finland as in elsewhere in Europe the process of deforestation was alike, but the northern environment meant that this process and agricultural development was somewhat slower, and in smaller scale. Main reasons, according to Williams (2000), for cutting down forests were to suit the needs of growing populations, agriculture and in some later cases religious motives (the forest was seen as dark and pagan in Christian mythology). Taavitsainen et al. (1998) discusses that around 700 AD the society in Finland changed to one that was more permanent; people started to live in villages (rather than spread out homesteads) and had permanent agricultural fields. This flux of permanent communities shaped the society by allowing trade, and by 300 AD the northern forests began to be treated as a commodity. The forest also provided furs and edibles to barter with other commodities such as jewellery. The slash-and-burn expansion lasted up to the 19th century in Finland and changed the landscape profoundly as agricultural fields took more space from forested areas. The method of slash-and-burn was by no means sustainable, and by 19th century the creation of temporary fields with this method was banned by legislation due to deforestation (Taavitsainen et al. 1998, p. 247).

Not all countries in Europe have vast coherent forests—due mainly to the fact that the countries had prominent early agricultural expanse and land grab for population growth and residence (Williams, 2000)—an expanse that was not seen in Finland at the same scale. In Finland the slower historical process in the development of forestry, and less beneficial soils for agriculture (Taavitsainen et al. 1998) caused lower population and lower deforestation. This has shaped rather large coherent forests especially in northern Finland. In 2008 up to 66% of Finnish land cover consisted of forest (Korhonen, et al. 2013).

The human population is now—more than ever—urban and centralized. As of now in Europe even up to 80% of the population is living in cities or other urban areas. This process of urbanization started mainly during the end of the 19th century with the introduction of industrialization (Antrop, 2004). In Finland the population growth had been steady up to the 19th century with population doubling at every turn of the century (Taavitsainen, et al. 1998, p. 246). With urbanization the cities became larger and the surrounding areas and fringes of the cities grew in size (Antrop, 2004, pp. 9-10). In urbanization during the 20th century the land uses of the growing areas were not anymore tied ecologically with the pre-existing land types (e.g. forest). The development areas were

connected to global influences and demands projected from non-local sources (Antrop, 2004, pp. 9-10). For example nowadays the growth of a certain business can cause population growth with a population influx, which in turn takes space from e.g. forests. The usage of forests for recreation came with the people moving in to urban areas. In Finland there has been long historical traditions related to everyman's rights (Niemelä, et al. 2010, p. 3231). These rights enable the people in Finland to go out in to even privately owned forests for recreation and e.g. berry picking. Thus the access to forests in Finland is seen more as a right than a privilege.

The industrialization of the 19th century shaped the way the Finnish forests were treated. Efficient and growingly motorized forestry had a more profound impact on larger forest areas. In the late 19th century a more managed type of forestry was created. In the northern reaches of the Baltic sea—in the boreal forests—the mainstay of forestry in the 19th century was to shape the wild *natural* forests in to a highly productive forest that would yield the highest income, while at the same time replacing "old and dying" trees with more "healthy" trees (Östlund, et al. 1997, p. 1199). The actions of industrialized forestry changed the Finnish forests drastically, as swamps were dried out and fallows reforested to answer the needs of wood production (Korhonen, et al. 2013). As pointed out by Konijnendijk (2000); one of the current key benefits of forests is—and has been—forestry in its many forms. Rather recently there has been a shift in values in traditional forestry (due to urbanization as well), as it moves from a purely economic perspective towards more a more participatory point of view (Konijnendijk, 2003). Here the forest is seen as a matter in which many parties have interests in and should mediate, not only foresters and their will to maximize timber production. This shift of paradigm has been initiated by the urban population, which creates an interesting contradiction of values between rural and urban dwellers (Konijnendijk, 2003, p. 174). Konijnendijk (2003) tells that this contradiction is something that influences land use planning as well. People wish to preserve forests, even though their actions of living in urban fringes may cause loss of these actual forest areas.

The process of urbanization has had strong effects on forests in Finland, as space for housing and industry has been often taken from forests (Tyrväinen, 2001, p. 75). This sometimes uncontrolled growth of urbanity is referred to as urban sprawl. This urban sprawl is the chaotic growth of urban fringes where usually low density housing developments take space from existing functions such as agriculture or forestry. Urban sprawl has been considered to be a product of low control, emphasis on automobiles, wish to grow in the boundaries, homogenous populations and lack of participation and co-operation between governments (Johnson, 2001, p. 721). How urban sprawl affects forests is that the continuous expansion of the city towards the peripheries (forests in the case of Oulu) creates fragmented forest areas within, and in the fringes of, the new development areas. These urban forests are considered to be (in Finland) green areas in the city structure that have forest vegetation, and their primary function has been recreation (Konijnendijk, 2003, p. 178).

Urban areas extend to the city peripheries and fringes due to population growth. The actual process is highly complex, and according to Antrop (2004) the development in urbanization creates fragmented spaces in city fringes and centres alike. Here land uses collide and conflicts among stakeholders arise. The urban forests often get put aside as cities not only grow outwards, but they also compress inwards with densification and compaction (Jim, 2004). Green spaces are often main targets for further infill densification

(Bolund & Hunhammar, 1999; Pauleit, et al. 2005). Careful city planning and land use planning are capable of developing the situation of land use of conflicts. However the tools or information at hand might not always be enough. The usefulness, quality, size and cohesion of urban forests then remain questionable as cities spread and grow.

The amount of forest lost under housing and industrial expansion is considerable as the Finnish National Resources Institute shows in its study (Korhonen, et al. 2013) that building and landscaping has caused the most loss of commercial forests and woodland since the 1970s in Finland. The forests that are left in the infrastructural network of cities often fall under municipal care and are not considered to be a part of the economical forestry-regulated forest. Korhonen et al. (2013, p. 327) recognizes that these urban forests and their share of the total Finnish forest land area are not available to study due to lack of material from municipalities. The preservation and protection of the existing forests against threats, such as urban sprawl, has been an important task of land use planners for a long period—but the efficiency of forest preservation strategies; such as the Green Belts (urban growth boundaries) strategy remains doubtful (Konijnendijk, 2010). Thus it can be said that urban forests still are under threat of further infill housing, industry and other constructions as cities grow to accept the influx of population.

There has been comprehensive study relating to the benefits of urban forests for the urban population. For modern society the benefits of forests are those that relate to health, well-being and economy (Konijnendijk, 2000). Studies show that urban forests can improve people's health, create a more enjoyable urban environment and offer a variety of recreational options. The forests can avail in creating a sense of community as well (Dwyer, et al. 1992). In current urban land use planning the most influential tool to improve the green areas of urbanities (including urban forests) could be the ecosystem service concept. This tool could enable the economic evaluation of ecological processes beneficial for humans. These valuations could be used in actual planning (Gómez-Baggethun, et al. 2010). According to Gómez-Baggethun et al. (2010) the actual monetization and appraisal of certain services over others is a cultural construct and needs to be criticized. This shows that for the urban forests to receive appreciation and improved status, the researched benefits need to be incorporated in to the land use planning strategy.

This thesis and it's subject was formed with discussions that the author had with Terttu Kurttila (senior consultant at Ramböll Finland) and university teacher Kari Nykänen (Oulu University, Oulu school of Architecture). They both expressed concerns relating to the loss of green space in urban environments due to urban growth and expansion. I then approached the question from the perspective of urban forests, as pointed out previously the Finnish land cover has copious amounts of forest, but to see how it is planned and treated I found an interesting subject—especially in the northern environment. Urban forests can be considered a contemporary subject as well, as Oulu is now also starting to use the ecosystem service concept (N.B. not only meant for urban forests) and recently had commissioned an investigation relating to the ecosystem services (City of Oulu, Urban and Environmental Services, 2014).

1.2. Aim

The aim of this thesis is to study urban forests and how they are treated in land use planning on the local plan level in Oulu. The purpose of this thesis is to study why the urban forests are planned often in Oulu with presumably low detail. Furthermore the aim is to provide a concise idea of the possibilities of urban forest amenities. The objective is to study urban forests and are they merely treated as generic green spaces destined for urban development, or are they given appropriate value in regards to e.g. ecosystem services concept. The goal is to study the challenges relating to urban sprawl. Observations will be made of how urban sprawl affects urban forests in Oulu—or are the effects minimal or negligible. It is presumable that the housing developments in Oulu do have a prominent effect on urban forests in the city, as development usually takes place in forested areas in the city outskirts (thus affecting large forests). The aim is to study the plans for the three housing development areas, and the purpose is to provide comparisons for them. Focus will be placed on the ecosystem services and how they are represented in the plans. Conclusions will be made from the plans and the applied literature research.

1.3. Research questions

- How could the urban forests remain as cohesive urban green areas, when they are under pressure due to urban development?
- What is the current understanding of urban forests, and how are the forests treated and improved in Oulu city development?
- Are there any differences in the three housing development areas (in relation to urban forests), and if so; how do the differences manifest?

1.4. Method

To learn from the process of creating this thesis work, the work will be divided in to three parts. Firstly the applicable literature relating to the study subject will be read and analyzed, and secondly the planning system concerning Finland will be studied. Thirdly the case study will take place, and the sites will be compared. The literature for the first part will be gathered from two main sources: Google Scholar database and the Web of Science database. Oulu will be described in the second section of this thesis. The history and current situation of the city will be introduced.

To gather and study information relating to the subject, I began with urban forestry. I had contacted Cecil Konijnendijk personally before and was aware of his research on urban forestry. With the help of his articles and studies I received plenty of keywords and viewpoints to begin with. Keywords for gathering the literature are as follows (in an order of importance):

- Urban forest
- Land use planning
- Ecosystem services
- Green space planning
- Urban sprawl
- Densification
- Deforestation
- Urban forestry

For the second part, information regarding the plans and strategies of the housing development sites was gathered from the city of Oulu. From the city I received help from landscape architect Johanna Jylhä who aided this work by providing information regarding the development areas. The data from Oulu city are represented as maps, graphs and text documents. These documents will be studied in depth, and presented in this thesis. The plans are analyzed and it is observed how the e.g. ecosystem services function in the urban forests on these sites. Furthermore conclusions will be drawn from the planning documents, to find out how the urban forests are treated in planning.

2. Literature review

2.1. Landscape and urban forests

What is a forest? Michael Williams (2000, p. 30) points out that most studies merely skip this question, and often delimitate two kinds of forest types that exist; the open forest and the closed forest. Whichever of these two the forest is, the fact still remains that the classification of forest is a cultural phenomena, and is riddled with various views from different stakeholders. Due to variance in the perception of what a forest is, there has been a large difference in calculating forest areas globally as well (Williams, 2000). Konijnendijk (2010, p. 244) mentions that the definition of forest could be that of a ecosystem with prominent tree cover. In this thesis the focus will be on boreal forests, as that is the forest type found in the northern hemisphere where Oulu and the study sites are located. The boreal forest has seen a drastic change due to the interaction and deforestation caused by humans and the development of e.g. forestry (Östlund, et al. 1997). This change has influenced also the perception of forests as arguably many perceive the commercial forest to be that of a *natural* forest. Therefore it is paramount that the classification of said forests be as transparent as possible, with clear distinctions between e.g. uses. Whatever the perception of forest is, it is important to note, that with even large scale deforestation the forest has a tremendous capacity to restore itself—that is if the human activity of e.g. agriculture or forestry is diminished or ceased (Williams, 2000, p. 30).

The terminology and classification of forests may perhaps be hard to grasp, but what about landscape? Landscape means a myriad of things for different people throughout different times. It is important to comprehend that the understanding of what landscape is also a key to realizing why planners plan it in a certain way. Olwig (2004) writes that humans understand the world through representations because they cannot comprehend everything they see. The focus on visual (maps and pictures) in landscape influences the planning of the urban spaces, because the environment has been shaped from highly variable biotopes (i.e. reality) to mere simple gridlines and plots on the map (i.e. representation). Understanding that landscape is more than just what meets the eye is critical. It can be said that the human landscape has been formed by the actions of humans for a very long time. It is then hard to delimitate the *natural* (often seen as e.g. forests) from a *cultural* (seen as built-up environment) landscape. The reference to *natural* and *cultural* landscapes should be then taken with a grain of salt.

In Finnish the terms scenery and landscape are synonymous and they create a perplexing situation where the actual landscape is sometimes mixed with the perceived, visual landscape. Rather recently in Finland the Centre for Economic Development, Transport and the Environment released a guidebook in relation to landscape and its assessment. In this release (The Centres for Economic Development, Transport and the Environment, 2013) there is a glossary of terminology, and the concept of landscape (*maisema*) and scenery (*maisemakuva*) is importantly enough divided. The terms are divided in this guidebook with all good intentions, but the usage of the word *landscape* still remains in use when describing visual aspects of the landscape i.e. scenery.

The European society has changed dramatically from the 19th century. The start of industrialization shaped the landscape profoundly. The human population is now more urban than ever (Skärbäck, 2007; Niemelä, et al. 2010). Urbanization does not only affect the cities, but it also shapes the processes in rural areas surrounding the urban core (Antrop, 2004). This polarization of the landscape has caused other parts of the landscape to become less populated, and in some cases even abandoned (Haase, et al. 2014; Antrop, 2004). The dichotomy between urban areas and the peripheries surrounding it, also affects land use planning in many ways. Urbanization has caused loss of green areas in cities due to infill densification and sprawl (Pauleit, et al. 2005). This loss of green areas, among other factors such as the need for automobiles, has shaped cities in that they suffer from noise (Skärbäck, 2007), poor air quality (Borrego, et al. 2006) and heat-island effects (Eliasson & Holmer, 1990). The urban forests then are a by-product of a long process of urbanization, population growth, urban growth and a change in forestry policy. The process of urbanization is one that still does not show signs of stopping (Antrop, 2004, p. 23). It can be asked then, that do the urban forests merely wait for the inevitable conquest of buildings, rather than serving as a part of the ecosystem to their full extent?

Human beings living in urban (and rural spaces) share a wish to live in a better environment. Many scientific papers have proven (Tratalos, et al. 2007; Bolund & Hunhammar, 1999; Bryant, 2006; Hörnsten & Fredman, 2000) that humans prefer a more *natural* or *green* environment, even in urban centres. Terms such as *natural* habitat, green parks and forest are often used in these papers. These spaces are referred to as *green* or *natural*, but their appearance, and preference by the people, is often that of a formal park or garden. What is noteworthy is that these papers may use the same terminology, but the meaning and values behind them can be quite different. Olwig (1993, p. 100) proceeds on this by describing how the *natural* is actually perceived by people to include archetypes of landscapes: "pastoral, agricultural and wild landscapes" The value laden in to the word *natural* then becomes important, as planners and citizens portray their own perceived values also in to the word *natural*. Olwig (1993) points out that the aesthetical qualities of landscape are often forgotten in planning, and more focus is given to scientific qualities. Thus the landscape that is perceived as *natural* by the planners (landscape that looks good to their eye), is the landscape that is also seen as more valuable. There remains a need for criticism when the value-laden word of *nature* or *natural* is mentioned.

Human actions in developing a better urban environment for people to live in can create paradoxical juxtapositions. For example the action of moving to the city outskirts to be in more contact with *nature* creates the effect of increased pollution, cut down trees and less amount of the actual perceived *nature* the people were intent to see. It must be noted that living in the periphery, although harmful for the vegetation on site, usually does have the benefit of being closer to more *natural* space. This action of spreading out towards the city outskirts is referred to as urban sprawl. Urban sprawl is described by Johnson (2001, p. 718) as follows: "low density development beyond the edge of service and employment, which separates where people live from where they shop, work, recreate and educate—thus requiring cars to move between zones". In Finland the urban sprawl has been studied by Yli-Pelkonen & Niemelä (2005) and Niemelä et al. (2010). The urban sprawl in Finland is a manifestation of the wish to live in detached houses. The houses are being built farther away from city centres to provide the space needed for these single-family houses (Niemelä, et al. 2010, p. 3226). Finnish cities are spread-out and cover a vast area with low density of population (Yli-Pelkonen & Niemelä, 2005, p. 1948).

Urban sprawl affects many aspects in an urban environment. It lowers not only the amount of clean air (Borrego, et al. 2006) but also the health of the people living in suburbs, as people travel more by automobile rather than bicycling or walking (Frumkin, 2002). Although it can be said that the health risks are still debatable as Frumkin (2002) shows in his paper: there is no correlation between health and urban sprawl, but rather in the way people behave and e.g. which mode of transport they choose. If there are no possibilities of using a bicycle to move around, it is also less likely that the user will choose this mode of transport. Here again, there is a juxtaposition—as people move farther away from urban centres; more ecologically harmful modes of transport are required to reach places of work or shopping.

To begin to understand the process that has shaped the Oulu region, and its urban forests—is to understand what the landscape is, and which processes have moulded it. Mitchell (2008) wrote his article to give axioms (based on Peirce Lewis' original axioms) for understanding the landscape that envelopes the human population. All human landscapes share social and political aspects (power relations, rules and boundaries), this of course includes urban forests. To understand the landscape of our current society and the urban forests in Oulu, one needs to be critical towards the legislation and economy that oversees the usage and protection of urban forests. Mitchell's axioms (2008) are written from a social justice perspective and are a strong critique against the current economy which may be blind to values other than economical values. This concern is shared by Roe (2012, p. 348) comments on how current political trends favour economic growth and see the landscape as something merely to be exploited for economic gain.

The axioms presented by Mitchell (2008) in his text will be used in this thesis to conduct an analysis of the plans regarding the three case studies. The actual axioms themselves are primarily meant to be used in reading the landscape that we can observe outside, but it is also possible to use the axioms to analyze the perceptions of landscape already in planning stages. To research landscape, it is also important to understand the documents that are used to shape it. Mitchell (2008, p. 47) describes the process of understanding the landscape well:

As a concretization of social relations, landscape properly understood provides means to analyze—to make visible—the social relations that go into its making ... to learn what it [landscape] says about the status of and possibility for a just world in the here and now. All this takes the work of not just of looking, but all those other scholarly tasks [archival research, critical reading of scholarly literature and so on]".

The first axiom (Mitchell, 2008, p. 34) is that the landscape is a produced product, wilfully created and it manifests our being—both good, and in bad. Mitchell (2008) shows that landscape is a product in a way, that it becomes a commodity. In our economic system the landscape needs to provide profit, or it can otherwise be forgotten. To understand what the first axiom means in relation to urban forests is rather straightforward. For the urban forests to continue existence and receive input in planning, is for the forests to provide monetary benefits. It is then no surprise that urban forestry and the researchers behind it tend to favour financial estimates when arguing for urban forests (Dwyer, et al. 1992; Tyrväinen, 2001). Other benefits that are proven by research relate to health (Lee & Maheswaran, 2010) and ecosystem services (Escobedo, et al. 2011; Bolund & Hunhammar, 1999). These values perhaps not directly valued as monetary still, have relations to the overall economic benefit of society and are tied in a way to the wish of economical gain.

Mitchell (2008, p. 35) goes on to describe his second axiom as follows: "Any landscape is (or was) *functional*. As produced spaces, landscapes have a role to play in social life" He describes how the landscape is functional in two distinct ways. Firstly the landscape is a value for exchange between parties. The value is the landscape itself, but the landscape also provides the method for this exchange as well. Secondly the landscape is functional in a way that the needs of the people are projected in to it—e.g. the urban sprawl in Oulu is a manifestation of the concept, of what is proper for a certain type or class of people (i.e. detached houses with green lawns). Firstly for urban forests the ideals of everyman's right ascertain that the urban forests can function as a democratic space within a divided city—a remarkable benefit in a ever more privatized world, and a value in itself. Mitchell (2008, p. 38) speaks of struggle within the landscape. What this means for urban forests, is that the forests are continually under pressure to be lost to the process of urban sprawl and densification. The people's wish and appreciation is projected in to the urban forests—and thus they either thrive, or disappear under buildings and roads. This process of preventing urban sprawl and densification is possibly the main function of urban forests.

Thirdly Mitchell (2008, p. 38) explores that the landscape that we live in is in no way local—a landscape makes no sense if it is only studied inside its own context, not taking in consideration the surroundings. The global ideals of the compact city also affect Finland (Tyrväinen, 2001, p. 75). In Oulu the growth of urban peripheries has been sprawling even though the plans themselves denote a "compact" design. Many global *trends* drive the planning agenda, and sometimes these can be harmful, if the local milieu and situation is not taken in consideration. Study and research shared among professionals (such as landscape architects) shape the way we look at landscape and the urban forest. Ideals of biodiversity vs. tidiness, or recreation vs. ecology, just to mention a few, form the basis of how the urban forests are created and treated. A Finnish study (Tyrväinen, et al. 2003) has shown that the preference of tidiness for local users of urban forest in Finland is in fact more important than the biodiversity of the urban forest—although the idea of a *natural* (i.e. high biodiversity) forest is still seen as desirable. There are many externalities that shape urban forests in an urban environment, and the fact that Finland has up to 66% (Korhonen, et al. 2013) forest as land cover also influences the way people see and treat the forest in the urban framework. People have a certain amount of respect and admiration towards forests in Finland (Tyrväinen, 2001, p. 88). This respect reflects in the planning procedures and decision making.

Fourth axiom (Mitchell, 2008, p. 41) incorporates history, and how this can be seen from the urban forest perspective, is how technology has developed and influenced the landscapes of forests in Finland. Manual labour has changed to more automated forestry and with it, also the values of the landscape have altered. Williams (2000) shows that throughout history, the clearing of forest has changed the landscape of Europe; along with northern Finland. The roots of the culture of the forest runs deep in religion, agriculture and economy (Williams, 2000). The urban forest is a new phenomenon and is a product of multiple benefactors that necessarily do not strive for the same goals. Not only is the forest important historically for Finland, but Mitchell (2008) mentions how the landscape functions as a memory bank as well, a place where humans gain identity. With this comes also the importance of the national identity of the Finns as people living in the north—in the forest. This cultural constructs plays a part in the ethos of planning and maintenance of urban forests.

As Mitchell (2008, p. 43) points out in his fifth axiom: "Landscape is power." Landscape is the manifestation of the power-relations that control our landscape. The city officials and board-room meetings determine what our landscape should look like—and who it is for. Thus the values that the decision makers apply express the environment that is built. The Oulu region in northern Finland is growing as more residents move in within the city limits. Oulu city accepted its neighbouring municipalities to join itself in the beginning of the year 2013. This conglomeration expanded the Oulu region rather strongly, and further increased the need for more housing. It is predicted that the population rate will grow from 200,000 (2003) to 250,000 by the year 2035. (City of Oulu, Martti Ronkainen Oy, RTJ Advising Oy, Sirqu Oy, 2005) All this adds up as pressure towards more housing, and Oulu has indeed accepted and built (in various stages at the time of writing) housing developments around the city. Along with the buildings built on these premises, comes the infrastructure needed to sustain the city-dwellers lifestyle. As Mitchell (2008) describes, the very landscape that is created shapes also the social behaviour and practices of the people living there. Building houses on the city outskirts does not simply manifest the culture of urban sprawl, but it also aids in producing it more. All of this takes its toll from the forests in the city limits.

Final sixth axiom that Mitchell (2008, p. 45) presents is the spatial form of social justice. He mentions (p. 46) how the landscape is the manifestation of social justice and injustice. The idea is that when you study landscape, you can observe and learn from it by seeing how the social relations and power structures affect and shape it. By studying the landscape; key questions can be raised as to why and how something came to be. This study requires materialist analysis and critical reading. By studying the urban forests critically, the reasoning behind design, planning and valuation of it can be observed and commented on in an useful way.

With all these axioms and concepts of nature combined one can study the planning agenda of Oulu with a critical eye. Presumably urban forests are planned in urban development, because they are recognized as being a useful and beautiful, along with the fact that legislation also demands that these forests are protected. The protection of the urban forest, although legislated, can be undermined by presenting arguing values that favour urban sprawl and densification instead. The need for an urban forest can always be argued to be unnecessary, as the knowledge of their benefits is often minimal (or purposely hidden to enable development). It is the hypothesis that the planning of urban forests doesn't rely on the proven facts of e.g. ecosystem services, but more on the perception and general idea of what an urban forest is and what it can serve. Urban forests could instead offer improved benefits (e.g. social justice and democracy), if these factors would be considered in the planning stages. The question can be then asked, that does the Oulu city planning agency recognize any, or only some of the benefits associated with urban forests and their presence in the urban environment?

2.2. Urban forestry

Modern forestry has been experiencing a change in methods by the fact that forestry isn't only tied to the rural outskirts anymore, and could be feasible in an urban environments as well. This new kind of forestry is known as urban forestry, and compared to the traditional timber production forestry, the urban forestry focuses more on ecological and social matters. Urban forestry does not only focus on timber production, but also focuses on other benefits gained from forest amenities, such as recreation. Urban forestry could be an approach in the future that could combine the benefits of urban forests with the necessities of forestry. This more holistic view of urban forests and urban forestry combined could enhance the benefits gained by human beings from forest amenities. One of the most notable researchers in the urban forestry studies is Cecil Konijnendijk. He has studied the background, organization and future of urban forests in numerous studies (Konijnendijk, 2000; Konijnendijk, 2003; Konijnendijk, 2010).

Rural forest areas are influenced by the urban areas. Concept of urban forestry could affect the more rural forest amenities (Konijnendijk, 2000). The values that the urban dwellers have affect rural outskirts, and phenomena such as urban sprawl influences forests and urban forests prominently. Urban forestry can have a large impact on how the urban forest amenities are treated, as economical benefits from urban forests themselves can be substantial. To gain and profit from urban forests with urban forestry methods, one would need to change the polarization of seeing forestry merely for timber production. The influence of the social and ecological parameters have to be known already in planning stages to enable efficient use of the urban forests. The implementation of urban forestry in cities requires conflict management, participation and collaboration among professionals (Konijnendijk, 2003, p. 183).

Different perceptions of urban forests affect the premises of urban forestry as well. To perceive the urban forest as everything green in city (Konijnendijk, 2000, p. 91) can also affect how the urban forestry is seen and actualized. In this thesis the urban forests are delimited to include areas with higher vegetation such as trees and bushes. This perception influences urban forestry in a way, that it might not be tied to social matters and places more emphasis on timber production and e.g. recreation. The definitions of urban forests are presented in great detail by Konijnendijk in his study (2000, pp. 92, table 1.). It is obvious that there are differences worldwide in the definition of urban forests, but the differences might be related to the actual perception of *nature* and *culture*—and the dynamics between them.

2.3. Ecosystem services

According to Gómez-Baggethun et al. (2010, p. 1209) The development of the ecosystem services began in the need for establishing a better understanding of protecting the world's biodiversity. The researchers studied the subject extensively during the 1990s, but the ecosystem services, as a field of study, showed more interest after the change of millennia. The idea at first perhaps may have been that of raising awareness, but the situation developed more towards trying to achieve, and calculate economic benefit

with the help of the ecosystem services (Gómez-Baggethun, et al. 2010, p. 1209). This development is not all negative, as it gives planners tools to provide factual information that decision makers sorely need. The question then lies not on the actual monetization of the ecosystem services, but more on who creates and controls the values presented in the ecosystem services—and with what motives, and proof, have these exact values been chosen. Even though the monetary price can be set for certain ecosystem services easier (provisional and regulating services vs. cultural services) the valuation still relies on cultural perceptions. Gómez-Baggethun et al. (2010, p. 1215) shows, the economic values that the ecosystem services receive, are merely a cultural construct and require critical observation. The critical valuation of the services in relation to northern requirements could be a future subject of study, and could benefit also other cities in the northern hemisphere.

Ecosystem services are benefits that humans receive from various ecosystem functions (Bolund & Hunhammar, 1999, p. 295). These ecosystem functions are in many cases referred to with different terms (Groot, et al. 2002, p. 394). Ecosystem functions occur without the presence of the human population, and when these functions benefit the human population, they can be referred to as ecosystem services (Escobedo, et al. 2011, p. 2079). Ecosystem functions include, according to Groot et al. (2002): the regulative, habitat, production and information functions. The functions are described by Groot et al. (2002, p. 395) as follows: regulation functions maintain the ecosystem health and include benefits such as water, air and soil. Habitat functions give the animals and plants the chance for reproduction and gives them shelter, thus providing genetic variety and protection of the species. Production functions include the living biomass created by e.g. photosynthesis. This function provides food and materials for the human population. Information functions consist of health, recreation and aesthetics.

Ecosystem functions which are portrayed by Groot et al. (2002) have some overlap with the functions that the Millennium Ecosystem Assessment describe as being services instead. The rather new field of study concerning ecosystem services and the different viewpoints of the researchers are indeed confusing at times. The ecosystem services approach has cleared confusion in relation to function vs. service and is now considered the more dominant concept. The very definition of ecosystem services, as said by Escobedo et al. (2011), should depend on the goals and purposes of the research. This openness of the definition then requires transparency in setting goals, and describing needs and methods. In this thesis I will use the definition of ecosystem services as provided by the Millennium Assessment (MEA, 2005).

In these regards also the perception of how the human population is a part of nature can influence the planning and analysis of and with ecosystem services. If the human population is seen more dynamic in relation to nature, then cities can be seen, as described by Bolund & Hunhammar (1999, p. 294), more as a part of the ecosystem. These values are underlying and they form the approach, and the base of values, upon which each assessment of ecosystem functions and services are based on. The attitudes towards the gains and benefits (provided by ecosystem functions and services) received from urban forests then rely on the knowledge, conceptions, lack of information and misinformation that the decision-makers and planners possess.

For an urban environment the ecosystem services provide many benefits. These benefits have now been rather recently been studied more with the growing popularity of the ecosystem services. The basis for proving the advantages of ecosystem services are either social or economic. In the case of the Millennium Ecosystem Assessment (MEA, 2005) the ecosystem services are divided in to three main categories (shown in figure

1., created and simplified by the author). These categories (MEA, 2005, p. 15) are the provisioning, regulating and cultural services. Provisioning services give the human population through the means of food, fresh water, fuel and wood the services that relate to a good life with acceptable livelihoods and a sense of security. Regulating services affect the human population's (through the means of climate regulation, flood regulation, water regulation etc.) health, shelter and safety among others. Cultural services are aesthetical, spiritual, educational and recreational—these offer chances for social interaction, health and the means to achieve a good life.

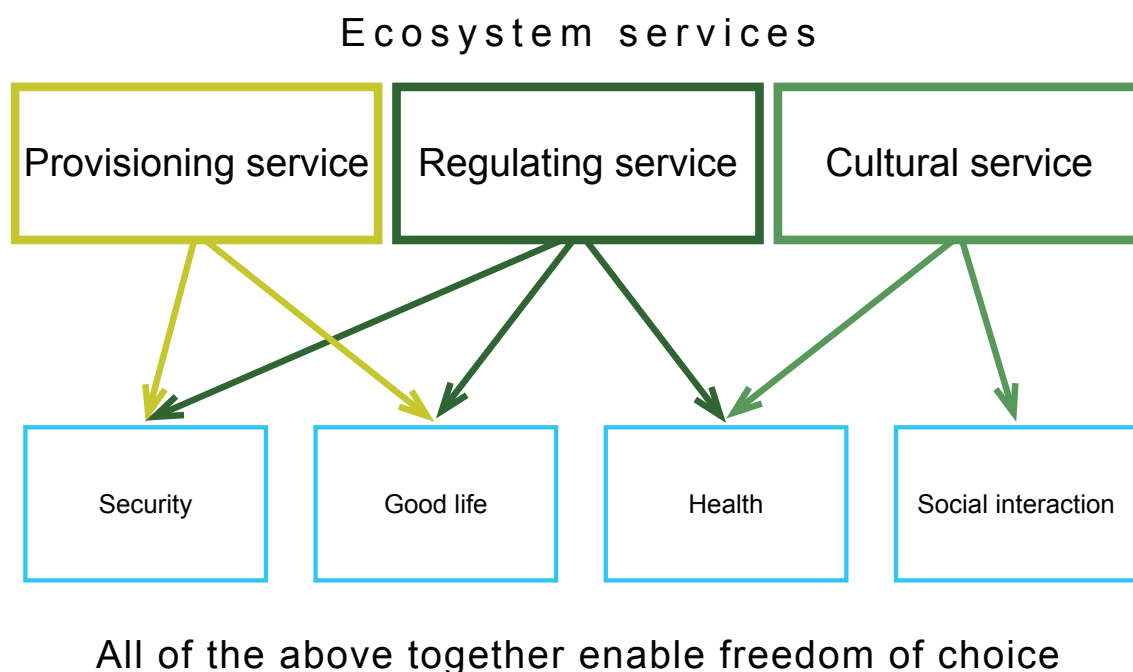


Figure 1. The ecosystem services as described by the Millennium Ecosystem Assessment (MEA, 2005).

Due to the economical point of departure in valuating ecosystem services, there has been more research of ecosystem services, and their economical values (Groot, et al. 2002; Gómez-Baggethun, et al. 2010; Niemelä, et al. 2010). The services as shown in figure 1. should not be considered to be in a authoritative order, but rather they are equally important. This important remark is also made by Groot et al. (2002, p. 395) in regards to ecosystem functions, as he points out that there is no order of rank in between functions i.e. services. Ecosystem services can be of local or global scale. In the case of air pollution (the service of carbon dioxide sequestration) the forest that captures the CO₂ from air can be quite far away and still the service is fulfilled. In other cases the service has to be close by for the service to be achieved, this could be for example reducing noise (Bolund & Hunhammar, 1999, p. 295).

Ecosystem services come with a price. The price or cost is referred to as ecosystem disservices (Escobedo, et al. 2011; Lyytimäki, et al. 2008). The costs for urban forests, are that even well-functioning carbon dioxide sequestering forests can be a source of nuisance for people living close by. Trees can block views, litter, provide too much shade or spread

allergens. Trees may use more water and cause drought in certain areas (Escobedo, et al. 2011, p. 2081). The maintenance of tree stands requires often noisy work as well and may be a source of dissatisfaction. Lyytimäki et al. (2008) mentions in his work that the loss of biodiversity has unknown effects on the human population in urban environments. Lyytimäki et al. (2008) points out the importance of recognizing the disservices caused by ecosystem services as critical in the planning process. In general the balance of finding both the positive and negative aspects of the urban ecosystem services is the key for efficient use of the ecosystem services as a way to present, promote and conserve the green in our urban environment. Urban forests have multiple disservices or costs related to them, and these need to be taken in account when planning them.

2.3.1. Ecosystem services of urban forests

To understand the ecosystem services provided by urban forests, one must first define what the urban forest is. In this study the concept of urban forest is based on the Finnish classification as shown by Konijnendijk (2003, p. 178), and that it includes forested areas, and not e.g. lawns and street trees. Some studies classify all green vegetation (bushes, lawns etc.) found in the city as being part of the urban forests (Escobedo, et al. 2011, p. 2078). All of these studies however find that the urban forest is an important factor in improving liveability and pleasantness of the urban living environment. The ecosystem services received from urban forests are delimited by research questions and focus. Some studies such as Niemelä et al. (2010) focus more on ecosystem services of the green areas in the urbanity in general, rather than emphasising urban forests.

Ecosystem services of urban forests

Provisioning service	Production of wood and other biomass				
	Wildlife habitats				
Regulating service	Availability of surface waters	Improvement of drinking water quality	Removal of CO ₂		
	Shade provided by vegetation	The reduction of the effects of wind	Decreased water run-off	Lower amount of pollutants in air	
Cultural service	Aesthetical viewing pleasure				
	Outdoor spaces for recreation etc.				

Figure 2. The ecosystem services of urban forests (Escobedo, et al. 2011).

Urban forests provide ecosystem services that can be categorized in the three main compartments. In figure 2. you can see the main benefits gained from these three services. It is worth noting that not all of the ecosystem functions of each service provided by the urban forest is present in the classification done by Escobedo et al. (2011). One major function that is missing from the list is e.g. the lowering of noise pollution. In the case of Finland such provisioning services as berry and mushroom picking are missing as well.

For urban forests the provisioning services can be those that provide monetary benefits such as urban forestry and timber production (i.e. biomass). More social benefits gained from provisional services include different habitats for animals and humans. These habitats are according to Escobedo et al. (2011) the already existing forests that are then fragmented by the built-up environment. The recreational spaces are spaces in which humans can find places and opportunities for meditative and active recreation. The urban forests that provide human recreation could have low levels of noise to prevent stress (Skärbäck, 2007), and could be even helpful for patients in hospitals, enabling them to recuperate faster (Dwyer, et al. 1992, p. 230). The importance of recreation in the planning of urban forests is evident as it is stressed already by the Finnish Ministry of Environment (The Ministry of Environment, 1999). It is perceived that the outgoing forest person uses the forest actively for his or her recreation, but indeed the urban lifestyle might be just the opposite. The urban forests might sometimes be seen more as a nuisance than a benefit, causing aesthetical, safety and economical issues (Lyytimäki, et al. 2008).

Regulating ecosystem services provide the most benefits of all within this classification of services. The urban forests can provide space for surface waters, that certain types of fauna and flora require to sustain themselves. These surface waters can also help in retaining water and reducing the run-off. The fact is that urban forests are quite efficient in preventing urban storm water run-off (Dwyer, et al. 1992, p. 229). The trees and other vegetation of the urban forest catch a substantial amount of carbon dioxide in the urban environment (Bolund & Hunhammar, 1999; Escobedo, et al. 2011; Borrego, et al. 2006). Certain studies show (Bolund & Hunhammar, 1999, p. 295) that specific trees, such as coniferous trees, can provide better carbon dioxide sequestration than others. Bolund & Hunhammar (1999, p. 295) do note nonetheless that the best solution for urban environments would be to have mixed forests, with coniferous trees mixed with deciduous trees.

Air pollutants such as carbon monoxide, nitrogen dioxide and ozone can be lowered in quantity and minimized with urban forests (Nowak & Dwyer, 2007). The amount of air pollutants that can be lowered with vegetation is dependent on the structure and location (i.e. fragmented forests vs. centralized forests) of the actual vegetation (Bolund & Hunhammar, 1999, p. 296). To observe the effectiveness of the urban forest in providing these ecosystem services then becomes also a study of what the spatial form of the urban forests is. The forests in the urban milieu do not only provide quantifiable benefits, but they also provide shade and protection against the heat that is present in urban centres (Eliasson & Holmer, 1990). The shade provided by the trees is an important factor to be considered in temperate environments, but can also be of use in the boreal north, as summers can be quite hot—as in the case of Oulu. Tyrväinen (2001, p. 87) mentions in his text that although beneficial, the shade also has negative aspects: People living close to large forest stands often complain of too much shading and litter.

Cultural services are services that can be considered somewhat difficult to quantify, as aesthetical preference is subjective. De Groot et al. (2002) defines aesthetical pleasure as enjoying scenery. This personal activity of enjoyment is an important part of urban forests as well, as the beautifulness of a landscape can have inherent effects on the appreciation of it (Olwig, 1993). Recreation is highly valuable in an urban setting—as space for it is often limited. Recreation in urban forests is a matter that has studied by Hörnsten & Fredman (2000), and they discovered that the majority of the population in Sweden would prefer to have the recreational forests within a walking distance to their home. This statistic can be applied to Finland, as the countries share similar urban and rural structure.

Ecosystem services provide the planners ways of quantifying and categorizing benefits of vegetation in an urban environment. With the benefits mentioned above, one has to be critical, because not all of them stand equal when a site is considered locally. The prevalence of certain services over others is evident, as the goal of trying to provide all of the services in one place is optimistic and unrealistic. Escobedo (2011, p. 2081) mentions that it might be hard for the decision makers to see the benefits that the urban forest provides on a social level (recreation, scenery enjoyment etc.) if focus is only given to their pollution mitigation quality.

The disservices that the urban forests have are often related to the perception of the users. Lyytimäki et al. (2008, p. 166) lists a comprehensive array of disservices related to the ecosystem disservices. Some may see the urban forests as areas unsafe for recreation or e.g. walking. The forests can have costs relating to wildlife spreading in to cities as sheltering environments are present for them to use. These animals are also often feared to spread diseases. There are also economical issues that are present: the use of

the green area for vegetation rather than infill densification, or that the maintenance of the actual forest is rather costly. All of these disservices are to be taken in consideration when planning. The local environment and local situation also requires for the planners to take note of disservices of urban forests that may be present at a certain site.

3. Planning in Finland

3.1. Land use planning system in Finland

In Finland the land use planning is controlled by the Land Use and Building Act (The Ministry of Environment, 1999). In the first chapter the general objective of the Building Act is laid out as follows: “The objective of this Act is to ensure that the use of land and water areas and building activities on them create preconditions for a favourable living environment and promote ecologically, economically, socially and culturally sustainable development.”

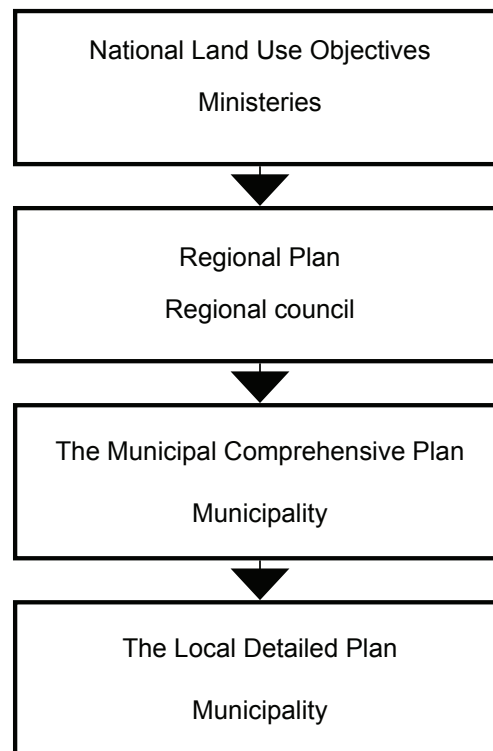


Figure 3. The structure of the Finnish Land Use and Building Act (The Ministry of Environment, 1999).

The structure of the Finnish planning system (see figure 3.) is rather different in comparison with other countries such as Sweden. The Finnish system has more control from a national level. According to the Finnish Land Use and Building Act; the national land use objectives (The Ministry of Environment, 1999, p. 6) dictate matters such as general land use and power network. The national land use objectives also include aspects that have influence on the nation's cultural matters, natural heritage or cases that may impact ecological sustainability or economy on larger scale. For urban areas the main influence caused by the national land use objectives can be the location and size of e.g. power lines and roads.

Regional planning (The Ministry of Environment, 1999, p. 6) is in charge of the regional plans (regional scheme, regional plan and regional development programme), which are made according to national land use objectives for regional development. The regional plans are co-ordinated with a minimum of two municipalities to ensure that the plans are co-operative and harmonious. The regional development and planning is done by the regional council which is a coalition of municipalities in the region. In the regional plans the protection and ecological sustainability of the landscape (*natural* and *cultural*) is considered, along with ascertaining the possibilities for recreational activities. The regional plan serves as the base for the local master plan.

The Municipal Comprehensive Plan (The Ministry of Environment, 1999, p. 9) is meant to control the structure of the community—and the land use of a particular municipality. The Municipal Comprehensive Plan controls housing, traffic, public transport, healthy living environment, business, environmental hazards, protection of the built environment, landscape and natural values along with recreation. Municipalities can in co-operation with other municipalities also create a joint municipal master plan if there is need for one. In this thesis the local master plan is an important and influential guide to observe, as one is hopefully then able to understand the level and detail of planning related to the urban forests in cities such as Oulu.

The municipalities after drawing up the Municipal Comprehensive Plan, also present the local detailed plan (The Ministry of Environment, 1999, p. 12). The local detailed plan follows the regulations set in the regional plan and local master plan. The local detailed plan includes regulations that control the construction of buildings (location and volumes etc.), types of services and the protection of landscape.

In regards to urban forests, the Finnish Land Use and Building Act (1999, p. 17) includes also an additional chapter regarding national urban parks. These national urban parks are also mentioned by Konijnendijk (2010, p. 252) as these parks could benefit the urban environment in the future as well as they could serve an important part in ensuring that green areas are present in the urban environment. The function of the urban parks is to: “maintain the beauty of the cultural or natural landscape, historical characteristics or related values concerning the townscaping, social, recreational or other special values of an area in an urban environment.” (The Ministry of Environment, 1999, p. 17) National urban parks require ministries (Ministry of Environment in Finland) to accept the plan for the actual adaptation of the park, with usually the local administration filing a request for adaptation. Areas such as these national urban parks are, at the time of writing, found in seven places in Southern Finland (The Ministry of the Environment, 2014). Cities such as Turku and Porvoo have these national urban parks. Similar legislation is also in effect in Sweden (Lawrence, et al. 2013, p. 469). In Sweden, at the time of writing, the only national urban park is the national urban park of Stockholm (Konijnendijk, 2010). This method of providing cities with national urban parks might be a way in preserving and instilling a need for urban forests in an urban environment.

4. Land use planning in Oulu

The city of Oulu (called Uleåborg in Swedish) was founded in 1605 by the Swedish king Charles IX. The city is now the 5th largest in Finland, and has had a long culture of tar business starting from the middle-ages until the 20th century (Kujanpää, 2011). Today the city is the largest city (above the 63rd parallel north latitude) of the three Nordic countries Finland, Sweden and Norway (see figure 4.) Oulu has had a long history with varying industries, and currently the thriving business in the area is that of paper industry. The city of Oulu has also been considered a hub for information technology development, and the university of Oulu is a leading actor in many sectors of this development. Thriving companies and growing industries have attracted people to move to Oulu, and it has become the “capital” of the north.

The city is currently promoted as the Capital of Northern Scandinavia by the city of itself (City of Oulu, 2014). The Oulu sub-region (see figure 4.) has 250,000 residents and the city around 190,000 (City of Oulu, 2014). The population is predicted to grow in a steady pace (City of Oulu, 2014). The city of Oulu was chosen for the study due to my experience and history in relation to Oulu and city planning. I received my Bachelor's degree from the degree program in landscape planning from the Oulu University of Applied Sciences in 2012.

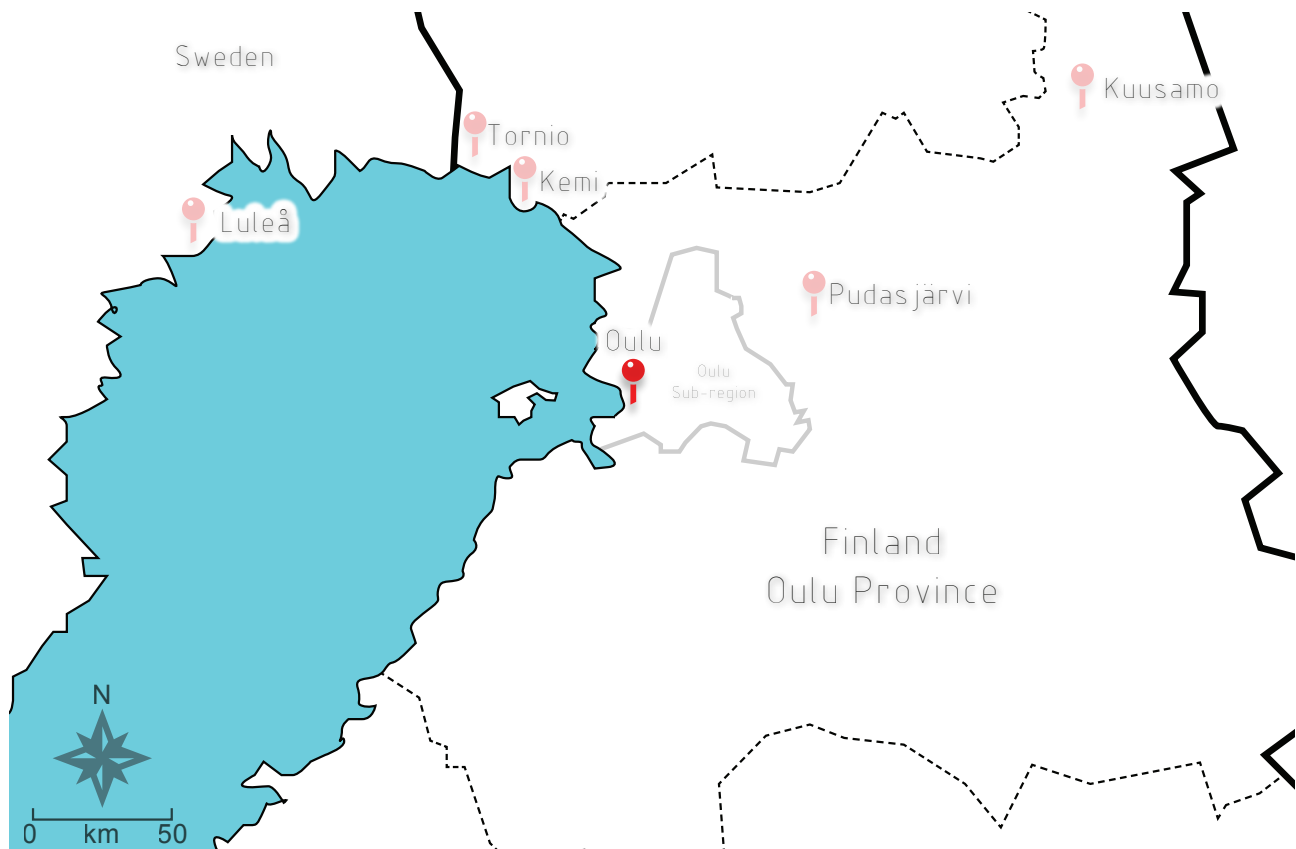


Figure 4. Northern Finland and the city of Oulu.

Three sites within Oulu city are described and studied in this thesis. These sites are three housing development sites around Oulu. Although these housing areas vary in size and form, the sites are identical to each other as large forest areas are being cleared to make room for the developments. The housing developments mainly have single family houses (detached houses) or row houses in varying sizes. All of these sites have a centre for services such as schools, shops and e.g. libraries. These sites will be studied in-depth in the case study section of this thesis.

4.1. The regional plan for Oulu

The regional development plan of the Oulu sub-region (see figure 4.) has been created by the municipalities of Hailuoto, Haukipudas, Kempele, Kiiminki, Muhos, Oulu and Oulunsalo in 2003 (The Regional Council of the Sub-Region of Oulu, 2003). This document is referred to as the regional plan (see figure 5.) and it sets the goals for the municipalities' development in the region. The plan for the sub-region is based on the regional plan for Northern Ostrobothnia. The sub-regional plan presents the proposed urban structure, infrastructure, protection areas and e.g. roads. The plan also includes the important aspects of landscape (cultural and natural) and important sites in regards to it. During the creation and development of the actual regional plan, many professionals share their concerns for the proposed development (The Regional Council of the Sub-Region of Oulu, 2003).

The regional plan controls the local plans made for the city of Oulu and for example the important connections and links between large green areas, referred to as green belts (The Regional Council of the Sub-Region of Oulu, 2003, p. 58). This regional plan has great input in what the forests in the city structure look like due to the fact that the goals that are set on a regional scale also affect the local plans and the form and structure of green areas; important landscape values are to be preserved and certain areas may have more functions relating to e.g. recreation. The regional plan mentions that urban greening is in need for more flexible use of the forests (The Regional Council of the Sub-Region of Oulu, 2003, p. 32). The meaning of this probably was to enhance the recreational usage of economical forests and vice versa, but is left open for interpretation and could be read also in a way that urban forests could be more multi-purpose in their function. This open readability of the guidance may be a reason why no determined effort has been made to enhance the functionality of urban forests in Oulu. The functionality of urban forests has been studied only by the VILMO-plan recently in 2014 (see chapter 3.3.1).

In the regional plan for Oulu, the development of future housing is recommended to take place in municipal centres and more local developments centres. These local area centres are located outside the immediate city core and the three sites presented in this thesis follow this premise well. It is recommended that these housing areas are built densely with detached houses. The idea is to build dense concentrations of detached houses in these local area centres. The concept of building dense is seen rather differently in the regional plan, than what is normally considered dense city structure. The plan does not rely on densification of former urban areas, but relies on the incorporation of urban sprawl towards the peripheries. This urban sprawl is done without setting limits to its advance, merely the direction for the growth is planned. The regional plan mentions that landscaping

in these housing areas should be of high quality and sustainability. The high quality of the environment within these areas should raise the recreational values of the sites. The importance of recreation and leisure activities in the region is clearly shown in the regional plan, as principles for their improvement are presented (The Regional Council of the Sub-Region of Oulu, 2003).



Figure 5. The comprehensive municipal plan—development of current and future built-up areas (orange areas) and important municipal greenway connections (green arrows), edited by the author based on the original (*The Regional Council of the Sub-Region of Oulu, 2003*).

In the plan for the Oulu region (see figure 5.) the chosen method for development is the so called *finger plan* where the city of Oulu grows towards its outer perimeter and the other municipalities and towns in the area, forming one day possibly a larger conglomeration. One of the benefits of this *finger plan* is said to be: "the distances to the recreational areas are short from residential areas" (The Regional Council of the Sub-Region of Oulu, 2003, p. 64) But with the numerous positive outcomes of the finger plan the regional council also recognizes that the plan might compromise the integrity of the green areas left in between fingers. The pressure for infill might cause more building on the green areas, thus eliminating the benefits gained from the green areas. The *finger plan* of the city of Oulu is not that of only a green *finger plan* (e.g. Copenhagen), but rather the development of the urban areas follows this method. The green *finger plan* of Oulu is mentioned in the following chapters.

The regional council also recognizes in its plan a number of landscape issues in the Oulu region: power lines, dumps and low-scale industry, gravel pits and highways. The highways are recognized as being major dividers of landscape. These issues are arguably often visual in their nature and relate to the fact that landscape is primarily seen as something visual rather than treating it in a holistic way.

4.2. Comprehensive municipal plan of Oulu

The Oulu comprehensive municipal plan (see figure 5.) was made in conjunction with the sub-regional plan and was finished in 2004. The comprehensive municipal plan presents the Oulu city region in more detail and has number of important additions in regards to green areas. The plan (City of Oulu, Urban and Environmental Services, 2004, p. 8) mentions that the city structure is supposed to be developed in a way that already built-up, low-intensity and functionally changing areas will be used for future development. This brownfield development goes hand in hand with new growth that takes place in the peripheries. It is specially remarked that Hiukkavaara will be a new growth region for the city. Other important growth of the city is mentioned to take place in Kuivasranta-Ritaharju area. Metsokangas is mentioned along with the nearby area of Kaakkuri as sites for future development (City of Oulu, Urban and Environmental Services, 2004, p. 12).

The plan remarks that there are no substantially important landscape values in any of three sites that are studied in this thesis. The visually beautiful river valley of Oulujoki (see figure 5.) received more attention in the plans. The Ritaharju area in the north has been marked to have only recreational or commercial forests and built-up areas. Hiukkavaara is recognized to have important aspects in recreation and thus the surrounding forest around the built-up areas is marked as recreational forests. In Metsokangas the built-up areas are marked to have recreational forests that are to be kept in a *natural* state (City of Oulu, Urban and Environmental Services, 2004).

4.2.1. The green and recreational area plan

The comprehensive municipal plan includes a green and recreational area plan (City of Oulu, Urban and Environmental Services, 2000). The green and recreational area plan presents the green area system for the city of Oulu. The system is the combination of all green areas within the city limits that include for example recreational areas, parks, agricultural and forest areas. All of the green areas combined form the encompassed green area network (City of Oulu, Urban and Environmental Services, 2004, pp. 26-28). The green area system is important to consider because it sets the goals for the green areas in the city, and thus actively shapes also the size and permanence of e.g. urban forests within and in the surroundings of urban residential, and other areas in urbanities. The local detailed plans for each site follow the principles set in green area system in regards to green area planning.

The municipal *finger plan* as shown in figure 5. has a weighty role in determining the green areas of the city of Oulu. The green wedges form a network of green areas to project themselves outwards from the core green areas of the centre of Oulu. The green area network of Oulu is a combination of the green spaces left in between the fingers of the *finger plan*. The centre of the green areas are focused on the city core and its immediate surroundings (City of Oulu, Urban and Environmental Services, 2000, pp. 19-20; City of Oulu, Urban and Environmental Services, 2004, p. 26). The core green area is complemented with directional wedges of green areas protruding outwards from the core and also three different green area zones. These areas and wedges are presented in figure 6. which is based on the green and recreational area plan of the comprehensive municipal plan.

The zoned green areas as presented (see figure 6.) in the plan are a method to connect the different residential areas in Oulu with a greenway connection—functioning as a green belt. These connections are meant to provide connectivity within and towards other residential areas in a recreational manner. The Oulu city's finger plan is much reminiscent of the Copenhagen finger plan of 1947 which in fact was also created to ensure the possibility of recreation and access to green areas in a growing urban environment of greater Copenhagen (Caspersen, et al. 2006).



Figure 6. The proximate green area network of the city of Oulu, edited by the author based on the original (City of Oulu, Urban and Environmental Services, 2014).

4.3. The local detailed plans

The local detailed plans concerning these three sites, which I study in this thesis, are preparatory local detailed plans (N.B. translated by the author from the word *kaavarunko*). The Finnish Land use and Building Act (The Ministry of Environment, 1999) does not have any mention of the preparatory local detailed plan (thus it is not present in figure 3.) but many municipalities choose to compile this sort of document to support land use planning and to point out objectives in the planning area. The preparatory plan is followed by the actual zoning and forming of the local detailed plan (City of Oulu, Urban and Environmental Services, 2008).

The preparatory plan includes matters such as traffic, size and location of housing, services, recreational network along with other technical aspects (City of Oulu, Urban and Environmental Services, 2008). The preparatory plans include site investigations which can be related to e.g. soil, economical and *natural* values. Often the preparatory local detailed plans recognize areas of high landscape value and which areas are to be protected against e.g. infill. The objectives presented in the preparatory plan are principles and often are further developed in the actual detailed plan. Although these objectives are considered principle in nature, they still have to be followed in the actual formation of the legislative detailed plan. As such these plans are adequate for analysis as they show what

features of the planned site the planning agency has shown to be of high importance—and which are not. In this case I will be focusing on the matters concerning green areas in the preparatory plans for these three sites. The development of the green areas is incorporated in the environmental plan within the preparatory plan.

There are however some shortcomings in analyzing the preparatory local detailed plans as they lack some more in-depth information regarding urban forests and their valuation. In the later phases of the planning (master plan), there are plans regarding the principle maintenance scheme as discussed in following chapter 5.1. To further analyze the green areas of the cases, i.e. studying local detailed plans and master plans would require a more prolonged effort and is not achievable in the context of this thesis. There could be room for intricate analysis of the form and goals of the local detailed plans in another study. I believe that would be a task where the goal would be less to contemplate on strategy and more on built form and space.

5. Urban forests in Oulu

5.1. Urban forest maintenance

The city of Oulu, as all of the Finnish municipalities, follows the national regulations in regards to the green area maintenance. The first iteration of the national regulations was published in 1992. Although, in relation to urban forests, the regulations were updated and the Urban forest guidebook was released in 2002 (Iloniemi & Kivilahti, 2012). The Finnish Association of Landscape Industries (Viherympäristöliitto ry VYL) started their work on new more in depth regulations in 2005, and the latest regulative guidebook was released in 2007. The city of Oulu uses the regulations set in the 2007 national guideline in the city's maintenance classification (Iloniemi & Kivilahti, 2012).



Figure 7. Pine tree urban forest (C1) in Oulu 2010, photo taken by the author.



Figure 8. Protective forest (C3) in Oulu 2010, photo taken by the author.

The Finnish classification of the urban forest distinguishes three main categories: the urban forest (C1, see figure 7.), Recreational forest (C2) and the protective forest (C3, see figure 8.). The differences between these classes can be that of pure aesthetics and as such can cause confusion. The urban forest is described in the Oulu city's documentation (City of Oulu, Urban and Environmental Services, 2011, p. 7) as an area with use in recreation, playing and passage. The urban forest may include footpaths, passageways and seating. The urban forest is situated near residential areas (see figure 9.). The urban forest has no economical return. The recreational forest is meant for trekking, hunting and other activities. These recreational forest are then often rather distant to the conurbation, and can have economical pursuit in regards to forestry. The protective forest lies in between a polluting source (e.g. noise and dust) and the actual residence. These can be forests in midst of roads and houses. In some cases protective forests are preserved between industrial areas and residential areas. These protective forests have no expected revenue in relation to forestry. As of 2011 the city of Oulu only has around 16% urban forests (all three classifications) of all forested areas, with commercial forests reaching up to 59% (City of Oulu, Urban and Environmental Services, 2011).

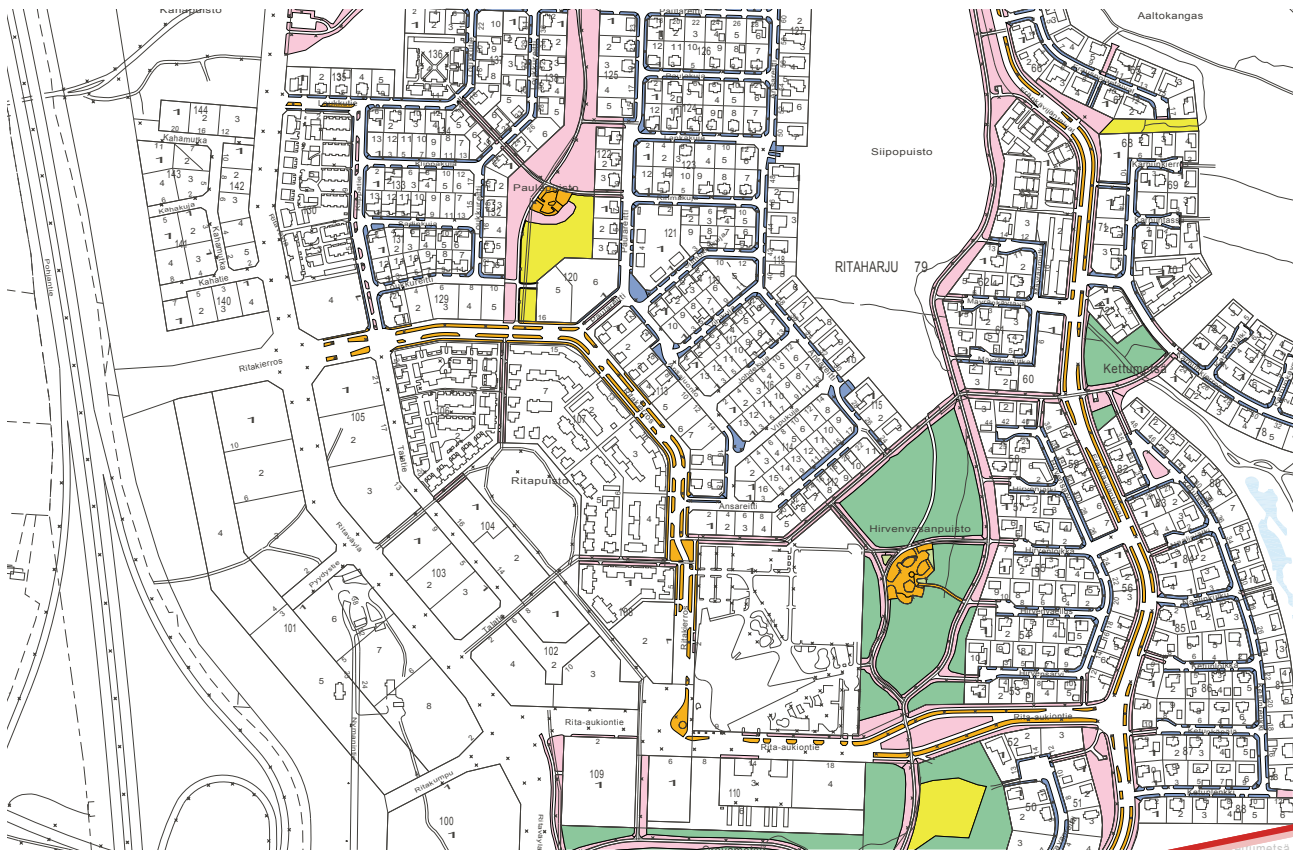


Figure 9. Extract from the Oulu classification of green area maintenance, urban forests (C1) here are marked with light green (City of Oulu, Urban and Environmental Services, 2015).

The dichotomy between urban forests and the commercial forests becomes evident in Oulu, as large parts of the urban forests are defined as not being a part of the urban green space maintenance scheme at all. This is due to the classification system only accepting urban forest stands near residences. It is unclear what distance there is between housing and urban forest areas. This causes large areas of forest to left outside

the area of interest, even if they clearly lie within urban reaches (e.g. between residential areas). Beside the fact that forest areas which are not classified as urban forests and are not maintained in the same capacity, can still serve larger green corridors in the city structure on a local master plan level. In Oulu these areas not marked as a part of the maintenance scheme are noted to be a part of the recreational forest areas in the region. These recreational forest areas often connect different residential areas (City of Oulu, Urban and Environmental Services, 2004) and are treated as commercial forests. These local recreational forests can have a lower commercial value of up to 30% than compared with more traditional commercial forests (Tyrväinen, 2001, pp. 85-86).

The classification of the maintenance group is then rather arbitrary and is most likely influenced by the volition of lowering maintenance costs. Furthermore the maintenance classification is based on spatial situation, as the descriptions of the different groups clearly show. This spatial relation can create confusing scenarios where e.g. the protective forests are identical to the urban forests (and possibly commercial forests as well) and the boundaries in between them become rather vacillating. The classification is also likely based on visual aesthetics and as such is inaccurate and inconsistent.

The influence of the maintenance scheme in land use planning cannot be downplayed. New developments can be designed with maintenance costs in mind, and the valuation and classification of these areas is then consequential to the amount and quality of the urban forests. The city's wish to lower maintenance costs creates a complex situation, where the area of urban forest may increase as it is considered to be the of the lowest cost (Iloniemi & Kivilahti, 2012) in comparison to more built-up green spaces. On the other hand the city of Oulu could leave the urban forests outside of the maintenance classification, and still have urban forests inside residential areas. This lower maintenance could create problems with shade and a feeling of fear in more dense (due to e.g. poor visibility) forests that have less upkeep (Tyrväinen, 2001, p. 87). It is all merely objective to perceive what part of the forest is urban and which is not.

5.2. Ecosystem services provided by forests in Oulu

With the formation of the new Oulu region in 2013 the city of Oulu and the Urban and Environmental Services required a new study of the ecosystems and natural biodiversity in the new Oulu sub-region (see figure 4.). The work began by studying both the landscape (City of Oulu, Urban and Environmental Services, 2013) and the biodiversity of the region (Kangas, et al. 2013). With the help of these two studies, that were also the preliminary research, the actual final report was done. The final report: Oulu's green area network and natural biodiversity: VILMO-plan (City of Oulu, Urban and Environmental Services, 2014), was completed in June 2014. The ecosystem services are to be applied for the first time in the local master plans, in the Oulu region, with this plan (City of Oulu, Urban and Environmental Services, 2014, p. 14).

The VILMO-plan divides the ecosystem services in to three main service branches. These branches are the provisional services, regulating services and cultural services. In the VILMO-plan the actual ecosystem services used to value and validate the services are the final ecosystem services rather than on intermediate ecosystem functions. The basis for

the usage of the ecosystem services lies in its easier commercial and monetary valuation (City of Oulu, Urban and Environmental Services, 2014, p. 15). The plan does not try to evaluate the benefits gained from cultural services (e.g. aesthetical values) because their valuation in economic terms is, according to the VILMO-plan, rather difficult.

The VILMO-plan achieves the local Oulu region valuation of the provisional services by dividing the services in to four different categories: forests, swamps and mires, agricultural fields and surface water (including groundwater). The biggest gains from forests are listed to be forestry and recreation (City of Oulu, Urban and Environmental Services, 2014, pp. 22-24). The regulating services in the Oulu region according to the VILMO-plan are the natural rotation of nutrients, erosion control, habitats, water cycle and climate control (City of Oulu, Urban and Environmental Services, 2014, p. 25). The ecosystem services in urban environments are mentioned to be usually smaller or fragmented in size than those that reside in the rural areas. The urban forests are mentioned to have especially have benefits regarding air quality and combating air pollution. The urban forests also help lowering noise, dust and traffic problems. Prevention of land erosion and water body protection are also deemed suitable for urban forests (City of Oulu, Urban and Environmental Services, 2014, p. 37).

6. Case studies

For the case study in this thesis there are three sites chosen that represent the current land use planning in the city of Oulu. All of these sites are still under construction in different stages during the writing of this thesis. The objective of the case study is to analyse how urban forests are considered in planning in these sites. The development sites are comparable as they are being built on forested land areas, and include mostly row houses and detached houses. The objective is then to study how the urban forests are handled in the plans for these building sites including how the spatial form of the urban forests also reflect ecosystem services and other benefits related to urban forests. Are these future development sites planned in a way that the benefits provided by the urban forests are actualized in the plans? Does the planning only recognize some of the benefits, and if so, which of these benefits have priority over others?

The chosen three sites (see figure 10.) are:

- Hiukkavaara
- Ritaharju
- Metsokangas

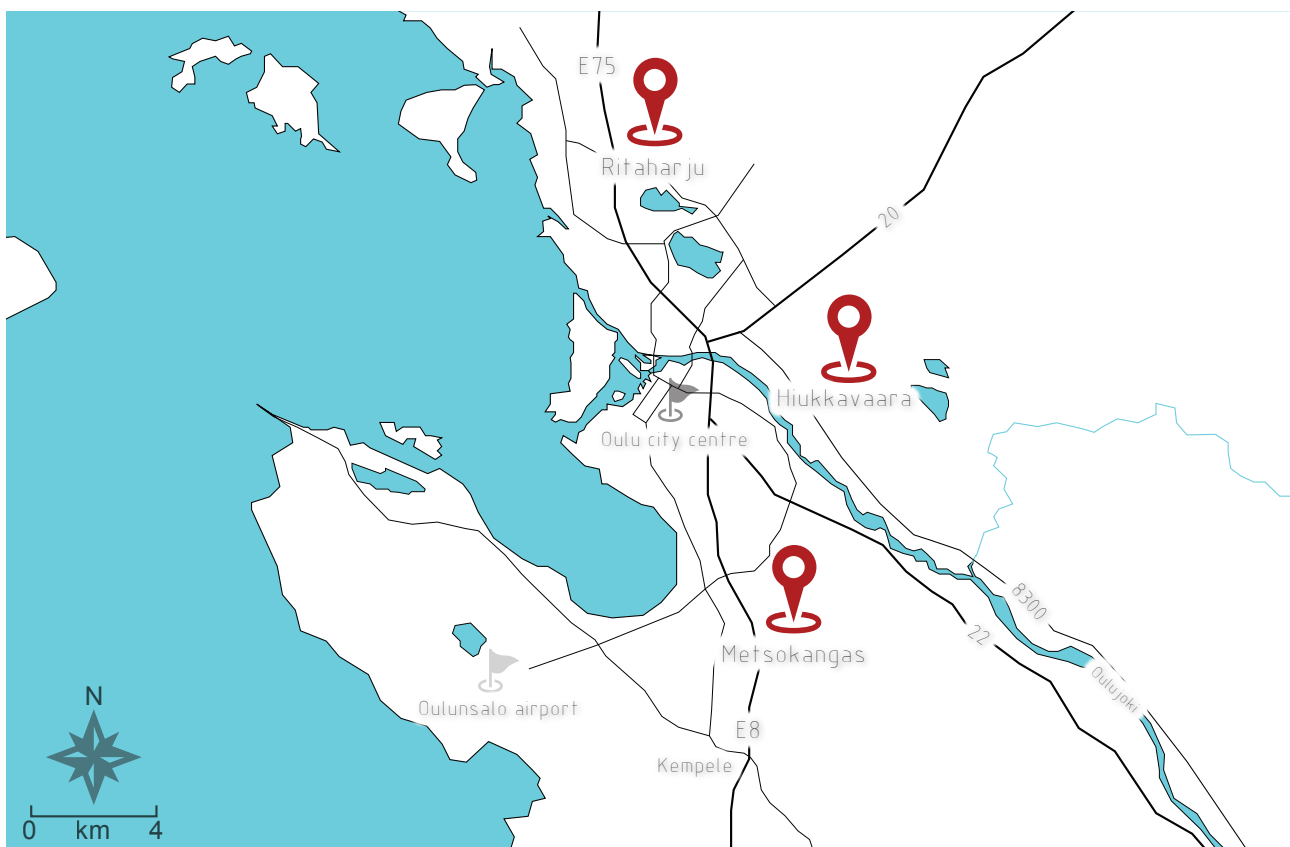


Figure 10. The three housing development sites in Oulu.

6.1. Case Hiukkavaara



Figure 11. The preparatory local detailed of Hiukkavaara in eastern Oulu, edited by the author, based on the original plan (City of Oulu, Urban and Environmental Services, 2008) along with proposed greenways (City of Oulu, Urban and Environmental Services, 2000).

6.1.1. History of Hiukkavaara and current plans

The residential development area of Hiukkavaara (see figure 11.) in the eastern part of Oulu is one of the more important axis of growth in the city, as said in the comprehensive municipal plan (City of Oulu, Urban and Environmental Services, 2004). The preparatory local detailed plan (see figure 11.) of Hiukkavaara estimates that the area will have around 13,000 new habitants by the year 2025. The construction of the new development began in 2012 with the area of Kivikkokangas and the whole area of Hiukkavaara is estimated to be built and finished by 2025 (City of Oulu, Urban and Environmental Services, 2008, p. 2).

The area of Hiukkavaara (see figure 12. and 13.) historically has been a training ground for the Finnish Defence Forces and will still partly continue to be used as such even with the new development (specified areas in the northern part of Hiukkavaara). The area has been used for sports and recreation, and the lakes of Niilesjärvi and Valkiasjärvi have been popular destinations for e.g. swimming for the entire population of Oulu. Due to changes in national defence strategies, parts of (1762 hectares in total) Hiukkavaara were sold to the city of Oulu for housing development in 1999 (City of Oulu, Urban and Environmental Services, 2008, p. 8). It is worth noting that the activity of the military in the area has been one of the reasons that such a coherent forest area has been left intact—in such proximity of the city limits. Based on a map calculation of an aerial photograph from 2004 (City of Oulu, Urban and Environmental Services, 2015), the forested area of the development area has been around 1280 hectares before the planned development.

The forest areas in Hiukkavaara have been commercial forests owned by the state (now partially owned by the municipality). The need for recreational forests is presented in the preparatory plans as a need of maintaining the forests in a way that they serve recreation (City of Oulu, Urban and Environmental Services, 2008, p. 28). There will still be large amounts of forestry in Hiukkavaara even after the development is completed in 2025, and this continuing existence of forestry might create conflicts with recreational use.

The preparatory plans for the development of Hiukkavaara are based on the municipal guidelines set in the Oulu comprehensive municipal plan of 2020. It is said that the area of Hiukkavaara will be a mixed housing residential area (City of Oulu, Urban and Environmental Services, 2008). The preparatory plan mentions that the forests are largely controlled by forestry, but the forested areas should have more recreational goals in the future (City of Oulu, Urban and Environmental Services, 2008, p. 9). It can be considered that this wish to emphasize the recreational use of the area of Hiukkavaara stems from the idea of having the greenway connection through Hiukkavaara towards north (City of Oulu, Urban and Environmental Services, 2000, p. 22)—on a regional scale as presented in figure 5., and in a local scale as shown in figure 11.

The green area plan (City of Oulu, Urban and Environmental Services, 2000) of Oulu does not present many *natural* areas of special or high quality in Hiukkavaara. Some ridgelines and small valleys have been depicted as important and they are to be taken in consideration when planning. Majority of the proposed recreational areas in the plan lie north of the current development in Hiukkavaara in the lake areas of Niilesjärvi and Valkiasjärvi, and are not shown to be in the area where the actual construction will take place. This lack of recreational areas within the residential area may be due to the fact that the development of Hiukkavaara was at a early stage in 2000 (i.e. when the green area

plan was made) and was left to be decided later on. The preparatory local detailed plan mentions (City of Oulu, Urban and Environmental Services, 2008, p. 10) that the area of Hiukkavaara will be developed in a way that the residents will have easy access to nearby recreational areas that are mainly forests.



Figure 12. Aerial photo of the Hiukkavaara area in 2004 before the planned development. Oulun kaupunki, ©Blom Oy (City of Oulu, Urban and Environmental Services, 2015).

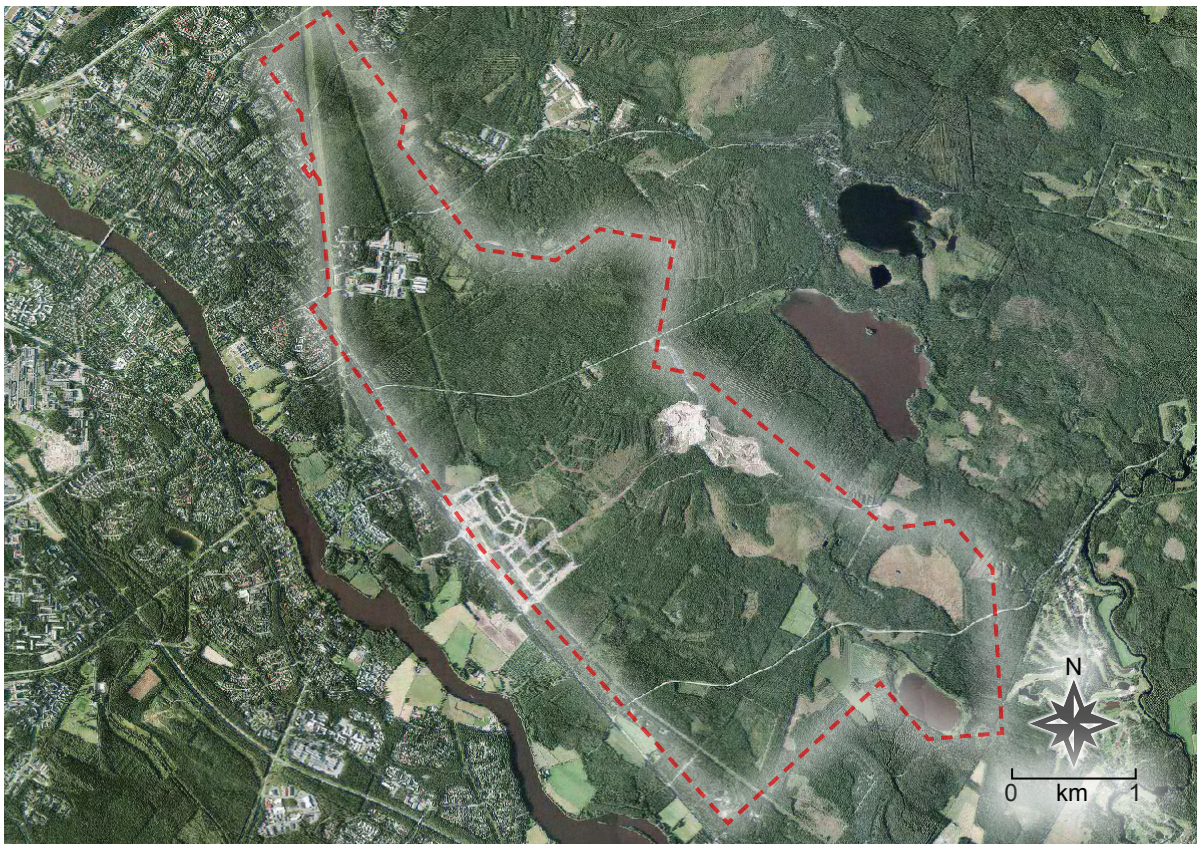


Figure 13. Aerial photo of the Hiukkavaara area in 2012 after initial construction has begun. Oulun kaupunki, ©Blom Oy (City of Oulu, Urban and Environmental Services, 2015).

6.1.2. Analysis of the plans

6.1.2.1. Urban forests in Hiukkavaara

The focus of the preparatory local detailed plan and its environmental plan is to protect the important *natural* values present in Hiukkavaara. Such values are presented by undrained bogs, lakes, hills and streams. These can be found within the planning area as presented in figure 12. and 13. The area is mentioned to be of an enclosed forest type and thus important areas that are present are the few openings in the forests (City of Oulu, Urban and Environmental Services, 2008, pp. 15-17). The forest is not mentioned often in the preparatory local detailed plan. The classifications of the important retained *natural* areas are based upon visual landscape beauty and the inapplicability for construction.

The existing forest types of Hiukkavaara have been classified into different groups by categorizing the future use and vegetation of the specific forest type. This classification is not related to the maintenance classification (e.g. C1, C2 etc.). The lack of coherence between the classifications in the plan and in city maintenance planning can create a confusing situation. Due to this the classifications presented in figure 11. follow the maintenance classifications (i.e. not the original categories in the preparatory plan) to ensure a more easier comparison between the three case studies.

The urban forests in Finland are mainly existing forests (that were present in the area before the development took place) adapted for more urban functions (Niemelä, et al. 2010). Observe figure 12. to see the existing forests. The forest in the area is mostly pine forest (*pinus sylvestris*) which has been cut down periodically for timber production. The mainstay of the urban forest in the area is classified, in the preparatory local detailed plan, to be class C1 or C2. Parts along the connecting road 8300 have C3 classified protective forest (see figure 11.). The devaluation of the forest in Hiukkavaara opens the possibilities for further expansion of housing to take place. This devaluation is related to the underestimation of the value that forest can provide (Niemelä, et al. 2010, p. 3227). This low value given to the forest also translates to less amount of urban forests available for the residents.

The development of Hiukkavaara has to take its space from existing forests. The development may take its assumptions on forests, but it is still considerably green in its outlined structure, as it is planned with the *finger plan* method. This method provides small corridors of green for almost all of the lots. The green areas and urban forests, due to the way they're planned, arguably seem to be resistant against further infill. The preservation of the more sensitive *natural* biotopes (i.e. bogs, hills) of the area, and including them in the fingers of the plan, ensures that these areas are protected (more so than the original forests). The low density and low pressure infill—as discussed by Yli-Pelkonen & Niemelä (2005)—might cause urban sprawl, but on the other hand it also provides ample space for preserving already existing vegetation and e.g. urban forests.

The urban forest's landscape is categorized (see figure 14.) according to the six axioms Mitchell (2008, pp. 34-47) presents in his paper. These categories are based on the preparatory local detailed plan due to the fact that the area is still under construction. Urban forests are formed within the residential area of Hiukkavaara by the separated

housing areas (see figure 11.). These strips of urban forests are said to be a part of the recreational network in the preparatory local detailed plan (City of Oulu, Urban and Environmental Services, 2008, p. 52). These forests are by width usually from a 100 meters and up and are connected to the surrounding forest areas.

Axioms for reading the landscape of the urban forest; Case Hiukkavaara

Axiom 1 Product	The recreational urban forest	The beautiful urban forest	
Axiom 2 Function	To enable better health conditions, create healthy citizens	Need for infrastructural functions such as stormwater infiltration	Varying and comfortable landscape
Axiom 3 Locality	New development direction to Hiukkavaara	Urban growth and sprawl	Ideals of global and modern urban life
Axiom 4 History	Growth of Oulu	The Finnish Defence Forces and its local influence	Hiukkavaara seen as <i>natural</i> and forested
Axiom 5 Power	Ministry of Defense	Forestry	City of Oulu
Axiom 6 Social	Everyman's rights		

Figure 14. The six landscape axioms (Mitchell, 2008) analyzed from the preparatory local detailed plan for Hiukkavaara (City of Oulu, Urban and Environmental Services, 2008).

The landscape is a product the human population, and manifests the values of its inhabitants. In Hiukkavaara the preparatory plan (City of Oulu, Urban and Environmental Services, 2008) presents certain types urban forests as landscapes suitable for the area. The urban forests are produced (see figure 14., axiom 1.) to function as a recreational link for residents, thus it can be said that the urban forests are made to be recreational. The focus on recreation in urban forests in Hiukkavaara is evident in the preparatory plans, as the area is mentioned to function as a node for outdoor recreation. The prevalence of the recreational urban forest is quite typical in Finland, and much of this preference comes already high-up from the Ministry of Environment (1999) and its regulations. The urban forest is not only a recreational forest, but also a visual forest to look at (see figure 14., axiom 1.). These urban forests within the residential area are mentioned to be kept in a tidy look and beautiful in appearance. It is said that the urban forest transits to a more *natural* appearance in the borders (City of Oulu, Urban and Environmental Services, 2008), thus creating a dichotomy that relies on the *natural* vs. *cultural* aspect. A big role is given to visual appearance of the urban forest, as the preparatory plan mentions urban forests often merely with visual terms. The preparatory plan describes the differences between urban forests as *natural* vs. park-like urban forests.

The urban forests are said to function as way to improve the residents health conditions, due to the focus on producing recreational environments (see figure 14., axiom 2.). The urban forest landscape is also mentioned to function as an area that has infrastructural functions such as storm water infiltration. The function of storm water infiltration is a positive aspect of the urban forest that the planners have realized, and is connected to the ecosystem services as well. The tidy urban forests with their park-like milieu is said to provide the populous with varying and comfortable landscapes that increase the amenability of the environment. The park-like urban forest is provided for the residents perhaps due to visibility and aesthetical issues, as it is often that the residents feel more at home in well maintained and thinned forests (Tyrväinen, et al. 2003). The preparatory plan does mention that the urban forests in between the residential areas could be developed in a more bio-diverse way with undulating ecotones along the edges (City of Oulu, Urban and Environmental Services, 2008, p. 53). Forestry is not mentioned to take part in the urban forests within the residential areas, and as such is not considered a part of the first axiom.

The residential development in Hiukkavaara is only of the cogwheel in the machine that is the development in Oulu (see figure 14., axiom 3.). To understand why the urban forest is divided in small strips and functions as mostly recreational area is to understand what the regional development is. The pressure to expand and grow causes often forests to be used for development (Tyrväinen, 2001, p. 75), which in the case of Finland is often small scale, low density and rather spread out (Yli-Pelkonen & Niemelä, 2005, p. 1948). The ideals of modern urban life shape the city, as hundreds of detached houses dot the landscape.

Historically Oulu has grown tremendously from a population of roughly 15,000 habitants from the year 1910 to a city around 200,000 in 2014 (City of Oulu, 2014). The growth is still ongoing and that is also a factor that plays a role in formation of Hiukkavaara and the urban forests within (see figure 14., axiom 4.). The local history of Hiukkavaara has influenced the planned urban forests, due to the fact that the area has been a coherent forest for such a long period. What has enabled this vast forest to remain in the periphery of the city is due to the Finnish Ministry of Defence and its interests in preserving it as a training ground for the military. Therefore the population of Oulu (and planners) have seen the forests of Hiukkavaara as an important location for recreation. It is to be noted that the mainstay of the forests in Hiukkavaara area still remain under forestry and its economic goals.

The urban forests in Hiukkavaara attest to power relations (see figure 14., axiom 5.) that shape the landscape. The Finnish state plays a role in how the area has been developed and is going to be developed in the future. National land use objectives (see figure 3.) have to ensure that the presence of the Finnish Defence Forces in the area is protected and it can remain active. Forestry in the area has been an important source of income for both the city and the Finnish state. The needs and requirements of forestry in the area have to be met in the preparatory local detailed plan. The power is manifested by the city of Oulu and its planning ethos in the area with the shape, size and function of the urban forests. The city might see some areas less beneficial or suitable for urban forests and thus its power is projected in the form of built landscape.

Social benefits gained from the urban forests in Hiukkavaara (see figure 14., axiom 6.) is the provision of everyman's rights. Everyman's rights in Hiukkavaara are very important due to the large forests that the residents have access to. These rights improve the appreciation of the local landscape and can create a feeling of belonging as one can move about the environment more freely without the fear of intruding someone else's

property. Although the preparatory local detailed plan does not mention everyman's rights separately, it can be deduced that everyman's rights are considered due to the focus on recreation. It can be said that matters of social equality are not considered in depth in the preparatory local detailed plan. The area of Hiukkavaara will most likely house a homogenous population of middle-class well-educated families (Niemelä, et al. 2010), and one can question the need for bridging social equality among them.

6.1.2.2. Ecosystem services of urban forests in Hiukkavaara

The Hiukkavaara preparatory local detailed plan does not include any mention of ecosystem services (see figure 15.) in relation to urban forests (or any other biotope) per se, but there are certain services that are reminiscent of the ecosystem services in the plan. Some of these services are not clearly announced, but they can be extrapolated from the planning goals (e.g. the wish to keep urban forests tidy is related to the aesthetical viewing pleasure).

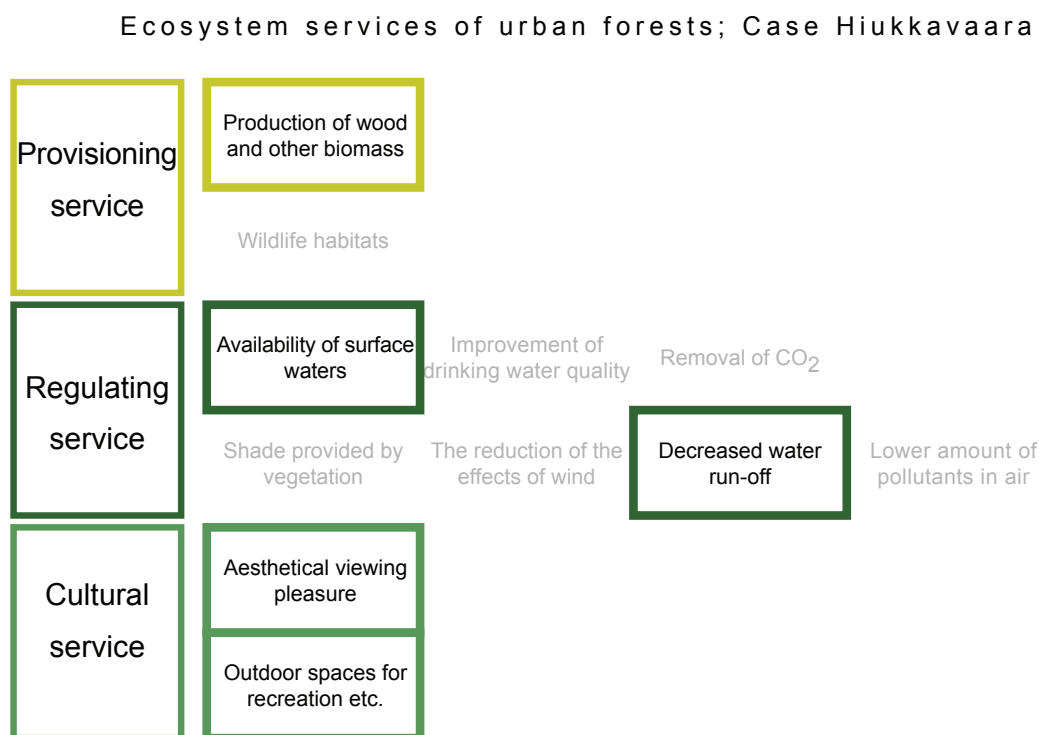


Figure 15. The present ecosystem services of urban forests (Escobedo, et al. 2011) as analyzed from the preparatory local detailed plan of Hiukkavaara (City of Oulu, Urban and Environmental Services, 2008). The services that are present in the plan are marked with bold outlines.

The services related to urban forests are the provisioning service and food production e.g. berries and mushrooms (Escobedo, et al. 2011), but these are not mentioned in the preparatory local detailed plan (City of Oulu, Urban and Environmental Services, 2008). It can be argued that the reason for having minimal discussion of the benefits of the urban forest (see the definition of urban forest in chapter 1.1.) is indeed due to the fact that the area of Hiukkavaara is in immediate surroundings of large coherent forests that may provide these services. The urban forests are to be maintained by means of urban forestry (i.e. the forests produce timber). This method of forestry is not aimed at economical benefit, but more on keeping forests aesthetically pleasing.

The regulating service in Hiukkavaara is mentioned in connection with providing flood plains, pools and other visible water bodies relating to storm water infiltration (City of Oulu, Urban and Environmental Services, 2008, p. 53). This availability of surface waters in urban forests also provides decreased run-off from impermeable surfaces. This approach of using storm water infiltration in urban green areas was clearly a step in the right direction in also realizing the potential of the urban forest for residential areas.

The services related to the cultural ecosystem service are presented in the preparatory local detailed plan quite well. The management and aesthetics of the urban forests are discussed in detail, and it is made clear that these urban forests need to be aesthetically pleasing while also functional. The main function indeed is recreation in these urban forests. There is no mention of specific types of recreation in the preparatory plans and it is only mentioned on a general level. The size, location and function of recreational areas are discussed in detail. This discussion proves the fact, that recreation has been considered the main benefit provided by urban forests. The urban forests that the plan presents (see figure 11.) are interconnected, and are supposed to offer easy access for recreation for the residents in the area.

The plans for Hiukkavaara were made before the study was made in Oulu concerning the ecosystem services. The introduction of the VILMO-plan for Oulu in 2014 (City of Oulu, Urban and Environmental Services, 2014) can also provide the already existing urban forests a more decisive status in regards to their value in the urban environment. Important ecosystem services mentioned in the VILMO-plan (City of Oulu, Urban and Environmental Services, 2014, p. 68) regarding urban forests in Hiukkavaara are: CO₂ sequestration, recreation, water runoff minimization and the provisioning service of berry and mushroom picking.

6.2. Case Ritaharju



Figure 16. Ritaharju preparatory local detailed plan with proposed greenway connections, edited by the author, based on the original plan (City of Oulu, Urban and Environmental Services, 2005).

6.2.1. History of Ritaharju and current plans

Ritaharju (see figure 16.) is a new housing development in the northern outskirts of the city of Oulu. Much like Hiukkavaara, the area is being built upon former forested areas used mainly by forestry. The area of Ritaharju is predicted to house around 6,500 inhabitants, which is roughly half of the inhabitants of Hiukkavaara (City of Oulu, Urban and Environmental Services, 2005, p. 17). The area of Ritaharju is evidently a major direction of growth in Oulu as it is said in the comprehensive municipal plan (City of Oulu, Urban and Environmental Services, 2004, p. 28) that the economical (i.e. forestry) forests north of Ritaharju are also reserved for further growth of the city. The area is split in ownership between private and municipal land of which the municipality owns roughly half. The construction of the housing area began in 2004 and was predicted to last to 2011 (City of Oulu, Urban and Environmental Services, 2004, pp. 4-5). The area of Ritaharju is planned to have its own services and it is meant to serve the local population with all the services (e.g. libraries, schools etc.), so there would be less need for traffic between other areas. The development of Ritaharju follows much the same principles as Hiukkavaara, and the basis for this is already laid in the sub-regional plans (The Regional Council of the Sub-Region of Oulu, 2003). Majority of housing will be detached housing, but some of the housing will be more urban-like in the centre of the Ritaharju development.

The preparatory local detailed plan of Ritaharju (City of Oulu, Urban and Environmental Services, 2005) describes the development of Ritaharju to be that of a densely structured residential area, that is surrounded by parks and recreational areas. The forests in the area have been used mainly for forestry, and there are large swamps in the area (see figure 17. and 18.). The focus of the environmental plan of the preparatory local detailed plan (City of Oulu, Urban and Environmental Services, 2005, pp. 18-19) is not so much on recreation as it is on Hiukkavaara, but the premise of recreation plays a role in the formation of the green areas in Ritaharju as well. Ritaharju is not predicted to have such an influx of people visiting the recreational areas as compared to Hiukkavaara. Thus Ritaharju's recreational areas are not considered as important recreationally for the whole of the population in the city to have access to it—rather the area is meant for the local residents. The maximum distance from housing to recreational areas is said to be between 150-200 meters. The size of all of the planned green areas is 167 hectares, while the size of residential areas is predicted to be around 164 hectares (City of Oulu, Urban and Environmental Services, 2005, pp. 16-17). The size and cohesion of the green areas can be considered rigid due to the high *natural* value areas are protected by the green areas, and more so by urban forests.

Important areas to be protected in Ritaharju are considered to be the swamps, hills, ridges and certain instances of endangered plants (City of Oulu, Urban and Environmental Services, 2005, p. 5). Here there is no mention of any special forest characteristic that should be maintained or preserved. The preserved areas are proposed to be used as mainly areas for recreation, and these recreational areas are to be kept as urban forests. Some preserved forests are marked to function as protective forests (in the vicinity of the highway) which block e.g. noise and *harmful* views. The recreational areas are linked to the green and recreational area plan (City of Oulu, Urban and Environmental Services, 2000) that proposes a conjoined network of recreational routes on the outer peripheral (see figure 6. outer green areas).



Figure 17. Aerial photo of the Ritaharju in 2004 before the planned development. Oulun kaupunki, ©Blom Oy (City of Oulu, Urban and Environmental Services, 2015).



Figure 18. Aerial photo of the Ritaharju in 2012 after the construction has begun. Oulun kaupunki, ©Blom Oy (City of Oulu, Urban and Environmental Services, 2015).

6.2.2. Analysis of the plans

6.2.2.1. Urban forests in Ritaharju

Urban forests in Ritaharju are distinctively sectorized into large cohesive green corridors that penetrate the area. The green corridors enable the passage of the housing development solely through green areas, much like it was designed in Hiukkavaara. The small amount written concerning the preservation of forests in the area may arguably be due to the fact that the area has been selected for development already early in the regional and comprehensive municipal plan (The Regional Council of the Sub-Region of Oulu, 2003; City of Oulu, Urban and Environmental Services, 2004). The planned green areas in Ritaharju are mainly urban forests with different levels of maintenance and different functions. The urban forests are classified in figure 16. in detail.

The prevalent size of the green areas in Ritaharju is considerable (see figure 26.) The areas used for housing are mainly the areas that were seen suitable for construction due to soil conditions, and so presumably due to this a good portion of the land was left for green areas. The urban forests in Ritaharju are said to be "varying in landscape" with different types of vegetation in urban forests. The recreational function of the urban forests is emphasized by the fact that two major recreational parks are to be designed in the area: a central park and a residential recreational area. In the preparatory local detailed plan the landscape of the urban forests is planned by giving development recommendations (City of Oulu, Urban and Environmental Services, 2005, p. 19). These recommendations mention several different types of urban forests and denote them by vegetation and function. It is important to note that this classification is different from the maintenance classification, but for the sake of comparison the maintenance classification is used. Two major different categories can be deduced and are as follows: recreational forest and park-like forest. The recreational forest is presumably mostly for jogging and skiing. The park-like forests are more destined to function as forests for walking and relaxing.

The six axioms (Mitchell, 2008) are presented in figure 19. and even though the figure may seem at first glance much alike the one of Hiukkavaara (figure 14.), there are subtle changes and different point of views. In Ritaharju there were noticeable differences in the formation of the environmental plan of the preparatory local detailed plan, and the values projected onto Ritaharju were that of a more varying forest landscape. This is evident in the classification of important *natural* values, as different types of forests are categorized within (City of Oulu, Urban and Environmental Services, 2005, p. 6) rather than seeing the forest as an inexact *natural* green area in the case of Hiukkavaara (City of Oulu, Urban and Environmental Services, 2008, p. 51).

Axioms for reading the landscape of the urban forest; Case Ritaharju

Axiom 1 Product	The recreational urban forest	The beautiful urban forest	The <i>natural</i> urban forest
Axiom 2 Function	To enable better health conditions, create healthy citizens	Varying landscape	Protect the <i>natural</i> values already present in the area
Axiom 3 Locality	Further development north of Ritaharju	Urban growth in the peripheries	Ideals of global and modern urban life
Axiom 4 History	Development of Oulu	Presence of forestry	
Axiom 5 Power	City of Oulu	Forestry	
Axiom 6 Social	Everyman's rights		

Figure 19. The analysis of the six axioms as presented by Mitchell (2008), based on the Ritaharju preparatory local detailed plan (City of Oulu, Urban and Environmental Services, 2005).

Recreation (see figure 19., axiom 1.) is mentioned multiple times in the preparatory local detailed plan as a key benefit for the development of the green areas in the case of Ritaharju (City of Oulu, Urban and Environmental Services, 2005). The types of recreation are not specified. The green areas are said to be maintained in a way that promotes or enables recreation. It is indeed the perceived Finnish lifestyle of the outgoing forest user who actively uses the urban forest for recreation, that shapes the urban forest to be as coherent as it is, although the urban lifestyle might be completely different (Lyytimäki, et al. 2008).

The environmental plan mentions the need to develop the green areas as *nature*-like areas (see figure 19., axiom 2.), which could be understood as developing the green areas as urban forests. Indeed the preparatory local detailed plan projects mostly urban forests in Ritaharju. There is will to preserve the already existing forest-like landscape as much as possible, as mentioned in the plan (City of Oulu, Urban and Environmental Services, 2005, p. 18). The urban forests are to be opened up to allow better views (i.e. the beautiful forest) but much of the urban forest is said to be left as in a *natural* state, which was not stated in e.g. the case of Hiukkavaara. This *natural* state is quite open for interpretation, and even the guidelines for urban forest maintenance (City of Oulu, Urban and Environmental Services, 2011, p. 12) mention the possibility of clearing forest just to open views for passers-by of e.g. a particular rock formation.

The premise of recreation is to serve the population of Oulu, and the neighbourhood, to engage in healthy outdoor activities. The urban forests are planned to provide different kinds of spaces by having varying types of forests and either closed-in or closed-out kinds of room. Much of the urban forest is shaped around the spaces that were seen as important in the classification of protected *natural* areas, and thus it can be said that the

function of the urban forest is in fact to preserve these areas that were seen as important either by classification of vegetation or e.g. important landscape views. It is noteworthy to question, that do these preserved nature-like areas serve recreation well as they are delicate wetlands not tolerant against hard use?

The future of Ritaharju may be that of a growing local centre as pressure for further development may cause the northern part of Ritaharju to be built-up as well (see figure 19., axiom 3.). This remark is already made in the comprehensive municipal plan (City of Oulu, Urban and Environmental Services, 2004, p. 12). The low pressure development has shaped the residential areas of Ritaharju into housing areas that take vast spaces, but on the other hand they offer also large coherent urban forests for the populations to use. The wish to have one's own backyard and automobile is one that influences the shape and size of the urban forests. Current development in Oulu (see figure 19., axiom 4.) has much relied on the action of sprawl rather than densification. It is arguable if the city of Oulu could of found space to for residents already within the more established city structure rather than spreading out in the peripheries and forests. Providing space for up to 6,500 people in Ritaharju is no easy task (and possibly more in the future). This sprawl-like growth, with its dense spots of infill that are spread out on a large area, has altered the forest resources available not only for recreation, but also for forestry. Ritaharju has been a large forested area and this is evident in the current and future state of the urban forests as they are former forestry woodlands.

Ritaharju's urban forests are controlled by the guidelines set in the comprehensive municipal plan (City of Oulu, Urban and Environmental Services, 2004). The urban forest becomes a regulated entity with maintenance to improve its value among the dwellers of the area. The city of Oulu has decided what the area should be with a questionable amount of public participation. The powers that are present in the landscape are also materialized in the needs of forestry, and how it needs to sustain itself (see figure 19., axiom 5.).

The cohesive urban forests of Ritaharju benefit the population of the area by giving them spaces for recreation and other outdoor activities. The urban forests also offer spaces to move about freely and everyman's rights (see figure 19., axiom 6.) ensures that people can also enjoy the forests around them. There is a homogenous population of educated families that move to housing development areas like Ritaharju, as according to Niemelä et al. (2010, p. 3226). Therefore the possible introduction of urban forests as a way to lower social separation between people of different income becomes rather obsolete, as the urban forests are only used by the middleclass.

6.2.2.2. Ecosystem services of urban forests in Ritaharju

The ecosystem services found in the preparatory local detailed plan of Ritaharju (City of Oulu, Urban and Environmental Services, 2005) are quite limited. The regulating service and its functions are completely missing from the planning document and the urban forest is not mentioned to provide many benefits. The ecosystem services as detailed by Escobedo et al. (2011) are presented in the following figure (see figure 20.).

Ecosystem services of urban forests; Case Ritaharju

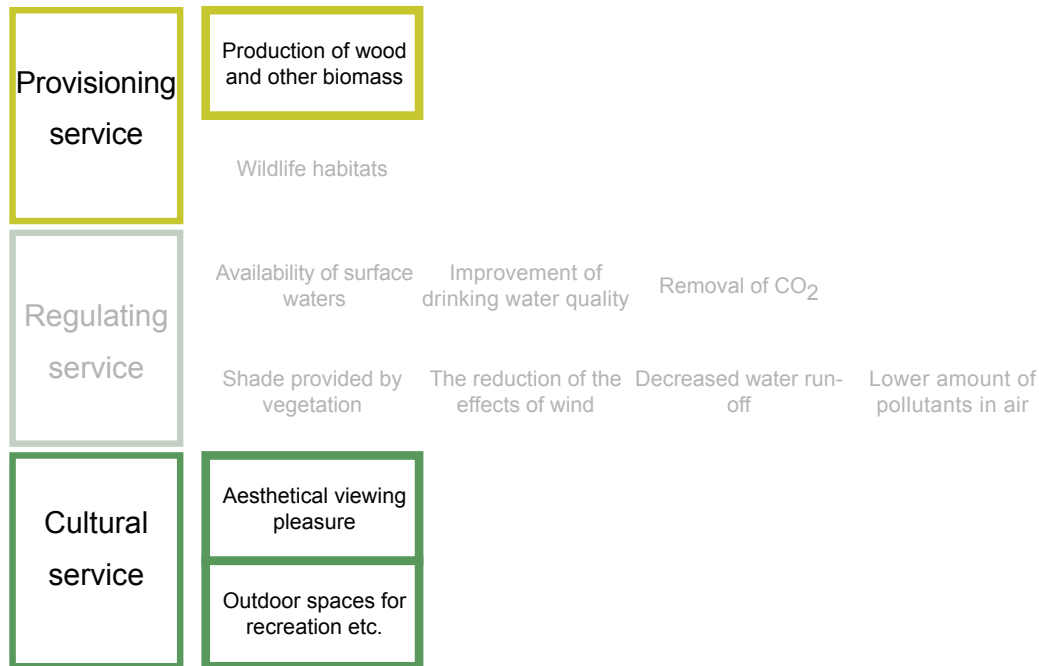


Figure 20. The analysis of the ecosystem services of urban forests (Escobedo, et al. 2011) provided by the preparatory local detailed plan of Ritaharju (City of Oulu, Urban and Environmental Services, 2005). The services present in the area are bolded.

The provisioning service of the preparatory local detailed plan of Ritaharju is the production of timber, as the plan mentions the need for urban forest maintenance where the trees are cut down to open up views for e.g. pedestrians. Aesthetical views are considered in the plan as many different solutions for opening up views or maintaining vegetation are described; for example ways to preserve vegetation at a certain height (City of Oulu, Urban and Environmental Services, 2005, p. 18).

Recreational spaces are mentioned in the preparatory plan (City of Oulu, Urban and Environmental Services, 2005, p. 18) and again it is considered, much like in Hiukkavaara, one of the key benefits offered by green areas. Large recreational parks are to be designed in the area to offer residents spaces for outdoor recreation. There is no mention of recreation specific to urban forests, but the areas to be built as parks will also have forest-like landscapes in them.

The distinct lack of described ecosystem services in the preparatory local detailed plan may be due to the timeframe when the planning took place (early 2000s), and these ecosystem services provided by e.g. urban forests were not seen as important than now with the adaptation of the new VILMO-plan (City of Oulu, Urban and Environmental Services, 2014). The VILMO-plan (City of Oulu, Urban and Environmental Services, 2014, p. 67) mentions several additional benefits that the urban forests could provide in the area of Ritaharju. The urban forests could provide decreased water runoff, CO₂ sequestration and availability of berries and mushrooms. Thus it is important to note that the ecosystem services that are mentioned in the preparatory plans might not be the actual ecosystem services that are present in the actual built environment. The focus here is to show what the planners thought to be important, regarding urban forests, during the planning phase.

6.3. Case Metsokangas

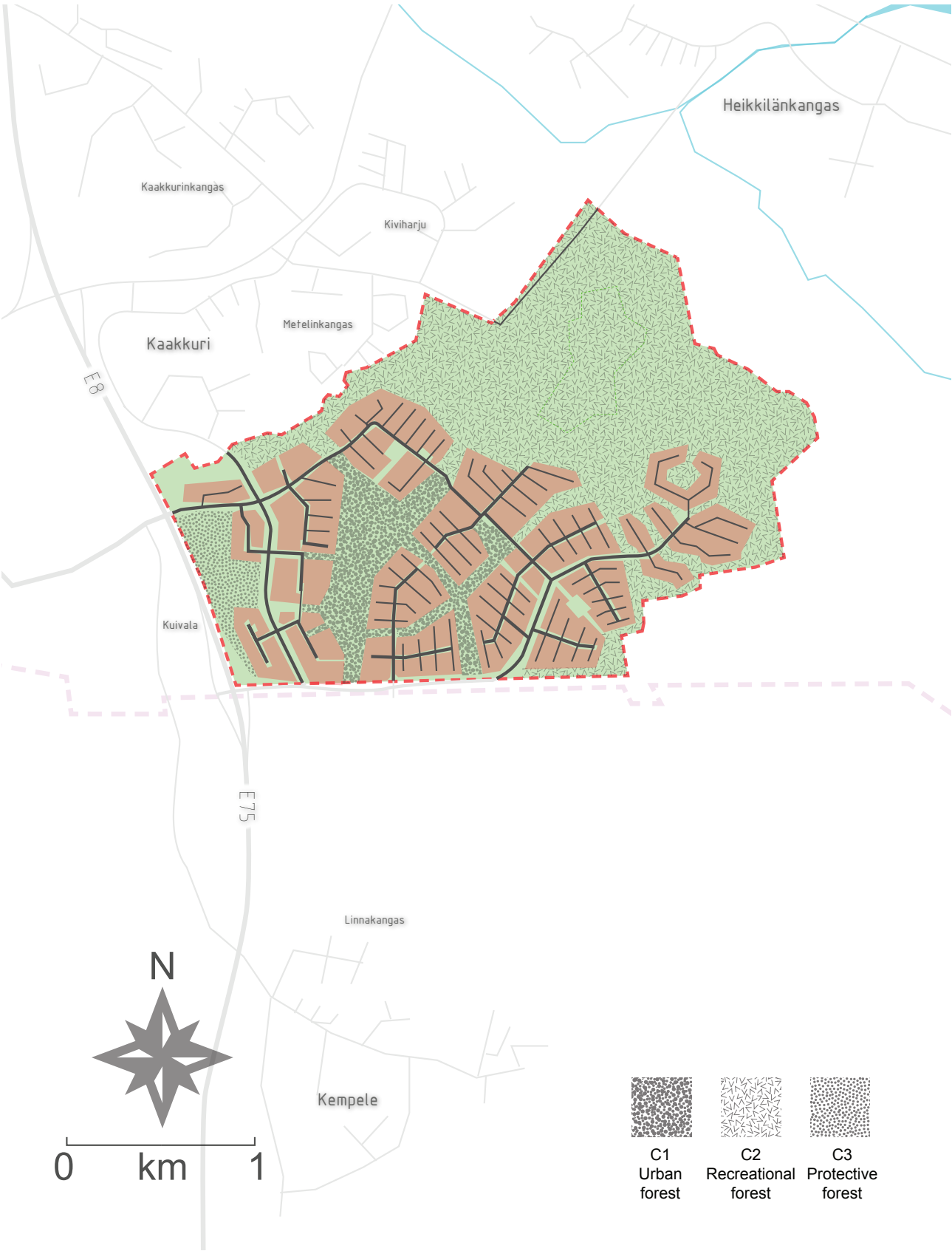


Figure 21. The preparatory local detailed plan of Metsokangas, edited by the author, based on the original plan (City of Oulu, Urban and Environmental Services, 2000).

6.3.1. History of Metsokangas and current plans

Metsokangas (see figure 21.) is a residential development in the southern part of Oulu and its situated right at the municipal border between the city of Oulu and Kempele. The area was before the housing development largely forested, and used somewhat for agriculture (City of Oulu, Urban and Environmental Services, 2000). The total area of the Metsokangas development is 472 hectares which compromises both green areas and built-up areas (City of Oulu, Urban and Environmental Services, 2000, pp. 11-12). The planning of Metsokangas began in 1999 and construction in 2003. The area has been mostly constructed as of the time of writing.

The area of Metsokangas will house up to 5,100 residents according to the preparatory local detailed plan (City of Oulu, Urban and Environmental Services, 2000, p. 11), which makes Metsokangas the smallest of all of the sites studied in this thesis. As presented in the comprehensive municipal plan (City of Oulu, Urban and Environmental Services, 2004), the area of Metsokangas will be developed in to a dense “city-like” detached house area with large forest bodies surrounding it (City of Oulu, Urban and Environmental Services, 2004, p. 8). The concept of dense construction here is not mentioned by any size parameters but described merely to be more “city-like” due to the designed separate housing areas being close to each other (which is arguable as well). The forests will be either for recreation (immediately north of habitation) or forestry (south east of habitation). There was a large raceway located north of the planned residential area that was moved from the area in 2004-2007 (see figure 22. and 23.), thus much of the area on the northern part of the planning area is not used for development. This raceway was to be replaced with a recreational centre. The recreational centre is meant to rectify the damage done by the raceway in the area, and offers many outdoor sport and recreational options. The centre is meant for the inhabitants of Metsokangas and the whole of Oulu (City of Oulu, Urban and Environmental Services, 2000).

The Metsokangas area has some parts of the city's green belt strategy, and its situated in the outer ring (see figure 6.). The green and recreation area plan of Oulu (City of Oulu, Urban and Environmental Services, 2000) has no specific guidelines set for the area of Metsokangas and only mentions the neighbouring areas of Heikkilänkangas and Kaakkuri and their importance in improving the green area network. The preparatory local detailed plan delimitates four important sites in Metsokangas that should be protected, these include a swamp, a grove and parts of a stream valley that runs through Metsokangas (City of Oulu, Urban and Environmental Services, 2000).

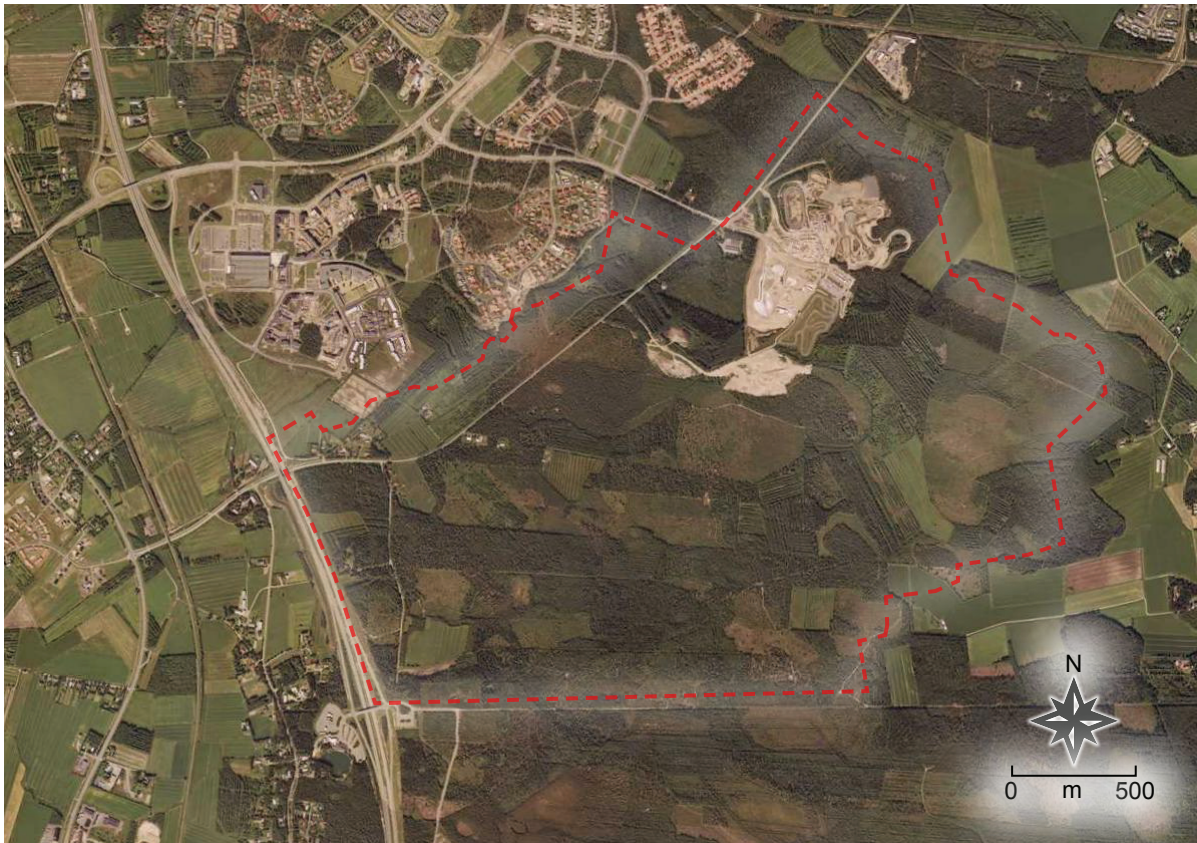


Figure 22. Aerial photo of the Metsokangas in 2004 before any construction has begun. Note the racetrack in the northern part. Oulun kaupunki, ©Blom Oy (City of Oulu, Urban and Environmental Services, 2015).



Figure 23. Aerial photo of the Metsokangas in 2012. Most of the development is completed. Oulun kaupunki, ©Blom Oy (City of Oulu, Urban and Environmental Services, 2015).

6.3.2. Analysis of the plans

6.3.2.1. Urban forests in Metsokangas

The preparatory local detailed plan of Metsokangas (City of Oulu, Urban and Environmental Services, 2000) is different in comparison with equivalent plans of Ritaharju and Hiukkavaara, due to the fact that the planning related to the green areas has no connectivity in mind. This most likely is caused by a lack of information during the planning process of Metsokangas, as the green and recreational area plan of Oulu (City of Oulu, Urban and Environmental Services, 2000) was completed in 2000, simultaneously with the preparatory planning of Metsokangas which took place between 1999-2000. Therefore the environmental plan of the preparatory local detailed plan (City of Oulu, Urban and Environmental Services, 2000, pp. 12-13) might not consider the needs of the green area network sufficiently.

The forest types of Metsokangas have been classified in to different groups by categorizing the use and vegetation of the specific forest type. The types are described as e.g. “neighbourhood parks” or “city block parks”. There is no correlation between the classification to other study cases. For the sake of comparison the maintenance classification is used instead in the figure 21. It can be deduced that the planners want the area to be developed in a way that three distinctive types forest landscapes are created; the *natural* forest, landscaped forest and the protected forest. It comes then by no surprise that this classification of urban forests can also be tethered to the maintenance classification. The descriptions and titling of the urban forests shows many similarities among planning and maintenance. The urban forests can be understood (as the preparatory plan does not use the same categorisation) with the maintenance classifications, in which the urban forest is dealt in to three main categories; C1 urban forest, C2 recreational forest and C3 protective forest. Therefore it can be said that the maintenance classifications of urban forests has a strong relation to how large, coherent and permanent these urban forests actually are, because they are considered already on a planning level.

It is also mentioned that most of the green areas are to be developed in a *natural* way. Forests are seen as natural where as gardens are not, with meadows falling in between (City of Oulu, Urban and Environmental Services, 2000, p. 13). This categorization is rather rudimentary and creates unnecessary distinctions between landscapes, of which many share similarities and are only categorized on a map and by name. No mention is made of forestry and how it would function in the area.

Axioms for reading the landscape of the urban forest; Case Metsokangas

Axiom 1 Product	The recreational urban forest	The <i>natural</i> urban forest	
Axiom 2 Function	To enable better health conditions, create healthy citizens	Protect the <i>natural</i> values already present in the area	
Axiom 3 Locality	Young families wishing to live in suburbia	Ideals of global and modern urban life	
Axiom 4 History	Growth of Oulu at the beginning of 2000s	Racing track and its demolishment	Presence of forestry
Axiom 5 Power	Promotes the ideals of <i>nature</i> vs. <i>culture</i>	City of Oulu	Forestry
Axiom 6 Social	Everyman's rights		

Figure 24. The urban forest and the parts that play a role in its landscape. Based on Mitchell's six axioms (2008) and the preparatory local detailed plan of Metsokangas (**City of Oulu, Urban and Environmental Services, 2000**).

The landscape of the urban forest in Metsokangas is a product (see figure 24., axiom 1.) that has been shaped by processes that are both local and global. The growth of information technology in Oulu was considerably high in the beginning of the 2000s and caused a large surge for housing to be built as business was high, in the process affecting the urban forests. The production of urban forests with recreational intentions in Metsokangas is an answer to demands already portrayed by the Finnish Ministry of Environment (1999) and a way to market the area for potential customers looking for residence. The *natural* urban forest is a product which is supposed to protect the valuable *natural* values (i.e. vegetation, streams and swamps). This protection is accomplished by determining important parts of the urban forest unusable for construction and infill.

The function of the urban forest (see figure 24., axiom 2.) is to provide the local residents and residents in Oulu recreational areas that they can use for outdoor activities. Functionally the urban forest are tasked with protecting important *natural values*. Thus areas that are considered visually or ecologically important are protected (i.e. streams and stream valleys), and can be used by means of recreation. This can create a difficult situation, as the increased pressure (i.e. more residents) in the area also raise the usage of the recreational areas, causing wear on the urban forests and possibly endangering the preserved *nature*-like areas.

Metsokangas has been built as a residential area due to a growing population and the demands that these people have (see figure 24., axiom 3.). White picket fences and large yards take room from existing forests in the area. The process is influenced by not only the wish to live in a more peaceful and quiet area, but also the wish to be in an urban area at the same time. These ideals and goals shape Metsokangas and has caused urban

forests to take place in between housing areas. The city of Oulu grew in the beginning of the 2000s with an expeditious rate (City of Oulu, 2014). The growing population needed living space and Metsokangas was one of the largest developments in Oulu to remedy this shortage. Historically the area of Metsokangas (see figure 24., axiom 4.) had mostly coherent forests, and due to this it had been under the control of different land owners who had benefitted from it by means of forestry. The area of Metsokangas was also once the site of the local racetrack due to its location in the periphery of the city, but with urban growth the racetrack was deemed too noisy and harmful to the residents to be preserved and the racetrack was moved (City of Oulu, Urban and Environmental Services, 2000).

The preparatory plan of Metsokangas (City of Oulu, Urban and Environmental Services, 2000) mentions in the classification of the existing green areas the distinction between different types of human influence. Unlike the plans of Hiukkavaara or Ritaharju, here the planners (see figure 24., axiom 5.) have noted the differences in green areas and mention that there are three different landscapes: cultural, semi-cultural and *natural*. With these distinctions the planners have proposed that areas that are more cultural in their perception, are also areas suitable for development. Power structures that shape urban forests in Metsokangas are the planning goals set by the city of Oulu and the wishes and needs of forestry to prolong its existence.

Metsokangas as a housing development site caters to mostly a middle-class family setting and as such there is little to do in terms of lowering social inequality (see figure 24., axiom 6.) among the population of Oulu. The urban forests can be used by the local population, and others, due to their public capacity and the amenity of everyman's rights. It can be said that urban forests have not been considered by terms of social benefits when it comes to the preparatory plans of any of the sites presented in this thesis.

6.3.2.2. Ecosystem services of urban forests in Metsokangas

The ecosystem services present concerning urban forests in the preparatory local detailed plan of Metsokangas (City of Oulu, Urban and Environmental Services, 2000) are limited (i.e. lowest of all the case studies), and only cover one service i.e. the cultural service (see figure 25.). There are many reasons why the situation could be such; the planning took place before the implementation of the green area network, studies relating to the benefits of urban forests were not available or applied, and the protection of *natural* forested areas were seen more important than the availability of urban forests.

Aesthetical quality of the urban forests in the preparatory local detailed plan of Metsokangas (City of Oulu, Urban and Environmental Services, 2000) is the wish to retain the urban forests as *natural* green areas, that are also enjoyable to see and use. The plan mentions that only a part of the green areas would be more park-like and the majority would remain as more *natural*. It is also mentioned that trees which "enhance the landscape" should be preserved, even in densely built areas (City of Oulu, Urban and Environmental Services, 2000, p. 12). Outdoor recreation is mentioned in relation to a residential area park (see figure 21., C1 urban forest) and the recreational centre. The residential area park is mentioned to cater for many age groups, and as such should provide multifaceted activities.

Ecosystem services of urban forests; Case Metsokangas

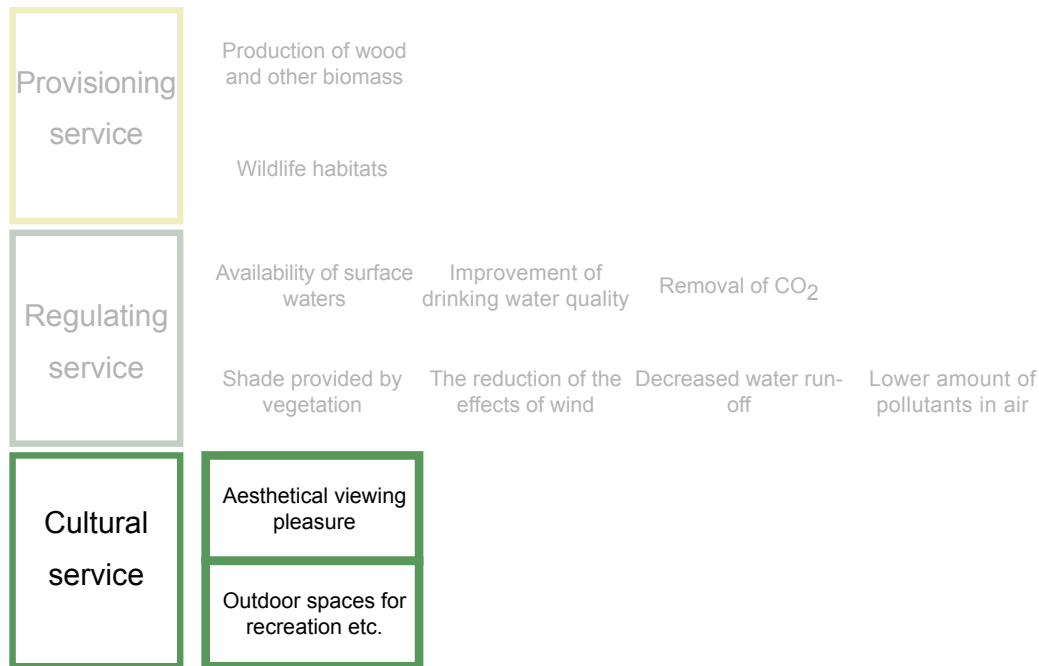


Figure 25. The ecosystem services provided by urban forests (Escobedo, et al. 2011) as shown in the preparatory local detailed plan of Metsokangas (City of Oulu, Urban and Environmental Services, 2000). The services present in the area are bolded.

The VILMO-plan (City of Oulu, Urban and Environmental Services, 2014) does not specify any ecosystem services that can be improved or increased in Metsokangas, but the plan does have a general notification of how the urban forests can help to provide ecosystem services. The urban forests (C1) in general are explained to reduce pollution and sequester CO₂. Protective forests (C3) can help to limit noise, dust and visual problems caused e.g. by traffic (City of Oulu, Urban and Environmental Services, 2014, p. 37). It remains unclear, as to why the ecosystem services are not specified in more detail in relation to Metsokangas.

6.4. Case study synthesis

Synthesis of the case studies

	Case studies		
	Hiukkavaara	Ritaharju	Metsokangas
Time of planning	2006—2008	2004—2005	1999—2000
Time of construction	2010—2025*	2008—2020*	2004—2013
Total size	1762 ha	389 ha	472 ha
Planned green area size	1169 ha	167 ha	306 ha
Planned housing area size ^{*2}	593 ha	164 ha	166 ha
Estimated population	19 999*	6523*	5100*
Type of housing	Detached and row houses, apartment buildings	Detached and row houses, apartment buildings	Detached and row houses, apartment buildings
Urban forest types	C1, C2, C3	C1, C2, C3	C1, C2, C3
Urban forest tree species ^{*3}	Pine, Birch, Spruce	Pine, Birch, Spruce	Pine, Birch, Spruce

* Approximated value in the documentation

^{*2} Includes roads and other infrastructure

^{*3} Predominant tree species present

Figure 26. Compendium of the case studies and their attributes.

The case study sites (see figure 26.) are evidently different in size and location, but nonetheless share many similarities. Planning for these sites has taken roughly the same time, but in the case of Hiukkavaara the site can be considered a more major development in comparison of the three. Presumably the time invested in planning can relate to higher input in regards to urban forests as well, as the site of Hiukkavaara had e.g. the highest urban forest ecosystem services present in the plans. The only finished site at the time of writing was Metsokangas. The two other sites are still under construction and their completion is mainly estimated. The size of the case study sites are varying, with Hiukkavaara being more than 75% larger in size than the other two.

Ritaharju has the lowest amount of planned green areas of the case studies with 42% green areas of the total size. Metsokangas comes second lowest with 64% green areas. Hiukkavaara on the other hand has the highest amount of green areas with 66%. The size of the green areas can be considered substantial in all of the cases, and it is important to note that these green areas are mostly urban forests. The population is approximately the same in Ritaharju and Metsokangas. Hiukkavaara has a considerably higher population estimate. The housing in all of the case studies is much alike; mostly detached and row houses along with a lower amount of apartment buildings in the centres.

The urban forests in the case studies are alike due to the categorization and classification in this thesis, which follows the maintenance classification to enable easier comparisons. The tree species in the sites are mostly pine, spruce and birch trees in various growth stages. The urban forests are much alike, due to the fact that these are forests in the area that are not used for development but are left as is.

7. Discussion

This case study showed results that urban forests are not often perceived important other than as a visual object, and as a place for recreation. Ecosystem services were not considered *per se* in any of the case studies, but there were early traces of same kind of ecological thinking and valuing. The lack of analyzed ecosystem services in the cases were presumably due to the new development of the service concept; a concept which has surfaced only lately. The development in the peripheries of Oulu; a process of development which arguably is much alike elsewhere in Finland (Tyrväinen, 2001), is one that takes large amounts of space to build principally single detached houses, row houses and some apartment buildings. The development sacrifices large forested areas to build these houses, but then again green spaces that are left on site can be often considered respectable in size. The focus on recreation can be considered positive due to it enabling these patches of pre-existing forests to be preserved as urban forests in the development areas. Furthermore these urban forests are often preserved even if large forests are situated all around the development, which in itself can be considered an unique approach.

The plans controlling urban forests and their development have different levels of comprehension, which is evident in the case studies. The Metsokangas case proves that the city of Oulu had less focus and effort in regards to urban forest and their function earlier on as they were planning these new residential areas. One of the fundamental results in this thesis is the prevalent reasoning for urban forests in Oulu, and arguably generally in Finland (Tyrväinen, 2001; Tyrväinen, et al. 2003; Niemelä, et al. 2010), is recreation. Although recreation is considered an ecosystem service, it is hard to quantify and study in relation to urban forests, as the proximity of forests to Finnish urbanity can downplay the importance of specific (more local) urban forests (Niemelä, et al. 2010).

The current understanding and methodology behind urban forests in the city of Oulu has been that of which focuses on proven benefits. The viewpoint has been rather predominantly on recreation and how it is enabled and developed in Oulu. Mitchell (2008, p. 44) describes the function of landscape, and this can be helpful in the case of recreation as well: "Landscape is thus ideology made solid: a produced space that does *more* than represent. It guides." This quote can be understood as that the focus on recreation creates a specific type of landscape; a landscape which arguably may not be all that it could be. The benefits of recreation may be well known to positively influence health and comfort of people (Lee & Maheswaran, 2010), but the users on the other hand may see urban forests as important for other reasons. An urban forest can be seen as a place for e.g. contemplation (Tyrväinen, 2001, p. 87) instead of merely treating it as a place for recreation. The prevalence of recreation as the main rationalization for urban forests needs to be criticized. This primary valuation of recreation comes in Finland from higher up; from the Land Use and Building Act (The Ministry of Environment, 1999), which in itself is in need of an update in regards to ecosystem services and their adaptation nationally.

For urban forests to remain as cohesive green areas that do not get trampled easily by urban development, they need to be justified in their existence. Overall urban forests can provide many advantages in urban environments: noise reduction, better air quality, lower heat-island effect, water infiltration, recreation and aesthetical qualities to name a few (Bolund & Hunhammar, 1999; Skärbäck, 2007; Lyytimäki, et al. 2008; Tyrväinen, 2001). Moreover if these attributes are considered when planning to expand the city, the preservation, protection and construction of urban forests should be effective, presumptive

and furthermore *planned*. Urban forests can serve the same function in principal in the urban environment as other parts of urban infrastructure, which enable the city to function. The appreciation and protection of urban forests has shown a slight positive development under time, as the case studies show. This may be due to growing awareness of e.g. ecosystem services. One reason for the positive development may also be better communication of knowledge, as this can be sometimes rather problematic between decision-makers (Yli-Pelkonen & Niemelä, 2005).

The amenities and benefits of urban forests should be taken in better consideration when planning residential areas. The urban development can cause a substantial loss of forest amenities. Development is posed often on already existing forests, as is the case not only in Oulu, but also elsewhere in Finland (Tyrväinen, 2001). Urban forests can provide multiple ecosystem services and yet still at the same time offer a comfortable environment for local populations, in regards to e.g. aesthetical pleasure and recreational benefit (Niemelä, et al. 2010). The multifunctional role of the urban forests has been considered lately in more detail by the city of Oulu, among other Finnish cities such as Joensuu (SITO, 2013), with the introduction and review of their ecosystem services (City of Oulu, Urban and Environmental Services, 2014).

The urban forests exemplify the planning criteria of those who plan it. The dichotomies between dense and sparse construction arise from e.g. in the case of Metsokangas. Here the planners purport that the structure of the residential area is dense, but in reality the plan is considerably spread out (N.B. regards to land use) in its design. Therefore it can be said that these areas show signs of urban sprawl. According to Johnson (2001) urban sprawl takes place due to low control, automobile focus, growth in peripheries, homogenous populations and lack of collaboration between decision-making bodies. These are all components that are apparent in different quantities in each of the case studies. The growth of the urban areas seems to be extensive also in a future scenario in Oulu as the municipal plan (see chapter 3.5.) does not display any growth limits in the periphery, but on the contrary only vague directions for more extended growth. The new urban development take mainly taken place in peripheries in Oulu, and this inevitably leads to loss of green areas. Furthermore in many cases the existing green areas are given little appreciation and their importance is downplayed (Tyrväinen, et al. 2003, p. 76), a fact that is also apparent in the development of these residential areas in Oulu as some parts of green areas only receive a protective status due to e.g. aesthetical beauty.

The urban landscape is shaped by the processes of our society. Perceiving an inherent difference in human (i.e. *cultural*) and nature (i.e. *natural*) appears to be within the core values of the case studies (Olwig, 1993). Promoting distinct borders between urban green areas and non-urban green areas, which lie outside the periphery, creates unneeded fallacies and hinders the true benefit that could be gained e.g. from the forests surrounding the peripheries. This would call for larger coherent urban forests to be retained within and around the residential areas. A better understanding of the terminology of landscape could help to raise awareness of seeing how the landscape is not only a visual environment, but an environment which has social and power structures within. Thus the benefits of the ecosystem services could be considered alongside of a more deeper landscape context.

The city of Oulu is envisioned to grow out in a finger-like method, in which large coherent green areas are left in between the constructed areas. The finger-plan can cause confusion, and mixed results, as the plan is used both for housing and green areas. These separate finger-plans could be combined in to a more conclusive document in the future to improve the plans overall. The green areas that are presented in the green

area finger-plan are composed mainly from existing forests. The municipal plan of Oulu mentions the risk of losing these green areas to further needed infill. The urban forests are therefore under a risk of being exploited for residential or other construction. This risk proves the point that the urban forests need to be planned in a way that their true benefits are realized. This prevention of the loss of urban forests can be done with the ecosystem service approach, as urban forests can be profiled with a certain economical gain. This profiling on the other hand has to be done critically, as the ecosystem services are inherently a cultural construct, mirroring the values of those who plan it. It is quite clear that the adaptation of the ecosystem services in general in land-use planning should increase the quality of urban living spaces, as discussed by Niemelä et al. (2010). Therefore it can be questioned, that does the sole focus of maximizing ecosystem services of green areas in general provide a healthy and enjoyable landscape? It remains to be seen how the application of the ecosystem services influences planning and zoning of urban forests specifically, if used in an early stage of the planning process.

The landscape of the urban forests in Oulu is that of which is often referred to with visual terms. The importance of forest aesthetics is not to be disregarded, as is proven by Hörnsten & Fredman (2000, pp. 7-8), but the preoccupation with it needs to be assessed. The maintenance classifications (see chapter 2.1.) that the planned areas receive, relay a national standard in how the urban forests are to be maintained. These maintenance classifications have created a national *harmony*, in which the urban forests tend to look the same no matter the locality. These maintenance classifications may prove hard to combine with the wider adaptation of ecosystem services, as they do not necessarily consider factors other than visual ones. Maintenance of urban forests and green areas in general may need revising when, and if the ecosystem service approach is accepted and utilized.

City and land-use planning is work that relies on representations of the environment. The surrounding environment cannot be understood in its holistic wholeness as is, but is often simplified to provide a more concise review (Olwig, 2004). Which part is then left out and what is focused upon is left upon the decision-makers to decide. As the work relies on representations, the focus which is given to aesthetical components then becomes rather predictable. The case studies show tendencies in which landscapes that are perceived as beautiful to be protected. This preservation is often also related to the protection of *natural* areas within the development areas, which are in fact arguably less beautiful and harmonic than what is presented. Most of the protected *natural* areas are in fact areas which have been maintained by means of forestry for a long period. Therefore one may ask the question, that what is worth protecting? Instead of preserving *natural* areas (i.e. the beautiful), the preservation could be focused upon retaining the most benefits that the urban forest can provide (i.e. functional). The importance of protecting the functional urban forests can be validated with that dissecting and infilling on existing forested areas creates a whole new level of utilization. This utilization can cause *natural* areas to suffer from changes in ecological conditions. For land-use planning the question can be relayed as such: Is it better to plan split up residential areas with green corridors in between; or dense residential areas with more coherent green areas surrounding them? The presented three case studies follow the first paradigm. There might be many justifications for using the green corridors in between the housing areas, but one key criteria presumably is the volition of lowering distances for recreation. Addressing the issue of dense vs. sprawl land-use planning is discussed by Bolund & Hunhammar (1999, p. 299), who note that the size and cohesion of urban ecosystems (i.e. urban forests in this case) should not be compromised.

All of the sites in the case studies presented in this thesis are built on existing forests. The loss of existing forests is substantial in some of the cases: Hiukkavaara and Ritaharju have both around half of the total land area used for infill. These are largely forested areas (the change is evident in figures 12.-13. and 17.-18.) which are cut down to make room for housing. The construction of these residential areas to the outskirts of the city is perhaps a manifestation of a culture where the idyllic family unit is purposed to live in a suburban utopia. What is sure, is that this type of expansion has an effect on the forests that subside in the area, and in turn shape the urban forests as well. This expansion can consequently create a situation where the urban forests are only available for a homogenous population; those who live in spread out residential areas. The city presumably grows and with it the urban and rural forests are pushed out of reach for those who live in the city's core or centre. Active planning is required to preserve existing urban forests so that they benefit as many people as possible. Furthermore the lessened availability of urban forests can also create a situation, where the demand for urban forests can also plummet, thus further reducing the amount of urban forests available for the city residents in the long run (Hörnsten & Fredman, 2000).

The situation in Oulu northern Finland can be considered an allegory to the other cities in northern Europe, where development of cities often similarly takes place in forested outskirts of the city. The abundant availability of forests in Finland, 66% as according to Korhonen et al. (2013); and Sweden, around 55% (Statistics Sweden, 2013) does not mean that the need and availability of urban forests can be downplayed. Some ecosystem services are tied to local production and as such need space to provide these services in the vicinity of e.g. residential areas as well (Bolund & Hunhammar, 1999). The growth of northern cities in Scandinavia and the Nordic countries is bound to happen, and as it takes place, the proper understanding of urban forest amenities can help in creating a better living environment.

The use of Don Mitchell's (2008) six landscape reading axioms in this thesis proved to be challenging, as providing information that is adequately analyzed is arduous in a short structure. One key reason for the application of these axioms, was that of applying learnt understanding of landscape theory. It is arguable whether the axioms served to their best advantage, but they were a pivotal addition to the thesis and as such augmented the analytical work of the preparatory plans. Mitchell's (2008) axioms are more focused on societal issues of landscape in general, and applying them to comprehend and analyze urban forests is intriguing but challenging. The tables (figures 14., 19. and 24.) make the reading easier, but they can be considered partially too simplified. Conveying deeply analyzed landscape in a simple way is rather hard. Furthermore Mitchell's axioms (2008) can be considered more adapted to the analysis of realized and actual landscape, rather than the planned equivalent.

Ecosystem services provided by the urban forests in Oulu were studied based on a review done by Escobedo et al. (2011), a review which focuses on primarily pollution mitigation. The text done by Escobedo et al. (2011, p. 2080) list several benefits of the ecosystem services provided by urban forests, a list which this thesis uses as well. The services presented by Escobedo et al. are by no means fully saturated, as there are other ecosystem services that the urban forests can provide. These other provisions of urban forests are discussed by e.g. Bolund & Hunhammar (1999). The focus on pollution mitigation perhaps in the case of Oulu was not of highest importance, and as such a more in-depth critique of ecosystem services available in the case studies could of been made with the help of more references.

The need to rationalize the benefits of ecosystem services for planning is mentioned in the VILMO-plan (City of Oulu, Urban and Environmental Services, 2014). Currently the benefits of ecosystem services are not present in land use planning in the Oulu region, but the situation could improve if the system was more widely used and recognized.

The acceptance of ecosystem services relies on the ability of the ecosystem services to include the economical assessment. It is paramount to note, that if the services cannot be calculated with economical means, they are useless to the planning agenda. The situation where ecosystem services would be more widely accepted, might have downsides as well. The need for an economical point of view also creates a situation where, as according to Gómez-Baggethun et al. (2010, p. 1215), the creation of privatized land ownership can negatively influence the common public green space (and urban forests). Previously public urban forests could be dealt into private land due to the zoning process and its aim at giving titles to categorize and dictate land use driven by the market need. The aim for participation is mentioned, as it could be a way to improve interaction between land owners and users. With ecosystem services the viewpoints of the different groups could be better understood (City of Oulu, Urban and Environmental Services, 2014, p. 17). Monetization of ecosystem services is evidently challenging.

This thesis studies the perception and planning of urban forests on a early stage in the planning process. The observations and remarks are related to the preparatory local detailed plans of each site and case study. By studying these preparatory plans, it was easier to draw comparisons between the sites, as same kinds of documents were available for study. However the validity and feasibility of these preparatory plans is arguable, as the plans tend to change during the planning processes. The three cases studied showed a change in planning values; from lower ecological values present in Metsokangas (planned 1999-2000) to higher in Hiukkavaara (planned 2006-2008).

In conclusion the urban forests in the three case studies were given little appreciation other than the provision of recreation. The focus on recreation in establishing urban forests can be considered somewhat outdated as the ecosystem services concept can prove to be a more holistic approach in regards to benefits. The three case studies shared similarities in their valuation of urban forests, but the cases also proved to be different in their valuation methods. Hiukkavaara's planning relied more on the gains of a multifunctional urban forest. In the case of Ritaharju large recreational areas were created to protect *natural* values. The case of Metsokangas showed to have a predominant interest in *natural* vs. *cultural* areas. To protect and preserve the existing urban forests from further development, the functionality and usefulness of these urban forests should be emphasized and made more clear. The planning related to urban forests may change in Oulu in the future due to the recently conducted study on ecosystem services, and hopefully the concept will be utilized in the city's future land-use planning.

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