Conceptual design models for social values of urban forests [in Sundsvall]

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Abstract

There is an ongoing urban development process in Sundsvall and the proper provision of the social values of urban forests that can meet public needs is now one of the issues for the municipality to deal with in planning. Moreover, the recent focus on the rehabilitative aspects of forests in human health has become a strong motivation for the municipality to invest in providing sufficient and proper networks of greenery over the city. Therefore, to provide such values for establishing a sustainable connection between nature and urban life, studying the social values of urban forests and the municipality's objectives is considered essential.

This study aims to develop a deeper understanding of the social values of urban forests in everyday urban life and apply that knowledge to propose a series of conceptual design models that can meet those social values through designing urban forests.

In order to reach the aim, multiple methods have been employed to collect data. Data were collected through literature studies and discussions on urban forests, studying forest policy documents and the relevant theories behind urban forest design as well as studying comprehensive plans of Sundsvall. Moreover, conducting online focus group meetings with some of the representatives of Sundsvall municipality could contribute to learning about their green visions and green strategies for the city until 2040.

The study resulted in multiple outcomes including finding the most essential objectives that Sundsvall municipality seeks to meet the public needs, learning about the social values of urban forests and their contribution to urban life, and more importantly, proposing conceptual design models [for Sundsvall] that can provide the desired social values within the city.

Keywords: Urban forests, Social values, Conceptual design, Sundsvall

Preface

I have had a strong affinity for nature since my childhood. Everything about the earth and its natural elements awakens my curiosity and fascinates me. Through my studies as a geologist, I developed an understanding of the extensive mechanisms that create different morphologies and landscapes on the earth's surface and cause another consequential natural phenomenon along the way. Together with the work experience, I have formed an inseparable bond with nature and found a deep passion for solving landscape-related issues that can directly influence the natural environment of the cities. Later on, I dedicated my passion to landscape planning, and sustainable urban studies, because I realized the path to save nature from all the destruction that humans have brought upon the earth, goes directly through working with the interrelation between humans' social needs and nature.

The background I have in geology has always been a helping hand that provides me a broad perspective in understanding how, when, and why nature should be cherished and seriously considered to be present in man-made structures. Although 'nature' is a general term that contains all sorts of natural elements (water bodies, mountains, etc.), yet, I believe that trees play the most vital role in the future of the built environment when it comes to the preservation of environmental resources that benefit human beings.

Given the experience I have in working with the environmental values of urban forests in my prior projects, I strongly believe that a city without forests and trees is an unsustainable city. The wide range of social values in urban life provided by urban forests can not only be a crucial contributor to reconsider nature preservation in an urban environment but also can guarantee a healthier life inside the city. So, in my opinion, working with the urban forest is the calling to change urban life into a better version that benefits both nature and humans.

In addition to living more than a decade in Sweden that made me realize natural environments in urban areas have always been cherished by the Swedes, my prior studies about the advancing green visions that Sundsvall's municipality has set for the city became another source of inspiration for this study. These are the reasons I found this topic both fascinating to work with and rewarding to learn from. The following work contains conceptual graphics that I created with so much passion and respect for urban forests and trees. The sketches, digital drawings, graphic design choices, and even the chosen images are the labor of love. I hope you enjoy reading it as much as I enjoyed working with it.

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Summary

The proper provision of the social values of urban forests that can meet public requirements is one of the issues to deal with during the ongoing urban planning in Sundsvall. The inspiration behind this work comes from the prior studies that the author had about the green visions and green strategies in Sundsvall. Studies revealed that there are top priorities for further developments in Sundsvall that focus on the creation of a good-quality green network over the city, the provision of more recreational activities that meet the social values and also being sustainable towards climate change through being a fossil-free city until 2040.

According to Sundsvall's comprehensive plan, (2021), working with a good-quality green network for the city is a matter of strengthening Sundsvall's identity through achieving the desired social values. To provide such values, this study aims to develop a deeper understanding of the social values of urban forests and propose conceptual models that can meet the desired social values in designing urban forests. The aim is addressed through three main questions; What social values can contribute to urban forestry? What social values are considered to be achieved through urban forestry and forest policy [in Sundsvall]? How can social values be implemented in Sundsvall through practice?

In order to reach the aim and discuss the questions, multiple methods could contribute to finding answers to the research questions and achieving the aim of the study. A brief definition of urban forests and their related values along with the relevant theories that focus on the social values of urban forests could make a solid platform out of literature studies and theoretical approaches. Moreover, studying the relevant theories could contribute to learning about the interrelation of urban forests and social values. Later on, the theoretical approach could assist with setting the design principles for the conceptual design models. Through literature studies and a series of Online Urban Forestry Events that were held in March and May 2021, the social values of urban forests and their interrelation were discussed. To find the considered social values in Sundsvall, a series of early online focus group meetings on February 24th and 25th 2021 with the representatives of the municipality was also conducted and other municipal documents such as the comprehensive plan and urban forests policy were also studied.

The study resulted in multiple findings; first, social values of urban forests and their interconnection were detected and thoroughly discussed. Second, the most desired social values and objectives that are supposed to meet the public needs in Sundsvall were detected. And third, the conceptual design models that can provide those expected social values (proximity, accessibility, and recreational activities) were created. It is important to mention that accuracy is not the goal of the conceptual design models, and they are not connected to a specific location in Sundsvall. Their totality can be considered as the very first step of achieving the desired social values for the city and more detailed aspects of planning such as measurements, plant species, sunlight studies, etc. should be considered in further studies[1].

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[1] *This summary is written based on an understanding of the whole thesis by a ten-year-old person.*
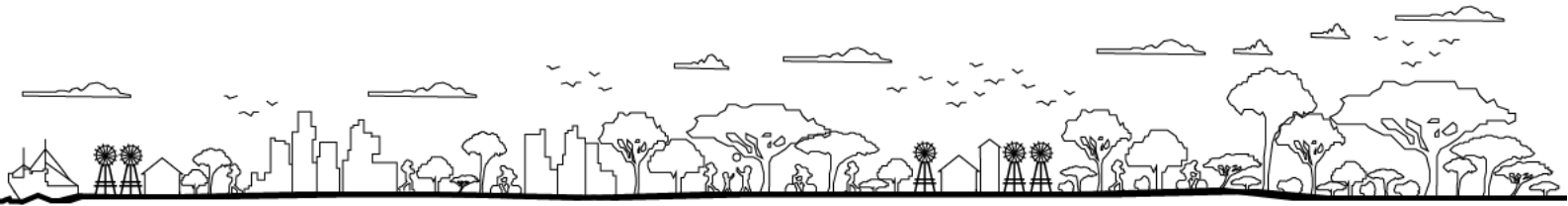
CHAPTER 1

INTRODUCTION
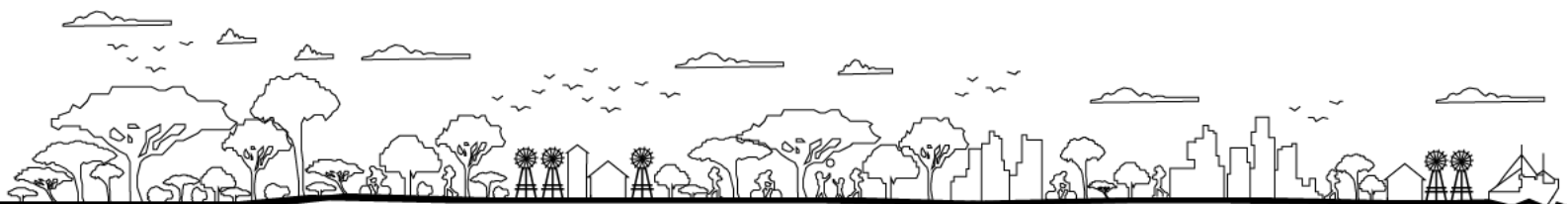
In the past century, the tendency to urbanization together with rapid population growth has increased significantly as a worldwide phenomenon. It is estimated that more than two-thirds of the global population will live in urban areas by 2050 (Palah, 2021). Cities are becoming more attractive because of the socio-economic benefits they can provide. Other than uncontrolled urban development that has led to massive environmental destruction, deforestation, land-use changes, as well as air and soil pollution, the increasing urban population has also resulted in increasing demand for recreational activities and better natural space that can meet the public needs. Urban forests as the natural elements not only can keep the balance between nature and the built environment but also as the cities' lungs should have dominant roles in urban landscaping and controlling uncontrolled development (ibid).

Forests are mostly used and known for their economic and environmental benefits. Urban forests, however, have been mostly seen/used as natural elements for keeping the aesthetics of the surrounding living environment (Späth, 2021). But this perspective is about to change around the world because of transforming the public demands since a few decades ago (Figures 1.1 and 1.2).

What are -in your view- the most important ecosystem services forests provide for the city/village where you live? (Multiple choices, Max. 3)
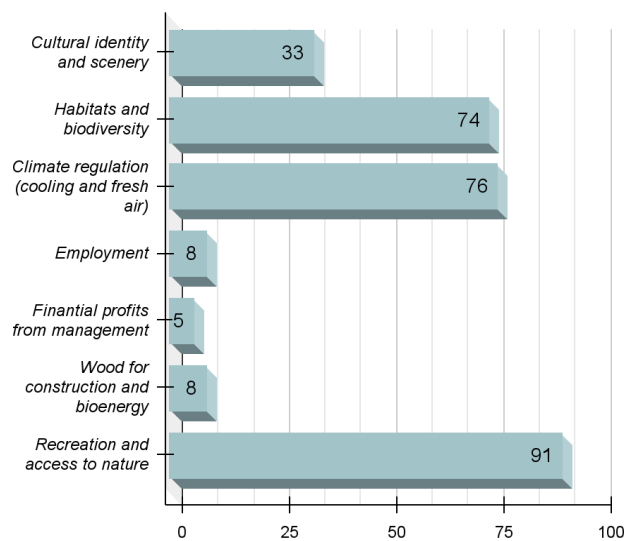
Figure 1.1. To the left; public opinion about the most important services provided by forests. Mojtabaei, S., 2021. (The question has been answered by 350 attendees of the International Urban Forestry Online Event and the result has been counted in percent).

Figure 1.2. To the right; the most important effects of urban forests on human well-being. Mojtabaei, S., 2021. (The question has been answered by 350 attendees of the International Urban Forestry Online Event and the result has been counted in percent).

Which are the most important effects of urban forests on well-being? (Multiple choices)

Although the provision of ecosystem services is still one of the top priorities, public expectations and demands have grown beyond the provision of aesthetics or just having a unidimensional role. Multifunctionality of the natural environments is now considered an important factor for societies and public demands for the provision of social values are increasing (Späth, 2021). In order to provide a sustainable connection between nature and urban life, provision of the social values should be considered as one of the important parts of urban development. Therefore, learning about the social values of urban forests and their contribution to urban life became one of the inspirations behind this work.

As it was also mentioned in the preface, my prior studies about the advancing green visions that Sundsvall's municipality has set for the city became another source of inspiration for this study. According to Sundsvall's comprehensive plan, (2021), the top five priorities of further developments can be concluded into the followings;

- Creation of a good quality green network over the city, especially in the center.
- Provide more recreational activities that meet the social values.
- Being sustainable and effective towards climate change.
- Using more clean energy and being a fossil-free city until 2040.
- Provide more educational opportunities for everyone, especially the young generation.

Working with a green network for the city is a matter of having the boldness to strengthen Sundsvall's identity (Sundsvall comprehensive plan, 2021). The green visions should be based on the municipal development plans that meet the social needs, and in-depth analyses of the ways that both the business community and the general public want Sundsvall to develop. Studies of fundamental principles for urban development in a 30-year perspective indicate that Sundsvall is determined to develop into a dense green town that provides equal accessibility, proximity, and security to its residents through a better green network over the town that can both meet and improve their social demands (ibid).

1.1. Aim and research questions

Inspired by learning more about the provided social values by urban forests and the green visions for Sundsvall, the main aim of this study is to develop a deeper understanding of the social values of urban forests in everyday urban life and apply that knowledge to propose a series of conceptual design models that can meet those social values through designing urban forests.

In order to reach the aim, the importance of urban forestry in urban planning and the social values for sustainable urban forest design are discussed and studied. The aim is addressed through three main questions;

- *What social values can contribute to urban forestry?* Urban forestry is multidimensional and in order to be sustainable, it should be economically, environmentally, and socially balanced. Therefore studying the social values of urban forests is important. New findings can sometimes change the course of planning into a better functional and sustainable version.

- What social values are considered to be achieved through urban forestry and forest policy [in Sundsvall]? Every city has its own social demands to be reached. Knowing about the most desired social values of urban forestry for a specific city can make a significant difference in both the planning and quality of its urban forests that meet public requirements.

- How can social values be implemented in Sundsvall through practice? Knowing about the public demands should finally reflect in the planning outcomes, and the opportunity to show possible forms of urban forests that can provide social values is considered essential.

Multiple methods have been employed in order to collect data which include literature studies, attending several Online Urban Forestry Events on March and May 2021, studying urban forest policy documents for Sundsvall and the relevant theories behind urban forest design, conducting online focus group meetings with some of the representatives of Sundsvall municipality on February 2021 to learn about the objectives and perspectives for the city, and also studying comprehensive plans of Sundsvall along with the green visions and green strategies for the city until 2040. The methods of study are discussed more thoroughly in the next chapter. Table 1.1 indicates the aim of the study and the research questions that contribute to achieving the aim.

AIM OF THE STUDY	RESEARCH QUESTIONS
✓ To develop a deeper understanding of the social values of urban forests in everyday urban life and apply that knowledge to propose a series of conceptual design models that can meet those social values through designing urban forests.	✓ What social values can contribute to urban forestry? ✓ What social values are considered to be achieved through urban forestry and forest policy [in Sundsvall]? ✓ How can social values be implemented in Sundsvall through practice?

Table 1.1. The framework of the study, Mojtabaei, S., 2021.

This chapter has provided a brief overview of the problem statement, the aim, and also research questions (see Figure 1.3). In chapter two, the relevant methods and the highlighted points of data collection are mentioned, so the reader can understand how the study methods contributed to forwarding the study.

Chapter three defines what an urban forest is and what urban forestry is about, its history, related values, and a perspective of urban forestry in multicultural societies. In the end, a summary discussion over the important aspects of the academic literature will be concluded.

Chapter four presents the theoretical framework for engaging with urban forests in Sundsvall. Moreover, the study scrutinizes relevant theoretical approaches and deeper literature review on social values of urban forests to indicate how they are interrelated and can be practiced in planning.
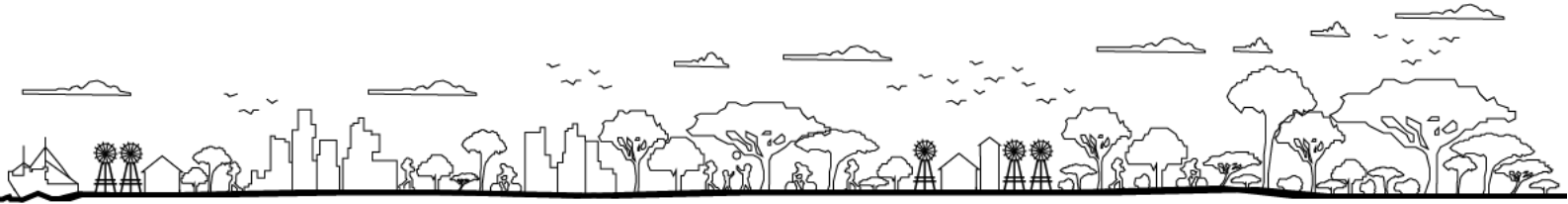
Further on, the analysis of municipal documents and online focus group meetings provide a solid foundation about their objectives and visions for a greener Sundsvall that on one hand, has a focus on the provision of social values and recreational opportunities for the public, and on the other hand, seeks for social values in urban forest policies.

All the data collection and data analysis from the previous chapters along with analyzing the municipality's objectives lead to forming the design principles for conceptual design models as the very first step that can be considered during the planning process. Results and discoveries are discussed both at the end of each chapter and also in chapter eight.

CHAPTER 1
A brief overview of the problem statement, the aims, and also research questions

CHAPTER 2
Relevant methods and data collection

CHAPTER 3
Definition of urban forest, related values, and urban forestry in multicultural societies (literature review)

CHAPTER 4
Theoretical approach and social values of urban forests (theoretical framework and literature review)

CHAPTER 5
Urban forestry in Sundsvall (municipal document analysis and focus group meeting)

CHAPTER 6
Data analysis

CHAPTER 7
Forming the design principles
And creation of the conceptual design models

CHAPTER 8
Discussion and conclusion

Figure 1.3. The document's roadmap, Mojtabaei, S., 2021. The applied methods of study are indicted in different colors.

CHAPTER 2

METHODOLOGY
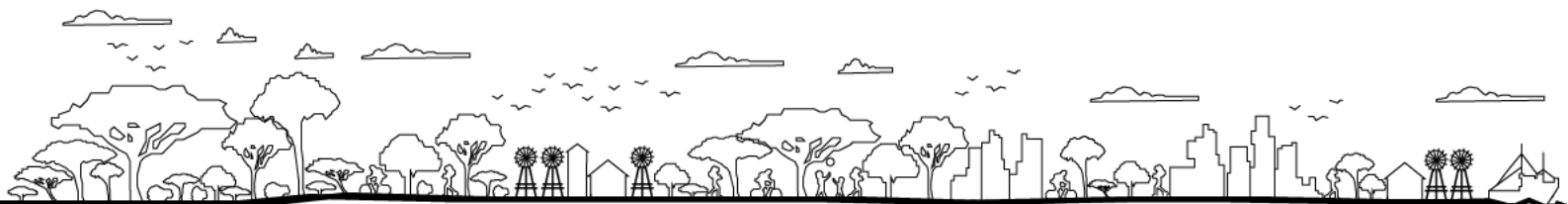
The chosen methods of study contributed to answering the research questions and reaching the aim (Table 2.1). As mentioned in the introduction, the study aims to develop a deeper understanding of the social values of urban forests in everyday urban life and apply that knowledge to propose a series of conceptual design models that can meet those social values through designing urban forests. Sundsvall City is the study area for my thesis and its selection is based on the ongoing urban developments which require sustainable design concepts that can improve the green strategies for the city, provide social values, and protect nature while constructions proceed. Therefore the conceptual designs focus on the expected social values of urban forests.

THE CHOSEN METHOD	THE PURPOSE OF CHOOSING
Literature review (Chapters 3, 4)	✓ *To develop a deeper understanding of urban forestry (Aim of study)* ✓ To find about the recognized social values in the academic literature
Theoretical framework (Chapter 4)	✓ *To find what recognized social values can contribute to urban forestry (Aim of study)* ✓ To find out how the social values of urban forests are being practiced in Sweden
Municipal document analysis (Chapter 5)	✓ *To find the desired social values for the city and conceptual designs (research question)* ✓ To learn more about the green strategies of the city ✓ To find out about future visions and plans for Sundsvall
Focus group meeting with Sundsvall municipality's representatives (Chapter 5)	✓ *To get the hold of municipal documents about urban forest policies (research Question)* ✓ *To find how the social values are dealt with in urban forestry policies (research Question)* ✓ To find about the social values of urban forestry in Sundsvall
Additional data	✓ To learn more about modern urban forestry ✓ To find out more about the social benefits of urban forests

Table 2.1. The important chosen methods of study. Aim and research questions are in color, Mojtabaei, S., 2021.

2.1. Understanding the theoretical and practical context

Literature reviews and theoretical approaches were the methods to understand the social values of urban forests and their interrelation.

2.1.1. Literature review

Data collection and data analysis have been done simultaneously through a broad series of online searches for scholarly literature as well as personal contacts with some of the urban forestry pioneers such as Cecil Konijnendijk and Alan Simson to get the hold of relevant literature and information. In order to take the step towards developing an understanding of the urban forests, their history, and their contribution to different values of urban forests, relevant pieces of literature were studied and summarized to make a solid foundation out of the urban forest definition and its values. A significant part of literature studies leaned on existing scientific articles and current ongoing international research about the urban forest and its values. Through the literature studies, the social values were recognized and separated from other aspects for a deeper study.

2.1.2. Theoretical framework

In addition to studying the social values of urban forests through literature review, three relevant theoretical approaches towards urban forests provided a framework upon which different aspects of human connection to green spaces as well as the interrelation between social values and different urban forest characters could be identified. The necessity of studying these theories came from their focus which is mostly on the classification of urban forests based on their accessibility, proximity, usage, and provided social benefits. So, they could partially contribute to forming the design principles behind the concepts for Sundsvall.

2.1.3. Additional data

Other related data for the study were gathered by attending the Online International Urban Forestry Online Event, held on the 24th and 25th of March 2021, and the Online Urban Forestry For Resilient Future Conference held between 4th-6th of May 2021. It is important to mention that watching existing documentaries about urban forestry played a pedagogical role in developing a perspective over different values of urban forests before the literature study.

2.2. Understanding Sundvall

Relevant methods were applied to understand Sundsvall and the desired social values.

2.2.1. Municipal document analysis

To be able to get hold of municipal documents that provide information about social values of urban forestry and urban forest policies, multiple online contacts with the key actors in Sundsvall municipality appeared essential to complete the study. The urban forest policy documents were sent via personal contacts with (Stadsträdgårdsmästaren) the city park manager and (Skogsförvaltaren) the forest administrator in the Sundsvall Municipality. In addition to the comprehensive plans, relevant documents about Sundsvalls municipality nature and outdoor activities plans, green space strategies for providing health and recreation opportunities as well as future urban visions for Sundsvall were studied and summarized in order to extract the most important information for further urban forest planning in the city.

2.2.2. Focus group meeting with Sundsvall municipality's representatives

Early online meetings with several key actors in Sundsvall municipality took place on February 24th and 25th, 2021 in order to address the research questions about finding the social values that are considered to be achieved through urban forestry and forest policy in Sundsvall, as well as understanding the general approaches towards the future visions for the city and evaluate the most expected qualities in planning for the green network of Sundsvall. The attendees were a group of eight people including urban planners, outdoor strategists, the city park manager, the forest administrator, etc. who all work in Sundsvall municipality. The focus of the meeting was about finding out the expected social values of urban forests in Sundsvall, urban forestry policies, as well as their plans, and green strategies for the city.

2.3. Development of the conceptual design models

Based on understanding the definition of urban forests and finding their social values, the conceptual design models are the outcome of methods of study that can contribute to taking the first step towards creating a livable sustainable environment where the social needs are met (Figure 2.1). The most important theme for the concepts is based on working with the social dimension and achieving the social function of the urban forests in this study. Nevertheless, ecological/environmental benefits can be also seen and considered as a bonus for working with urban forests in the designs.

Literature review (2.1.1)

Theoretical framework (2.1.2)

Municipal documents (2.2.1)

Focus group meetings (2.2.2)

Understanding social values And learning about urban forests

Understanding the interrelation between social values and urban forests

Finding about the green strategies and forest policies in Sundsvall

Finding about the desired social values of urban forests in Sundsvall

Forming the design principles and conceptual design models based on understanding the theories, findings from the municipal documents, and online meetings with the key actors in Sundsvall municipality

Figure 2.1. A roadmap to forming the conceptual design models, Mojtabaei, S., 2021.

The conceptual design models explore the design of urban forests in Sundsvall, whether the elements are considered new to the urban green network structure or they are the existing components that require changes in layout or management. Due to the evolving public demands, design has an essential part to play in landscape planning. The main focus of the designs is to include woodlands, parks, and street trees, especially around the residential areas, because as Ryan and Simson, (2002) mentioned the spatial layout of trees, their composition, as well as their color and structure, can deeply interact with the ways people perceive or use them in their everyday life.
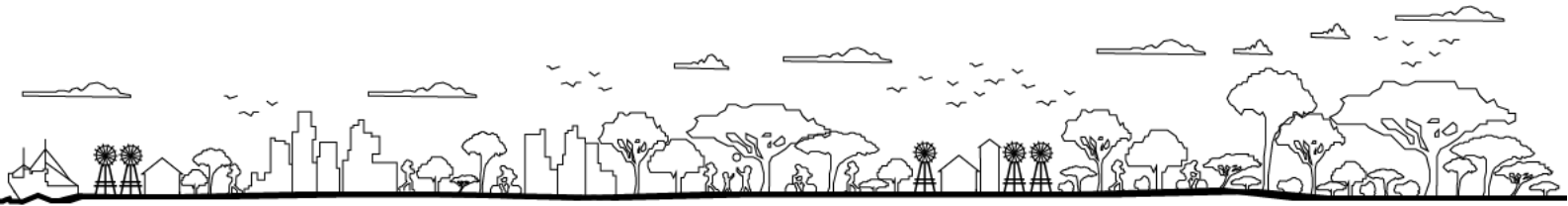
CHAPTER 3

URBAN FORESTS; DEFINITION, HISTORY, AND RELATED VALUES
A LITERATURE REVIEW
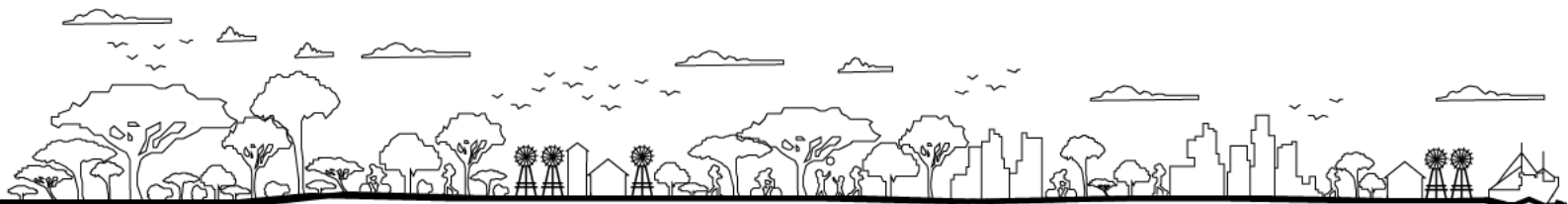
In order to form a solid platform for the studies, it is essential to know what urban forestry means and how an urban forest can be defined. This chapter includes the definition of urban forests, urban forestry, its history, and its different values. Although there is no simple, strict line between the different values due to their interrelation, the values are explained separately to lift the social values and take them on. The content of this chapter covers a small part of the aim of the study to develop an understanding of the role of urban forests as the natural resources for supporting sustainability in an urban environment during urban development.

3.1. Urban forests and urban forestry

The focus of this study is on the social values of urban forests within the field of urban forestry. Therefore it is important to have a clear understanding of their distinction. An urban forest is defined as the trees and shrubs in any urban area including yards, along the streets and corridors, protected areas, and watersheds (Miller et al. 2015, and Escobedo et al. 2011). However, according to Konijnendijk et al., (2005), the concepts of 'urban forests' and 'urban forestry' are relatively new and they are still subjects of ongoing debate because, in terminology, there is an important distinction between their 'concepts' and 'terms'.

> *"Concepts are considered mental representations of objects within a specialized context or field. They are not bound to particular languages, but they are influenced by social or cultural backgrounds. Concepts can take the form of terms, appellations, definitions, or other linguistic forms, (ISO 704:2000(E))."*

While the distinction comes from the culture and history of a nation, there is another reason for the diverse definitions of the concept; concepts change over time as the conditions change (Konijnendijk et al., 2005). Previously, the forest itself was mostly considered as a source of wood, but now it is valued by societies for the provision of environmental benefits and societal services, (Helms, 2002).

However, performing forestry in urban settings is not entirely new. Given expanding other aspects of the urban areas in terms of their economic, social, ecological, and political impact, more forests have become 'urbanized' as parks and green areas (Konijnendijk et al., 2005). Therefore, the concept of urban forestry deals primarily with the urban location and the urban function of the trees. In this context, and in order to harmonize different definitions, 'urban forestry' is defined as a multidisciplinary approach to the planning and management of all urban forest and tree resources influenced by the urban population while 'urban forest' includes all trees (in groups as well as single trees) in and around urban areas (ibid).

3.2. Urban trees in the international approach context

Worldwide rapid urbanization has been the most noticed character of the last century. According to Borreli et al., (2018), the increasing rate of the world urban population indicates a more than fivefold increase from 746 million people in 1950 to 4 billion people by 2015. It was also estimated that by 2050 the urban population in low and middle-income countries

would indicate more than double - and in some cases, more than triple - increase in their urban population (Borreli et al., 2018). Competing for space, demanding more products, and rising environmental pollution due to fast urbanization places tremendous pressure on adjacent natural resources in and around the cities. Uncontrolled urban development led the international discussions and debates into two main global development agreements endorsed by the international community in 2015; The 2030 Agenda for Sustainable Development and The Paris Agreement on climate change, (Borreli et al., 2018).

On one hand, achieving urban sustainability that can provide a safe, resilient city for all dwellers was the critical element in The 2030 Agenda. And on the other hand, based on the Paris Agreement approved by 195 countries, the most essential adaptations for preventing global warming and climate change mitigation should also be implemented in urban areas (ibid). However, A major challenge is to design and customize cities not only to overcome these global-scale problems but also resiliently planned to deal with other possible disastrous situations such as periodic floodings, heatwaves, hurricanes, etc.

Since well-planned and well-managed urban forests are the most essential components of green infrastructure in cities, nature-based solutions have come into the spotlight and gained a noticeable place in the first stages of urban development as the best possible strategies supported by the European Union (Calaza et al., 2018). These strategies emphasize the multifunctionality of green spaces in improving living standards along with the endless benefits of urban trees and urban forests. All the trees around water bodies and wetlands, along the streets, in residential areas, protected areas, and natural parks along with their associated vegetation inside and around the city shape the urban forests not only can in so many ways benefit us but also add to the values of the future nature investments for the city.

3.3. History of urban forestry in North America; last decades of the 20th Century

The concept of urban forestry and urban forest management did not emerge until the mid-1960s (Johnston, 1996). The birthplace of the term 'urban forestry' was Canada and it first came out in 1965 as a title for a graduate study on the success and failures of municipal tree planting in part of Metropolitan Toronto. Unlike Canada, which the term did not appear as an immediate success, in the United States, professional foresters responded promptly to the term and began to use it to describe the forest cultivation process and management of trees in urban areas (Jorgensen, 1986). While urban forestry remained mostly academic in Canada for many years, it took root in the United States and gradually grew into a national movement due to the positive attitudes towards urban forestry by many of the professional organizations concerned with urban trees (ibid).

Over 140 million acres of America's forests are located in cities and towns (U.S. Forest Resource Facts, 2014). According to Nowak and Greenfield, (2012a, 2012b) an average tree-cover in urban areas with a population density of at least 500 people/mi^2 is almost 35 percent of the urban land which is on the decline, and most urban tree-covers are established through natural regeneration. An estimated four billion urban trees in the United States provide countless benefits based on their function and composition (Nowak et al., 2013). The

most significant benefits of urban trees, besides their estimated basic economic values at $2.4 trillion, include air pollution removal which is estimated at 711,000 metric tons, and storage of 643 million metric tons of carbon per year (ibid).

New legislation and programs by local governments and the United States Department of Agriculture (USDA) at the beginning of the 1980s generated higher standards to create more pleasant environmental harmony between new urban development and existing infrastructure in order to protect the trees during construction activities (Dwyer et al. 2000). However, since the 1990s, despite the increasing importance of ecological benefits of urban forests in urban areas, an uneven distribution of urban forests across the landscape along with the declining effectiveness of urban forest management has become a growing concern in metropolitans. Due to the failure of municipalities to integrate elements of the green infrastructure into their planning and decision-making processes, it has been estimated that 634,407,719 trees have been lost from urban areas across the U.S. as the result of urban and suburban development (U.S. Forest Resource Facts, 2014). The locally inconsistent urban forestry programs eventually influence the social and ecological aspects of trees in the urban forest context.

3.4. History of urban forestry in Europe; last decades of the 20th Century

Although it has been a long time since the concept of urban forestry has emerged from North America and it has gone under constant development and challenges, such a concept reached Europe during the 1980s, firstly in the United Kingdom (Konijnendijk et al., 2005). The lack of international exchange of experiences, the absence of such an overview of research in specific areas, and underestimating the benefits of urban forests are the crucial reasons for the late arrival of the subject area in European countries (Konijnendijk et al., 2000).

According to Konijnendijk, (2003), the most essential confusion in acceptance of urban forestry is related to the difference between the 'concept of urban forestry' and the 'term of urban forestry' within the European context (Konijnendijk, 2003). As mentioned earlier, 'Concepts' are the cognitive representation of objects whereas 'terms' are the linguistic expressions' (ISO 704:2000(E)). Translations of the 'urban forest' concept in European languages - especially in German (Stadtwald), Dutch (Stadsbos), and Finnish (taajamametsa)- often refer only to the traditional meaning of woodland elements of urban green structures while the urban forest represents a new approach to urban forestry and urban forest planning (Konijnendijk, 1999). The major confusion that comes from the translation of the terms is to determine what woodlands can be classified as 'urban' in the urban forestry context. However, in many cases, the urban forest coverage is defined as 'forest' within the municipal boundaries (Konijnendijk, 2003).

The support for the concept of urban forestry began with interested researchers, from forestry, and landscape architecture (Konijnendijk, 2003). In the early 1980s, a group of researchers at the Dutch state forest research institute undertook several study tours to North America to learn about the urban forestry approach. However, based on the close collaboration with American counterparts, Britain became the first European country as the representative of urban tree planting and urban forest management by setting up several large-scale urban

forestry projects in various cities. After Britain, Ireland was the only country that initially embraced the concept of urban forestry by reviewing their very first urban tree resource in Ireland in 1993 after the first Urban Forestry Conference in Dublin in 1991 (ibid).

Forestry is currently the driving force behind urban forestry development as a leading discipline in education. Despite the definition of the urban forest corresponds more to the dense forests in urban areas rather than urban green space in the European urban forestry context, the blooming of urban forestry researches together with the mutual benefits of the relationship between forestry and urban forestry have gradually established the broad acceptance of urban forestry as an innovative approach towards the tree-dominated part of urban green structures in Europe (Konijnendijk, 1997 and 2003).

3.5. Different values of urban forests

In industrialized nations, the main benefits of urban forests historically relate to health, aesthetic and recreational benefits, (Tyrväinen et al., 2005), but the benefits of urban forests and urban trees are much broader (Table 3.1). Here, in order to easily follow their provided benefits, they are listed into three major categories; Social values, environmental values, and economic values to be able to go through each value separately. The first following part explains the environmental benefits, the second part goes through the economic values, and finally, the social values as the third category are briefly mentioned.

Social values	Social benefits	Recreation opportunities, improvement of home and work environments, impacts on physical and mental health. Cultural and historical values of green areas.
	Aesthetic and architectural benefits	Landscape variation through different colors, textures, forms, and densities of plants. Growth of trees, seasonal dynamics, and experiencing nature. Defining open space, framing and screening views, landscaping buildings.
Environmental values	Climate and physical benefits	Cooling, wind control, impacts on urban climate through temperature and humidity control. Air pollution reduction, sound control, glare and reflection reduction, flood prevention, and erosion control.
	Ecological benefits	Biotopes for flora and fauna in the urban environment.
Economic values	Economic benefits	Value of market-priced benefits (timber, berries, mushrooms, etc.), increased property values, tourism.

Table 3.1. Benefits of urban forests and urban trees. Modified by Mojtabaei, S. (2021) *from Tyrväinen et. all, 2005, pp 81- 114.*

3.5.1. Environmental values of urban forests

There are countless expected ecosystem services inside a city that are truly performed by urban forests when they are in good condition. Urban areas are currently covering less than 3% of the earth's surface and yet they are responsible for producing more than 70% of global carbon dioxide emissions and a significant volume of other greenhouse gases (Salbitano et al., 2016). Due to the increase of greenhouse gases, cities and their dwellers are highly vulnerable to climate change. From seasonal floods and rising sea levels to the strong storms and unwanted forest fires due to the extreme weather conditions around the globe, millions of urban and peri-urban populations are going to be affected in the coming decades. Urban forests as the key components of restoring the balance between nature and the built environment not only impact climate change mitigation but also are significantly effective in making a more resilient urban environment (ibid).

Depending on the city's location, the air temperature within large parks could be up to 3 °C cooler than the surrounding built area (Tyrväinen et al., 2005). However, in order to benefit from the cooling effects the park should be larger than 1 ha because when the urban heat island effect is at the maximum point on days with low wind speed, a large green park can only cool the air temperature up to 400 m of the radius to the adjacent built area (ibid). The presence of urban forests and their provided shades in the built environment -especially close to the buildings- contribute to lowering energy costs, energy saving, reducing the harsh urban climate, moderating the urban heat island effect, and helping cities adapt faster and better to climate change (Brandt et al., 2016). In addition to saving energy due to the shade provision, urban forests can also reduce the significant volume of carbon dioxide (urban forests in Canada removed approximately 662.8 kt C in 2012, (McGovern and Jon, 2016) and provide oxygen, as well as reducing wind speed, minimizing air pollutants, and other small particles by trees (Konijnendijk and Randturp, 2004).

Aerosols, particulate matter, and dust are constantly removed by the leaves of the trees. According to Tyrväinen et. al., (2005) one individual tree provides a Sun Protection Factor (SPF) of 6-10, which means that the level of exposure to ultraviolet radiation from the sun reduces between one-sixth to one-tenth. Planting urban trees and creating urban forests should become an integral plan for the cities in order to raise awareness of the ecosystem services they can provide and simply as the guardians of human health.

Urban forests are also effective to protect soils against stormwater runoff and they can actively assist with both wastewater infiltration and storing water (Konijnendijk and Randturp, 2004). Up to 190 liters of runoff rain can be cut off by a large tree that is a tremendous help in reducing the risk of floods and landslides in the city (Dobbs et. al, 2018). A deciduous forest canopy can reduce the intense rainfall up to 21% in the summer and be effective up to 19% during the winter (Kuehler et al., 2017). Although the volume of stormwater reduction strongly depends on the city location and seasonal rainfall intensity, the tree canopy can reduce the stormwater discharge due to the gradual streamflow release over time (ibid).

Compacted soil loses its ability to absorb and store water whereas well-established green spaces with a fair number of trees and vegetated areas are showing otherwise (Kuehler et al., 2017). By increasing the urban soil permeability, the vegetated areas and exposed spaces to tree planting not only provide great storage for stormwater runoff and stores water below the ground for urban trees usage but also the tree roots infiltrate the pollutants before they reach the underground aquifers and contaminate the Drinkwater sources (Figure 3.1), (ibid).
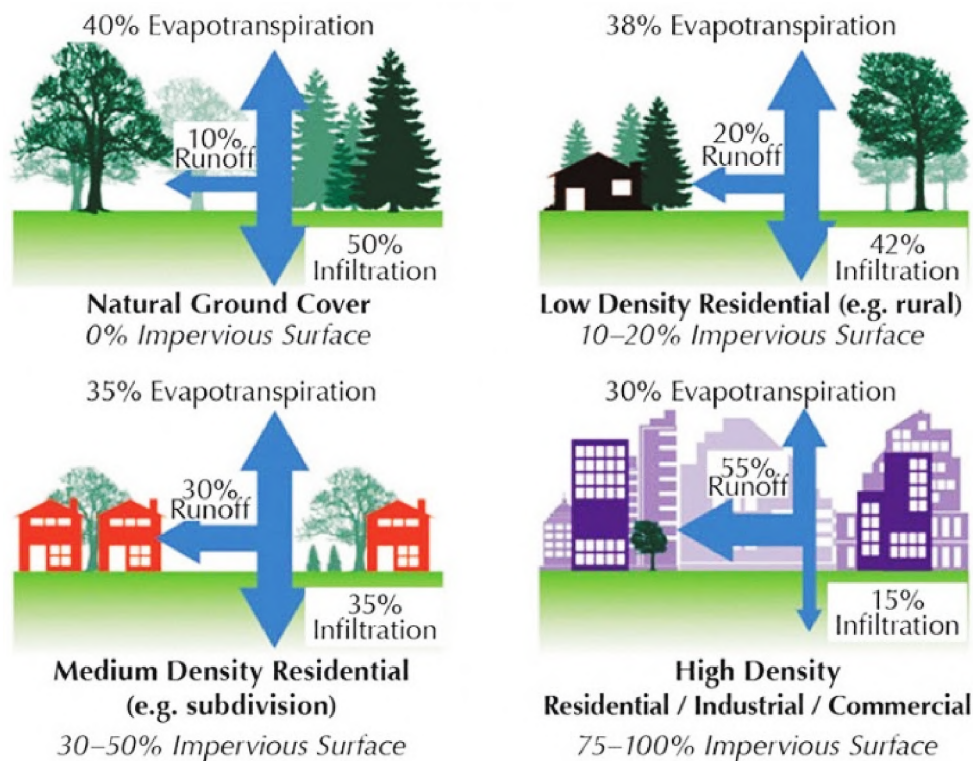
Figure 3.1. Runoff coefficient for developed areas, Highland Park, 2018.

BOX 3.1

Factsheet 5.1.3. © 2011 California state water resources control board all rights reserved. (with permission)

1. What is the runoff coefficient (C)?
The run-off coefficient is a dimensionless coefficient relating the amount of runoff to the amount of precipitation received. It is a larger value for areas with low infiltration and high runoff (pavement, steep gradient), and lower for permeable, well-vegetated areas (forest, flat land).

2. Why is it important?
It is important for flood control channel construction and possible flood zone hazard delineation. A high runoff coefficient (C) value may indicate flash flooding areas during storms as water moves fast overland on its way to a river channel or a valley floor.

3. How is it measured?
It is measured by determining the soil type, gradient, permeability, and land use. The larger values correspond to higher runoff and lower infiltration. (It varies between 0 and 1. The closer the runoff coefficient to 1, the less would be the infiltration and vice versa.)

Urban forestry can play a significant role in biodiversity conservation. According to Aronson et al., (2014) it is estimated that 20% of the world's bird species and 5% of the vascular plant species live in cities of which, an average of 70% of the plant species and 94% of the bird species are native to the urban area. Despite the green space fragments in cities, the level of preserved biodiversity in urban green spaces indicates a high natural variation close to the residential areas (Stewart et al., 2004).

According to the studies not only the city plants but also a large number of native threatened species -especially in Australia- are dependent on urban habitats (Ives et al., 2016). Urban forests are capable of maintaining age, genetics, and diversity in order to control diseases, provide multifunctionality for the ecosystem, reduce the risk of invasive plants, and increase the complexity of natural habitats, (Dobbs et. al, 2018).

In addition to providing ecosystem services and viable habitats, studies indicate that urban forests can significantly reduce noise pollution by absorbing disturbing high-frequency noises from traffic in urban environments. According to the report from Alliance for Community Trees (ACTrees) in 2011, planting the noise buffers that are combined by big trees and shrubs can mitigate the traffic noise up to 50% to the human ear.

BOX 3.2

<u>*How loud is too loud?*</u> © *2021 BIOKINETIX all rights reserved. (with permission)*

Decibels (dBA)

0 dBA	**Near total silence** Threshold of hearing
10 dBA	**Normal Breathing**
40 dBA	**Quiet Office**
60 dBA	**Normal Conversation**
85 dBA	**Handsaw** Max. 8 hours
95 dBA	**Truck or shouted conversation** Max. 2 - 4 hours
110 dBA	**Pnuematic Drill** 1 - 2 Minutes
120 dBA	**Rock Concert** 7 seconds
130 dBA	**Power Drill or Jackhammer** 1 second
140 dBA	**Jet engine at takeoff** Beyond threshold, immediate damage
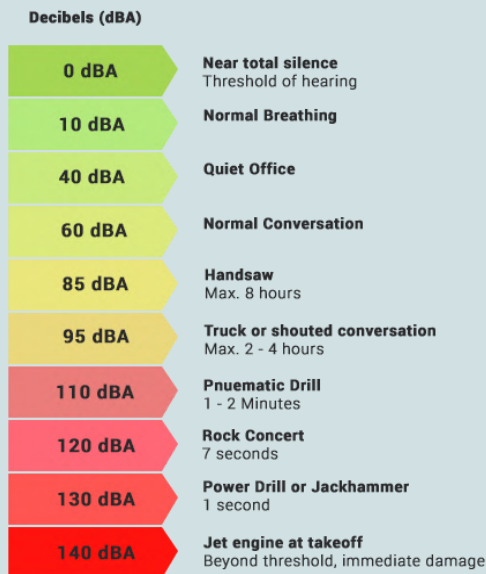
Noise is measured in decibels, using "A-weighted sound levels" (dBA) that measure how sound is perceived by the human ear. For example, a normal conversation would measure in at around 60 dBA, and the sound of a large truck being driven several yards away would be about 90 dBA. Noise exposure is dependent on one's proximity to the source of noise, as well as the duration of exposure to the source. In short, the louder the sound, the less time it takes to cause hearing damage.

By safeguarding biodiversity, urban trees and urban plants can be a source of food production, maintaining soil fertility, and providing aesthetic scenery for the city dwellers. Loss of urban forests and habitat fragmentations due to the city expansions can strongly impact natural ecosystem services in and around the city, and result in facing an irreversible chain of issues that are interrelated to the balance between humans and wildlife.

3.5.2. Economic values of urban forests

Urban forests provide benefits that go beyond environmental values. They provide many direct and indirect economic benefits that help cities build dynamic and prosperous green economies through green strategies (Salbitano et al., 2016). Direct benefits usually come from peri-urban forestry, wood production, tourism, the food industry, etc., while indirect benefits are often hidden under the shadow of environmental and social values. For instance, the provided shade and wind protection that is directly linked to ecosystem services and environmental values not only can increase the property value between 2-12% in some parts of the residential areas but also significantly reduce the energy costs and increase savings (Dobbs et al., 2018 and Salbitano et al., 2016). Also, the presence of large trees in yards and streets can add between 3-15% to home values as well as customer satisfaction with a rise in canopy coverage (Wolf, 2004).

Other than the forest industries and products that play a crucial role in the economic system, urban forestry can also have a significant impact on the economy, generate employment, and lead to socio-economic equity (Salbitano et al., 2016). Urban forests can be planned to directly influence the economic development of a local community (Wolf, 2004). For instance, urban agroforestry practices can produce human and animal foods as well as medicinal materials. Based on the cultural trends and the urban capacity, all kinds of business opportunities such as gardening, food production, planting medicinal herbs, tree-care services, tourism, and forest management services can appear as a promising sustainable green strategy and boost the local green economy (Wolf, 2004 and Salbitano et al., 2016).

Urban forests contribute to city development in many ways including being the natural wealth that supports urban welfare and also providing wide ranges of goods and services for urban settlements (Killicoat et al., 2002). The rising awareness of the importance of urban trees in urban development strategies has caused the communities to include urban forests in the policies that modify tree qualities and distribution as productive and public infrastructural systems that have economic benefits. A city would never develop piece by piece with no advanced planning for green infrastructure (Wolf, 2004). Urban forests are pieces of nature in cities that should be administered in a way that grey infrastructure systems have been because urban trees provide ecosystem services that also contribute to cool cities, conserve energy, reduce runoff, and absorb pollutants as well as the provision of social values such as human wellbeing and aesthetics. Moreover, urban forests represent productive assets that can attract new investments and developments to the city and encourage civic participation (Wolf, 2004 and Killicoat et al., 2002).

Due to the multiple roles and competing interests, it is difficult to address the total economic benefits of urban forests (Killicoat et al., 2002). Table 3.2 indicates a few key concepts of the economic valuation approaches that can be applied to a variety of situations. However, the main values of urban forests have no market price (Tyrväinen et. al., 2005). These values can be identified as the non-consumptive values and their benefits are derived from reduced wind velocity, balanced microclimate, erosion control, providing clean air, and a pleasant landscape, as well as the diversity of their recreational activities (ibid).

THE KEY CONCEPTS	THE KEY DEFINITION
Use value	Harvested goods from green space such as food or fuel may have market value or substitute for market goods.
Environmental services	Natural areas provide services to society such as stormwater reduction or air pollution reduction and the costs of creating such services using built systems are deferred.
Hedonic pricing	The value of an amenity such as the effect of a park on a home price is determined as increasing the purchase price.
Travel cost	The costs that people are willing to add to a trip to experience a desirable amenity or landscape are calculated by this method.
Contingent valuation	The willingness to pay for an actual or hypothetical change in environment, lifestyle, or landscape condition is stated by consumers, often in surveys.
Externalities estimation	The costs of a negative consequence of a landscape condition or change are assessed through this method. For instance, the health costs associated with human inactivity in cities that are not walkable.

Table 3.2. A few key concepts of the economic values of urban forests. Mojtabaei, S.,2021 from Wolf, 2004.

3.5.3. Social values of urban forests

The social values of urban forests are one of the most crucial parts of this study and they are going to be mentioned quite briefly in this chapter via Table 3.3. These values together with the theories and their interrelation with urban forests are thoroughly explained in chapter four.

SOCIAL VALUES	URBAN FORESTS IMPACT ON THE VALUES
HEALTH AND WELL-BEING Physical activities, Stress-relief, Psychological well-being	✓ Increase physical well-being ✓ Improve mental health ✓ Increase illness recovery ✓ Increase pain tolerance ✓ Improve workability ✓ Reduce sick leave
NATURAL/CULTURAL HERITAGE Public events, nature preservation, Sense of community, Cultural learning	✓ Increase awareness of the environment ✓ Increase integration with public events ✓ Increase sense of community ✓ Increase nature preservation
SOCIAL INTERACTIONS AND CRIME REDUCTION Brain development, Social cohesion, Getting to know other people, Hostile behavior, Responsibility, Safety and security, Discrimination	✓ Improve brain development ✓ Increase social health ✓ Reduce social isolation ✓ Increase social cohesion ✓ Increase tolerance to natural disasters ✓ Increase responsible behavior ✓ Increase sense of community ✓ Increase neighborhood safety ✓ Reduce discrimination and hostile behavior

	✓ Improve scenery
AESTHETIC ASPECTS AND SENSE OF PLACE Scenic value, enjoyment, relaxing, Aesthetic addition to the place, Place attachment, Memories, Social interactions	✓ Motivate outdoor activities ✓ Decrease mental stress ✓ Add more value to the place ✓ Shape the social identity ✓ Motivate nature preservation ✓ Improve sense of attachment ✓ Increase social interaction ✓ Decrease social isolation
EDUCATIONAL VALUES Learning skills, Creativity, Brain development	✓ Increase interaction with nature ✓ Increase environmental protection ✓ Increase learning skills ✓ Improve creativity ✓ Increase productivity ✓ Motivate sense of learning
RECREATIONAL VALUES Walking, Group activity, Riding a bike, Mixed-use activities	✓ Provide outdoor activities ✓ Improve human well-being ✓ Increase mobility ✓ Increase social health ✓ Reduce social isolation

Table 3.3. The interrelation of social values and urban forests, Mojtabaei, S., 2021. To the left, this table indicates the studied social values and the most known forms of them. In the middle, the impact of urban forests on the social values are mentioned.

Urban dwellers can easily lose contact with nature, especially when there is not a noticeable green network nearby (Tyrväinen et. al., 2005). Other than the provision of ecosystem services and biodiversity, urban forests can promote the urban environment by providing social values. Today, urban forests are symbolized through personal and socio-cultural meanings, and therefore they are held meaningful and important to people. They provide a joyful and pleasant environment through aesthetic benefits and create opportunities for different outdoor activities (ibid).

Moreover, urban forests can provide a unique experience of nature in the middle of urban life (Tyrväinen et. al., 2005). Along with important educational values, remaining old forests with big trees may provide opportunities to recover from daily stress, revive memories and regain confidence. Regular contact with trees -especially for children- can help people learn about nature and cherish its benefits for society (ibid).

3.6. Urban forestry in a multicultural society

The multicultural character of societies is not a new phenomenon. Over the past century, globalization in the economic, political, and cultural realms has massively altered the character of immigration and has dramatically changed both the dynamic of modern society and the composition of the population (Johnston and Shimada, 2004). Not only do many cities attract large numbers of new residents from all around the globe with different languages and cultural backgrounds, but also unfortunate situations such as war and political conflicts in troubled societies cause the new arrival of refugees and asylum seekers (ibid).

Influxes of non-European immigrants and asylum seekers have increased the multicultural set-up of urban populations in European countries and due to the fragmentation of families, socializing on occasional outdoor events such as open-air concerts and seasonal festivals has become important in order to integrate with society (Konijnendijk et al., 2005). Urban forests -especially public green spaces- should offer a great opportunity for everyone to be able to meet in an arena that can be used in a participatory principle in order to benefit all (ibid).

Outdoor social interactions have always been the major purpose of urban green space designs (Johnston and Shimada, 2004). However, studies indicate that among the provided social values by urban forests, both a strong sense of place and well-being can play a crucial role in how different ethnic groups understand their local landscape. Therefore the area must be viewed as a safe and non-threatening environment. It is important to mention that as much as Informal social inclusion -especially among the younger generations- can promote, on the other hand, high levels of crime, anti-social behavior, and racial harassment may discourage them to integrate with public open space (ibid).

The challenges and opportunities of a multicultural society should concern everyone. The role of cities as the focal points of socio-cultural platforms is to provide their inhabitants with appropriate green space that is considered to be both close to nature and open to everyone (Tyrväinen et. al., 2005). Since the social values of urban forests must be included in the green strategy, multicultural residential areas may need extra attention while the preferences and principles for the creation of urban forests are being set, because studies indicate that certain trees or plant species can be particularly important to the non-native part of the society (Johnston and Shimada, 2004). The sociological benefits of urban forests should be closely interrelated to urban forest strategies and be able to effectively address social inclusions and the needs of ethnic communities. This can be achieved through adequate community education and the involvement of distinct ethnic groups in different social interactions that are specifically designed to encourage their participation (ibid).

3.7. Summary of the literature review in this chapter

As it was mentioned before, urban forestry is a multidimensional phenomenon, and in order to be sustainable, it should be economically, environmentally, and socially balanced. Through this chapter, the literature review contributed to developing a deeper understanding of urban forestry and urban forests, different values of urban forests, and their interdependence. The social values that can contribute to urban forestry were also briefly mentioned in table 3.3 to prepare a background that can address one of the study questions; What social values can contribute to urban forestry?

Detecting the interrelation of urban forests and social values is an important part of this chapter that can contribute to taking one step further towards making the conceptual design models and provide these values in everyday urban life. The findings for Table 3.3 build a solid platform for the more thorough discussions in chapter four. Chapter four includes the theoretical framework and the literature review on the social values of urban forests.

CHAPTER 4

UNDERSTANDING THE THEORETICAL AND PRACTICAL CONTEXT
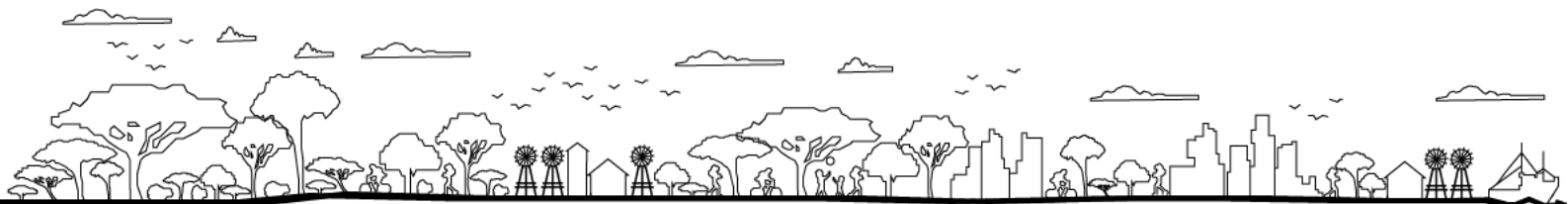
The focus of this chapter is to make a transitional platform in the form of a theoretical study in order to have a closer perspective of the role of urban forests as a dynamic part of the public's everyday life to understand how they are classified, and what social values each classification can provide. In order to reach this goal and more importantly forming the design principles for the design models in chapter seven, studying the provided social values by urban forests is the first essential step to take. Moreover, as the second step, three theoretical approaches towards urban forest classification are also studied and briefly explained. However, because there is a massive overlap in the provided social values by each character, social values appeared as a clue to see how different characters can fit into each other and develop the concept behind designing a specific green area.

The first theoretical approach is from Rydberg and Falck, (1999) that mentions the classification of urban forests in Sweden based on their size and usage. The second theoretical approach is from Ryan and Simson, (2002) that brings out the direct linkage of social values to design-related issues in urban forests. And the third theoretical approach is from Patrik Grahn, (1991) that is based on eight classified park characters and explains the human interaction with each character. Every approach is summarized into a related table that contains the most highlighted points of the classified category.

4.1. Literature review on the interrelation of social values and urban forests

In general, there is a complex relationship between society and landscape (Swanwick, 2009). The chosen recreational activities often reflect the type of engagement and public attitude towards the surrounding natural landscape. However, whether the engagement with nature is through direct activity or indirect involvement, the behavior can be strongly shaped by different factors such as age, ethnicity, economic status, and more significantly, the place someone has grown in. To form a closer connection to nature, early education, understanding the public's needs by the key actors, and also the proximity to urban forests are essential factors and may direct the society's relationship with nature in the future (ibid).

As mentioned in chapter three, the benefits of urban forests are broad. On one hand, urban forests contribute to stress reduction and promote social contact, on the other hand, they have countless environmental and economic benefits that can directly impact social values (Urban Forestry Online Event, 2021). For instance, as an environmental benefit, urban trees can massively reduce air pollution and provide cleaner air that can result in human health increase, and their ability in noise reduction can lead to less stress-related illnesses and decrease anxiety. Moreover, the closeness of urban forests to the residential areas can both provide shade and wind protection in addition to their aesthetic aspects, feeling of protection, and decrease the energy costs in the building (ibid). To make the notion of sustainability, social values, environmental values, and economic values should exist in balance to be able to make a liveable society that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (Brundtland Commission Report, 1987). In order to understand the impact of urban forests, social values are thoroughly explained based on the supporting references in table 4.1.

SOCIAL VALUES	IMPACT OF URBAN FORESTS	REFERENCE
HEALTH AND WELL-BEING Physical activities, Stress-relief, Psychological well-being	✓ Increase physical well-being ✓ Improve mental health ✓ Increase illness recovery ✓ Increase pain tolerance ✓ Improve workability ✓ Reduce sick leave	Tyrväinen et. al, 2005 Ulmer et al., 2016 Kuo, 2015, Davern et al., 2016 Richardson et al., 2013 Grahn, 1991, Grahn et al., 2012 European Forest Institute, 2021 Swanwick, 2009
NATURAL/CULTURAL HERITAGE Public events, nature preservation, Sense of community, Cultural learning	✓ Increase awareness of the environment ✓ Increase integration with public events ✓ Increase sense of community ✓ Increase nature preservation	Tyrväinen et. al, 2005 Salbitano et al., 2016 Gómez et al., 2013 Ryan and Simson, 2002
SOCIAL INTERACTIONS AND CRIME REDUCTION Brain development, Social cohesion, Getting to know other people, Hostile behavior, Responsibility, Safety and security, Discrimination	✓ Improve brain development ✓ Increase social health ✓ Reduce social isolation ✓ Increase social cohesion ✓ Increase tolerance to natural disasters ✓ Increase responsible behavior ✓ Increase sense of community ✓ Increase neighborhood safety ✓ Reduce discrimination ✓ Reduce hostile behavior	Tyrväinen et. al, 2005 Davern et al., 2016 Grahn et al., 2008, 2012 Gómez et al., 2013 Fan et al., 2011 Tidball et al., 2018 Holtan et al., 2015, Kuo, 2003 Jennings et al., 2016 Bogar and Beyer, 2015 Salbitano et al., 2016 Branas et al., 2011 Ryan and Simson, 2002
AESTHETIC ASPECTS AND SENSE OF PLACE Scenic value, enjoyment, relaxing, Aesthetic addition to the place, Place attachment, Memories, Social interactions	✓ Improve scenery ✓ Motivate outdoor activities ✓ Decrease mental stress ✓ Add more value to the place ✓ Shape the social identity ✓ Motivate nature preservation ✓ Improve sense of attachment ✓ Increase social interaction ✓ Decrease social isolation	Tyrväinen et. al, 2005 Jennings et al., 2016 Dandy, 2010 Ryan and Simson, 2002 Gómez et al., 2013 Coles and Bussey, 2000
EDUCATIONAL VALUES Learning skills, Creativity, Brain development	✓ Increase interaction with nature ✓ Increase environmental protection ✓ Increase learning skills ✓ Improve creativity ✓ Increase productivity ✓ Motivate sense of learning	Salbitano et al., 2016 Sharik, 2009 Olsson, 2012 Kellert, 2005 Grahn, 1991 Davern et al., 2016
RECREATIONAL VALUES Walking, Group activity, Riding a bike, Mixed-use activities, outdoor activities	✓ Provide outdoor activities ✓ Improve human well-being ✓ Increase mobility ✓ Increase social health ✓ Reduce social isolation	Tyrväinen et. al, 2005, 2009 Grahn, 1991 Rydberg and Falck, 1998 Bolin and Chesney, 1974

Table 4.1. The interrelation of social values and urban forests, Mojtabaei, S., 2021. To the left, this table indicates the studied social values and the most known forms of them. In the middle, the impact of urban forests on the social values are mentioned and to the right, the list of references that these social values were detected can be seen.

4.1.1. Health and well-being

Health benefits in metropolitan and industrialized cities are historically related to the main benefits of urban trees (Tyrväinen et. al, 2005). When it comes to human well-being, not only trees can contribute to a better quality living environment, but also they can promote physical activities by providing space for recreational activities to decrease the risk of obesity, asthma, and diabetes, as well as improving the mental well-being by reducing stress, maintaining the heartbeat rate and blood pressure (Ulmer et al., 2016). Simple walking through the forested areas along the paths covered by intense tree canopy, decrease not only the level of inflammatory cytokines and elevated blood sugar but also has a massive effect on stress reduction, reduce the risk for poor mental health through physical activity, and improve spiritual feelings (Kuo, 2015, Grahn, 1991, Grahn et al., 2012, and Swanwick, 2009).

BOX 4.1

_Inflammatory cytokines__, p. 2. © 2015 Ming Kuo all rights reserved. (with permission)_

Inflammatory cytokines are released by the immune system in response to the threat and have been implicated in diabetes, cardiovascular disease, and depression. Chronically elevated blood glucose carries multiple health risks, including blindness, nerve damage, and kidney failure.

According to the report from Alliance for Community Trees (ACTrees) in 2011, the risk of asthma and other respiratory problems can be significantly reduced due to the infiltration of air pollution by trees. Another study from Columbia University indicates that in parts of the city where the tree density was the highest, the childhood asthma rate was the lowest. Regardless of population density and different sources of pollution, the rate of asthma fell by 24% for every 343 trees per square kilometer (Lovasi et al., 2008). However, in order to reduce pollen-related allergies in urban environments and yet maintain biodiversity, controlling the plant species and consulting with botanists can assist with a solid guideline to handle the situation wisely (ibid).

An attractive nearby natural area invites people to become more physically active, especially during their leisure time. Children, older people, and people with moving or walking disabilities who are restricted to move long distances are the most affected groups by the closeness of parks and urban forests that can provide an attractive green network to visit (Tyrväinen et al., 2005). Urban forest proximity for these groups can appear as a decent motivation to become more physically active and benefit from the natural environment. Easy access to the green network is essential for the active use of the area (Ryan and Simson, 2002, Urban Forestry Online Event, 2021). In 2001, half of the respondents in a survey study in Finland mentioned that the long-distance was the main reason for not using the urban recreational areas. Also, the number of studies in England indicates that the absence of nearby green space increases the number of less interested people being physically active (Tyrväinen et al., 2005).

Beyond the physical health benefits, other significant positive effects of urban greenery have been reported on the improvement of mental health and reducing stress. For a long time, not only has it been a public assert that long term exposure to urban stressors such as noise, crowding, and fear of crime can affect mental health and increase the risk of depression and anxiety, but also different studies indicate that regular contact with nature can work against these stressors and account for long-term physiological and psychological health benefits (Davern et al., 2016). In the late 1990s, studies in the United States and Sweden revealed that compared to the built environment without natural elements, having a visual experience of natural scenery or visiting even ordinary urban green areas decrease blood pressure, relax muscles tension, improve brain activity and physiological recovery (Tyrväinen et. al, 2005). According to Richardson et al., (2013), the spent time in green spaces has shown a noticeable improvement in mental and physical wellbeing from stress reduction and therapeutic effects on people with Attention Deficit Hyperactivity Disorder (ADHD) to increased physical activities, depression, dementia demotion, and Increased feelings of happiness.

According to Salbitano et al., (2016), The World Health Organization (WHO) Health Promotion Glossary from 1998, defines a healthy urban environment as;

> *"One that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and developing to their maximum potential". (WHO, 1998)*

Based on this simple definition, a balanced built environment plays a crucial role in human health. In order to reach such a balance, urban forests can provide three distinctive health-related functions for urban dwellers (Davern et al., 2016):

First and foremost the effect of urban forests on physical and psychological disease prevention is significant. From promoting regular exercise and being active to decrease stress and anxiety (ibid).

Second, urban forests can contribute to speeding up illness recovery. Several studies indicate that experience of natural scenery accelerates the process of physical healing, especially after surgeries, and increases pain tolerance in patients (ibid).

And finally, urban forests can perform a great role in therapy and rehabilitation. In 2015, the results from the nature-based rehabilitation studies in Sweden (Sahlin et al., 2015) indicated clear improvements (often statistically significant) not only in terms of reduced symptoms of depression, anxiety, and other stress-related symptoms but also in reduced sick leave and care consumption and improved workability.

4.1.2. Social interactions and crime reduction

Connection with nature especially from the early ages in childhood plays an essential role in children's brain ability and brain development (Davern et al., 2016). Several studies suggest that a diverse vegetated area with a distinctive topography not only can contribute to the

quality of the natural environment (Ryan and Simson, 2002) but also motivates children to be creative, take risks, discover their surroundings, enhance their sense of self, improve their concentration and their self-confidence, as well as continuing nature-based activities in their adult life (Davern et al., 2016).

A survey study by Fan et al., (2011) in Chicago also indicated that close parks and urban forests to the residential places not only mitigate stress levels through recreational activities but also provide this opportunity for the residents to interact with other people outside of their family and form a social network. Other studies also indicate that access to green environments is a link between nature and increased social cohesion, and major loss of green infrastructure can negatively affect the community identity and social inclusion (Grahn et al., 2012 and Gómez et al., 2013).

The institutionalized nature-oriented behavior can affect the general social health like the social connections within a community. According to Dutch research and also several other studies in the United States related to green space, especially trees, the positive connection between the urban forest and built environments contributes to better social interaction, reducing the social isolation feeling, and less depression (Tyrväinen et. al, 2005). It was also reported that in many cases, the strength of social connections between neighbors is directly related to the tree canopy cover that not only is an indicator of spending more time outside in nature and socializing but also the community's attachment to the environment can lead towards an environmentally responsible behavior (Holtan et al., 2015).

More recent studies indicate that access to green space can positively impact social cohesion, local interactions, ability to recover from natural disasters, increased sense of community in civic ecologic practices, neighborhood connection, higher safety and security, and crime reduction (Tidball et al., 2018). Also, a greener environment is often associated with lower levels of crimes, gun assaults, and acts of vandalism (Jennings et al., 2016).

Studies at the beginning of the 21st century indicate that the presence of green spaces in the city has a positive impact on violence and crime reduction (Bogar and Beyer, 2015). The role of the urban forest in a safer urban environment is mentioned by Kuo in 2003;

> *"The presence of trees and well-maintained grass can transform these no man's lands into pleasant, welcoming, well-used spaces. Vital, well-used neighborhood common spaces serve to both strengthen ties among residents and deter crime, thereby creating healthier, safer neighborhoods."*

Despite that, a couple of studies by Gobster in 1998 and Stodolska in 2011 suggested that discrimination and hostile behavior can be deteriorated by the green spaces -especially green walls- that physically divide the heterogeneous neighborhoods, other multidisciplinary researches by Salbitano et al., (2016), and Branas et al. in 2011 illustrate that crime and violence can be significantly reduced by urban green spaces.

In addition to the positive impacts of urban forests on crime reduction, other activities such as planting trees, creating community gardens, and regular maintenance of the semi-public or shared green space also strengthen the community bonds and increase the sense of safety in the neighborhood which leads to the less stress among the community members, and hence, the stress-related crimes will be also decreased (Rakhshandehroo et al., 2015).

In total, urban areas with street trees, public and semi-public green spaces appear to have stronger and more stable communities. Due to the safety value, the community intends to use the green space more frequently that can result in both increased social interaction between the community members and also increased mental health among the members (Kuo, 2003).

4.1.3. Natural and cultural heritage

Physiological and psychological studies of human beings' response to green spaces and trees indicate that humans have positive feelings toward nature and their natural surroundings (Tyrväinen et. al, 2005). Due to the countless health and safety benefits that urban forests can provide for a city, there has always been a positive desire to be around nature. This is the main reason that flourishing urban forests have been cherished by people and integrated into our cultural events (ibid). Strong support for tree-planting events and preservation of existing urban trees have recently become part of the traditions among people and communities, especially with rising awareness of climate change around the globe (Salbitano et al., 2016). Ancient trees and forests often possess strong cultural and social values; their persistence over decades and maybe centuries provides connections between generations and strengthens the feelings towards the place by creating a 'sense of place' and helping people feel attached to the city (ibid).

The cultural ecosystem services such as the place value, social cohesion, sense of community, physical and mental health, as well as social identity are directly associated with the cultural values of urban forests (Gómez et al., 2013). Cultural values have formed for a long time and they have been inherited by society, but public attitude and their actions towards nature and its provided services are difficult to be captured and monitored because they often emanate from the spiritual, moral, and educational values that reflect the attached symbolic views to nature (ibid).

Cultural references within urban forests may be an important tool to encourage social inclusion (Ryan and Simson, 2002). Public access to the large urban forests and natural parks (for the middle and lower classes) happened during the 18th and 19th centuries. The 21st century, however, brought an increasing demand for entertainment and amusement parks (Tyrväinen et. al, 2005). Nowadays, the pleasant environment that urban forests provide not only has become a solid platform for all kinds of socio-cultural attractions but also they have become an inseparable part of society's future demands. Every activity from the open-air summer events, concerts, festivals, exhibitions, and weekly markets to simply enjoying a walk in nature for its recreational purposes are both welcome and regularly followed by people as part of their cultural approach towards enjoying nature (ibid).

However, the limited knowledge about social expectations and specific needs of different groups of users which have roots in constant social changes and increasing demands on different types of green spaces appears as a challenge for the traditional concept of urban forests maintenance that is often designed according to the architectural and aesthetic standards (Tyrväinen et. al, 2005). Regardless of cultural changes, recent studies emphasize that the ideal green space for social interactions and cultural expressions consists of enough open space and also a sufficient number of trees that can provide shade and protection (Rakhshandehroo et al., 2015).

In order to help achieve SDG target 11.4 -"protecting and safeguarding the world's cultural and natural heritage"- (Figure 4.1), and also provide a solid platform for all generations to benefit from urban forests, the socio-cultural values should be fully integrated into urban forest management planning and policies (Salbitano et al., 2016).

Figure 4.1. SDG target 11.4, Cultural and natural heritage preservation. UNESCO, 2020.

4.1.4. Aesthetic aspects and sense of place

Before the 21st century, the beautification of the private gardens and parks played a major role in making green space in central Europe (Tyrväinen et. al, 2005). However, the aesthetic aspects of urban forests have been gradually affected after granting public access to the large parks that started a couple of centuries before. Due to the constant increase in urban population, the aesthetic aspects of urban forests are now expected to meet recreational aspects and provide both a pleasant natural scenery along with a healthy platform for daily activities in the urban environment (ibid).

Vegetation and especially different forms of trees and shrubs or a noticeable variation in plant composition and their structure is the crucial element of a natural place (Ryand and Simson, 2002). Because of the seasonal changes, urban trees are under constant change in shape, color, flowering, and fruiting which can add more value to the urban scenery (Figure 4.2). Different trees and plants define the open space, give it a dimension, and create a sense of place (Tyrväinen et. al, 2005).

The shape and structure of urban forests can attract people and motivate them to be physically active (Ryan and Simson, 2002). Environmental psychology studies revealed that people are attracted to high-quality urban forest aesthetics because of their stress-reducing effects, experiencing solitude, and peace (Tyrväinen et. al, 2005, and Dandy, 2010). The

frequent visiting of pleasant scenery can form a strong attachment between people and architectural values of trees that not only can consequently increase 'sense of place' and 'sense of community' but also a major loss of green infrastructure can negatively affect the community identity, and social cohesion (Gómez et al., 2013, and Dandy, 2010).

Figure 4.2. Seasonal variation of a row of Lime trees and their effect on the scenery, Shelli Jensen, 2012.

However, aesthetic values can change over time and get affected by trends and changing the cultural approach by society (Tyrväinen et. al, 2005). Aesthetics evaluations are presumed to be directly connected to the people's characteristics, their recreational activities, and more importantly, to their age and gender. The result of the studies in North America during the late 1990s indicated that because the diverse natural places were inspiring to the children, even more than a well-organized playground, children had a high sense of appreciation towards wild, dense, and hidden forests, whereas adults valued the open-forest landscape more than dense forests (ibid).

Other than respondents' characteristics, design parameters and size of urban forests also play an essential role in regular visiting by people (Ryan and Simson, 2002). Conducted observations and investigations by Coles and Bussey (2000) in Redditch indicated that the shape of urban forests was important. The smallest size of the urban forest that had been regularly visited by people was 2 ha. Smaller forests can also be attractive if they are connected by walking paths (ibid).

The strengths of aesthetic aspects of urban forests as green infrastructure are not only in the provision of beautiful scenery. Other intangible aspects and values such as the provision of a wide range of ecosystem services and tourist attractions are often tied up to the aesthetic values of a well-managed urban forest.

4.1.5. Educational values

Educational aspects of urban forests are broad; not only can people learn from nature but also they can learn how to protect and cherish their surroundings. Regular access to the natural environment along with outdoor activities can positively impact children's physical movement skills (Olsson, 2012). Studies indicate that other than recreational purposes of green spaces that can enhance the quality of the child-growth in the city, a diverse urban green area motivates children to play outdoors, enjoy the natural landscape, and explore dimensions of nature (Rakhshandehroo et al., 2015). The educational values of urban forests are significant, especially in natural environments that are large and benefit from a good diversity of plant species (Davern et al., 2016). Children pay special attention to the plant composition and recognize the difference between species and the variety of colors they show when they play outside and explore their natural surroundings (ibid).

The result of recent studies in several playgrounds indicates that the locations where benefit from the presence of shady trees and fresh open green grass appear as more favorable environments for children to play than the locations that suffer from lacking natural elements (Rakhshandehroo et al., 2015). The development of learning skills -especially in children- as well as improvement of creativity and productivity in adults, seem to be significantly enhanced through regular contact with nature (Sharik, 2009). Knowing this simply may cause some essential implications for the teaching and learning process in our society.

The way we interact with nature can make a significant difference in our learning (Salbitano et al., 2016). According to Kellert, (2005) there are three ways that people can experience nature; the first and the most important way is the direct connection through actual physical contact with nature. Being spontaneous and simply being there to walk, enjoy, play and feel nature. The second way is indirect, which still includes the actual physical contact with nature but through a more structured plan such as visiting a zoo or being in an open-air concert in a park. And finally, the last way is the vicarious or symbolic way that includes only the visual or verbal representations of nature scenery, such as watching a program in the media or looking at a picture.

However, among these ways of experiencing nature, the direct experience of nature has a great impact on cognitive and evaluative development in humans that is not replaceable by indirect contacts such as just seeing nature without being able to touch it or experience it closely (Sharik, 2009). Being connected to nature has always been the main source of learning about our natural surroundings that not only could contribute to increasing our knowledge and awareness of environmental issues but also motivates our sense of learning. Natural elements in playing areas can provide scope for change and challenge, exploration, and imagination (Grahn, 1991). According to Olsson (2012), the contribution of the impressive collection of plants in public gardens or well-managed urban forests to the recreational and aesthetic values of the place can often inspire people to learn more about different species of plants and flowers (Figures 4.3 and 4.4). In general, the richness of species in urban nature shows the urban residents that their city nature has its special features and diverse values to learn from (ibid).

Figures 4.3. and 4.4. A well-managed collection of plants. Tiergarten public park, Mojtabaei, S., Berlin, 2019.

Several studies during the late 1990s and early 20s indicate that direct human contact with nature is massively decreased (Sharik, 2009). Reduced contact with the natural environment has mainly roots in the urban structure; destruction of habitats that consequently lead to loss of species, rapid population growth, environmental contamination, urban development, and urban sprawl, deforestation, and depletion of natural resources along with the fear of violence are the main reasons that urban dwellers can lose their connection with nature (ibid). Fortunately, the same studies indicate that the proximity of urban forests to residential areas can positively compensate for some of the negative impacts and improve the relationship between trees and people (Urban Forestry Online Event, 2021).

4.1.6. Recreational benefits

Urban forests are priceless natural resources to people who seek to renew physical, mental, and spiritual feelings. Recreational benefits of urban forests include all the outdoor activities that on the one hand are directly related to natural resources such as trees, forests, lakes, etc., and on the other hand provide equal opportunity for everyone to be close and active in natural environments (Bolin and Chesney, 1974). Most of the studies on urban green space that have been converted into a practical guideline agree on countless recreational benefits that urban forestry can provide for a growing city. Recreational activities refer to engagement with exercise, relaxation, social contacts, natural studies, and aesthetic pleasure (Rydberg and Falck, 1998). Within the past three decades, major socio-economic changes such as population increases, better incomes, and increased mobility have led to a general increased demand for recreational aspects and urban forest recreational activities.

Urban forests offer attractive environments for all sorts of recreational activities such as walking, cycling, jogging, or simply visiting to enjoy the aesthetics and being close to nature (Tyrväinen et. al, 2005). The provision of biodiversity and entertainment that can compensate for the built area along with the multifunctionality of urban forests are the most important components that can attract people towards recreational activities and develop an attentive attitude towards nature. In this context, to be able to create a green space that meets the

public demand and provides their recreational preferences, the participation of people in the designing and planning process for the public green areas seems essential (Grahn, 1991). Studies indicate when people participate in decision-making processes for recreational planning, not only do they recognize the importance of urban forest recreation and its contribution to the local community but also their awareness and appreciation of urban forest recreation will increase (Bolin and Chesney, 1974).

The majority of people seek to be around nature because it is primarily about a change of environment that can be relaxing, educational, and healthy (Urban Forestry Online Event, 2021). However, urban forests have more to offer and the diversity of the recreational values is not limited. Depending on the type of activity, proximity, capacity, and size of the green area it can vary from the more intense activities such as visiting peri-urban forests, hiking, camping, fishing, and sightseeing to the more regular urban-related activities such as walking, jogging, cycling, walking the pets, enjoying nature, bird watching, outdoor photography, weekend picnics, and friendly gatherings.

The scenery has always been one of the most important reasons for the choice of destination (Tyrväinen et. al, 2009). Other than the frequency of outdoor activities that can be directly connected with the recreational values of the urban forests (the more undertaken recreation, the more obtained benefits), recreational opportunities in scenic landscapes can promote tourism attractions and increase economic development in both urban and rural areas. In Europe, nature tourism has been appreciated as a unique chance to diversify the means of livelihood (Tyrväinen et. al, 2009, and Urban Forestry Online Event, 2021).

4.2. The theoretical approach towards urban forests by Rydberg and Falck

The urban forests -especially spacious green areas for multiple activities- play an important part for the inhabitants of Sweden (Rydberg and Falck, 1998). Several studies indicate that almost 83% of the Swedish population lives in cities and the annual visiting of forest areas by the adult population is more than 80%, of which of all these visitings, 50% of them is the frequent visiting of the urban forests that are located less than 1 Km. from their houses. Therefore, the concern for protecting and enhancing the variety of urban forests in the expanding cities has become a general growing interest in the early planning process (ibid).

A successful and sustainable urban forest is the multifunctional one that not only can provide ecosystem services but also be a solid platform to support the rising public demands on green areas (Rydberg and Falck, 1998). Accurate silvicultural management (a pre-commercial thinning) is essential to create a sustainable urban forest, especially for the young urban forests that are now a considerable part of the green areas in cities and because they mostly consist of different varieties of broad-leaved trees and a mixture of different plant species, they can regenerate fast and often be very dense. However, in order to adapt to the actual functional use of the forests, the silvicultural treatments should differ between all the categories to be able to create and maintain forest structures (ibid).

The structural variation of the urban forests is as essential as the visual variation (Rydberg and Falck, 1998). While the visual variation can stimulate the sense of smell, taste, touch, and hearing, the structural variation not only provides a solid platform for enhancing visual qualities but also strengthens the diversity and creates a unique character to the green area. Although visual forest types may need a larger space to be able to provide a good experience of visual variation (ibid). Nevertheless, based on size and usage, urban forests can be classified into five main categories in Sweden (Table 4.2), (Rydberg and Falck, 1999).

SIZE AND USAGE CLASSIFICATION BY RYDBERG AND FALCK, 1999	PROVIDED SOCIAL VALUES (SEE TABLE 4.1)
1. Trees near houses ✓ Groups of the trees and large bushes close to houses ✓ Provide shadow ✓ Add to the aesthetic aspects ✓ Prevent the negative wind effect for the householders	✓ Health and well-being ✓ Aesthetical values ✓ Recreational values ✓ Sense of place ✓ Crime reduction ✓ Educational aspect
2. Neighborhood forest ✓ Relatively small forests within residential areas ✓ Provide opportunities for children to play ✓ Absolute proximity to nature ✓ Are mostly part of old forests ✓ They can be planted after the construction ✓ Common visitors, the elderly, children, and handicapped people	✓ Health and well-being ✓ Sense of place ✓ Aesthetical values ✓ Recreational values ✓ Social interactions ✓ Crime reduction ✓ Natural/cultural heritage ✓ Educational aspect
3. District forests ✓ Between two or more quarters of the town ✓ Meant to be used for short walks, bikers passings, and walking dogs ✓ Are often located close to the urban areas ✓ Mostly consist of old trees and more dense vegetation ✓ High level of biodiversity ✓ Suitable for frequent visitings, weekend picnics, enjoying the scenery ✓ Are mostly located near water bodies and lakes in Sweden	✓ Health and well-being ✓ Sense of place ✓Aesthetical values ✓ Recreational activities ✓ Social interactions ✓ Natural/cultural heritage ✓ Crime reduction ✓ Educational aspects
4. Recreational forests ✓ Large forests on the urban fringe, well-drained paths ✓ People travel for recreation purposes ✓ Suitable for long walks, fishing, hunting, camping, and exercising ✓ Are mostly the protected areas ✓ High level of biodiversity ✓ Include large lake/s, river flows, low-height stone hills or mountains	✓ Health and well-being ✓ Sense of place ✓ Aesthetical values ✓ Recreational values ✓ Social interactions ✓ Natural/cultural heritage ✓ Educational aspects
5. Production forests ✓ Located on the urban fringe ✓ Are mainly used for wood production, pulp, paper, and wood fuel ✓ Biodiversity is relatively low ✓ Rich in wild berries and mushrooms	✓ Health and well-being ✓ Natural/cultural heritage

Table 4.2. An overview of the classification of urban forests in Sweden based on their size and usage (introduced by Rydberg and Falck, 1999) along with the essential qualities of each category and their provided social values, Mojtabaei, S., 2021.

4.3. The theoretical approach towards design issues by Ryan and Simson

Identification of good practices in designing sustainable urban forests that can enhance social values seems essential. The natural environment is widely considered an important contributor to human health through the direct or indirect benefits they provide via ecosystem services. According to Ryan and Simson (2002), the closer the green areas are to the settlements, the more social values they can provide. The theme of this concept has been a motivation to European countries to collaborate on a project that is called 'Neighborhood Woods' that directly targets the planning and designing of the urban forests. The main objective of the project is to develop tools that are based on a strategic and multidisciplinary approach towards the diversity of European urban forests contexts, including the contribution of these urban forests to the quality of life in an urban environment and better management of our limited natural resources (ibid).

The proximity of the urban forest plays an important role in the frequency of using and visiting the area (Ryan and Simson, 2002). Several studies in the late 1990s and early 21st century in England Netherlands and Belgium indicated that the frequency of visiting an urban forest with a maximum threshold of 6-8 minutes walking distance (corresponds to 0.6 km) was desirable and weekly or daily visitings of a further urban forest (within 8 km distance from the settlements), would rise if the place had special attractions. The position of the urban forests and their proximity were both important inspirations to visit the area (ibid).

Creating nature-like areas close to the settlements can provide regular and equal visiting benefits for everyone (Ryan and Simson, 2002). In order to decrease the planting and maintenance costs and also to enhance the visual and ecological benefits of the urban forests, it is recommended to choosing native plant species and small planting stocks rather than large ones because they are cheaper to buy, tend to grow better, and chances of their survival are higher than the imported stocks (Ryan and Simson, 2002, cited Lucas 1991, Peterkin 1995).

As the urban forests get mature and old they become solid platforms for rich biodiversity, more aesthetic and recreational values, as well as conservation opportunities (Ryan and Simson, 2002). To enrich the new urban forests by native bird species, however, it is recommended to plant a mixture of large and small forests (more than 5 ha), along with a substantial percentage of native trees and shrubs. In addition to the bird composition, the population of small mammals can also be affected by changes in the ground vegetation or other management activities such as weed control and canopy closures (ibid).

Nevertheless, the size and structure of the urban forest can impact the visitors' experience (Ryan and Simson, 2002). Public preferences for different sizes of urban green areas indicate that well-structured vegetation can provide a time for the visitor to explore and experience the character of the area before entering a new visual forest type (ibid). In this context, the main design-related issues can be addressed in three general areas (Table 4.3).

DESIGN-RELATED ISSUES BY RYAN AND SIMSON, 2002	PROVIDED SOCIAL VALUES (SEE TABLE 4.1)
1. Urban forest location ✓ Proximity (6-8 minutes walking distance, corresponds to 0.6 km) ✓ Usage frequency (daily and weekly usage within 8 km distance from the settlements, if the place has special attractions)	✓ Health and well-being ✓ Social interactions ✓ Aesthetical values ✓ Crime reduction ✓ Natural heritage
2. Plant size and plant composition ✓ Native plants ✓ Natural-like planting (deadwood on the ground) ✓ Small planting stocks (faster growth, better survival) ✓ Different colors (diversity of species) ✓ Visual variation	✓ Health and well-being ✓ Sense of place ✓ Aesthetical values ✓ Social interactions ✓ Crime reduction ✓ Educational aspects
3. Size, shape, and structure of urban forests ✓ Naturalistic approach ✓ Smaller size; (0.5-5 ha, local, informal, limited recreational activities, limited species) ✓ Bigger size; (5-15 ha, wilderness experience, recreational values, fair and equal zoning) ✓ Open-structured is more preferred ✓ Experience different characters of the green area ✓ Fair and equal zoning	✓ Health and well-being ✓ Sense of place ✓ Aesthetical values ✓ Recreational activities ✓ Social interactions ✓ Natural/Cultural heritage ✓ Crime reduction ✓ Educational aspects

Table 4.3. An overview of the classification of urban forests based on design-related issues (introduced by Ryan and Simson, 2002) along with the essential qualities of each category and their provided social values, Mojtabaei, S., 2021.

4.4. The theoretical approach towards urban forests by Patrik Grahn

According to Grahn, (1991), the main question behind this theory was to find a basic pattern of characteristics in parks and green areas that contribute to understanding why certain parks are more appreciated than others. In order to reach the answer, they got in touch with different groups of people, key actors, local authorities, and different activity-provider organizations. 1600 park reviews were received that included the evaluation of park usage and the responses pointed at the heart of the study; why they use the park. An appropriate environment for the chosen activity is the most important criterion in using the place. It means that a strong correlation between specific activities and specific characteristics could be detected through the studies and this result could lead to the classification of eight major park characters based on their qualities (Table 4.4), (ibid).

However, not every type of activity is necessarily connected to a specific characteristic, for instance, most of the physical activities such as walking, jogging, or riding a bike can be done in both activity parks, and forest characters. Also, the studies revealed that different groups of people and different ages could mention different characteristics for the same park. It means a wilderness character can be seen as an activity park in the eyes of children while it can be seen as the rich species character for an adult. Nevertheless, the given impression by the park character could also clearly motivate the chosen activities (ibid).

EIGHT PARK CHARACTERS BY PATRIK GRAHN, 1991	PROVIDED SOCIAL VALUES (SEE TABLE 4.1)
1. Wilderness characteristic ✓ Natural-like planting with rich biodiversity ✓ Visual variation, different shapes and colors ✓ Un-planned few paths in the area ✓ Size does not matter	✓ Health and well-being ✓ Aesthetical values ✓ Natural heritage ✓ Recreational activities ✓ Educational aspects
2. Reach variety of species character ✓ Rich biodiversity ✓ Different shapes and colors ✓ Visual variation ✓ Add to the aesthetic aspects	✓ Health and well-being ✓ Sense of place ✓ Aesthetical values ✓ Recreational activities ✓ Natural heritage ✓ Educational aspects
3. Forest character ✓ Should be old, relatively dense, and large (at least 60 ha) ✓ Not too visually varied ✓ Rich biodiversity ✓ Should not have too many things to discover ✓ A great requirement for mental fatigue (Kaplan, 1990)	✓ Health and well-being ✓ Sense of place ✓ Aesthetical values ✓ Recreational activities ✓ Social interactions ✓ Natural heritage
4. Activity parks; Play inspiring ✓ Should be durable and visually varied ✓ Should make a place for imagination and challenge ✓ Should include different types of vegetation	✓ Health and well-being ✓ Recreational activities ✓ Educational aspects ✓ Social interactions ✓ Crime reduction
5. Activity parks; Sport-oriented ✓ Should make a place for imagination and challenge ✓ Should be surrounded by trees and woods ✓ Fine grass or gravel surface ✓ Fair and equal zoning, correct dimension	✓ Health and well-being ✓ Recreational activities ✓ Educational aspects ✓ Social interactions ✓ Crime reduction
6. The fine parks; Peaceful character (the most denied character) ✓ Should be large ✓ No permanent activity ✓ Quiet and peaceful environment ✓ Mature trees, open grassed areas, well-maintained	✓ Health and well-being ✓ Sense of place ✓ Aesthetical values ✓ Natural heritage ✓ Crime reduction
7. Intensive parks; Festive character ✓ Opposite of the peaceful parks ✓ Include lots of activities and entertainments ✓ Big on public activities	✓ Health and well-being ✓ Social interactions ✓ Crime reduction ✓ Recreational activities ✓ Educational aspects
8. Intensive parks; Square character ✓ The concentration of garden culture and building culture ✓ Often contains the work of art, statues, flowerbeds, etc. ✓ Can be found in different combinations ✓ Can reflect other characters	✓ Health and well-being ✓ Social interactions ✓ Crime reduction ✓ Sense of place ✓ Aesthetical values ✓ Cultural heritage

Table 4.4. Eight major park characters along with the essential qualities of each character and their provided social values (introduced by Grahn, 1991), Mojtabaei, S., 2021.

4.4.1. Wilderness characteristic

The character is perfect for instructive discoveries due to the rich impression of different colors and shapes of the vegetation (Grahn, 1991). The combination of vegetation looks natural and there may be a few un-planned paths in the area. The size of the area also is not important. There is a profound need for this character (need for mystery) among the visitors (ibid).

4.4.2. Rich variety of species characteristic

It is possible to discover and explore a couple of particular biotopes along with distinctive shapes and colors that represent a rich variety of species in a limited area (Grahn, 1991). This character satisfies the need for fascination and because it comes in different structures, sizes, and shapes of vegetation, it can add more value to the scenery (ibid).

4.4.3. Forest character

The forest character should give an impression of old, dense, and large areas (Grahn, 1991). The paths should be well-drained and have good quality. The number of activities is limited and there is no need to discover so many elements. A few deciduous trees, spring flowers, and mushrooms can appear ideal in a coniferous forest (ibid).

4.4.4. Activity parks; Play-inspiring character

The play inspiring parks are rare but there is a massive need for them (Grahn, 1991). The opportunity for exploration, imagination, and challenge should be impressive. These parks should be durable, have many elements, and motivate the children to play (ibid).

4.4.5. Activity parks; Sport-oriented character

A well-designed area with correct dimensions is mostly expected in this character (Grahn, 1991). There should be a good quality surface, enough changing rooms and the park should be surrounded by large trees to provide shadow and wind protection. These parks motivate people to be physically active and socially interact (ibid).

4.4.6. Fine parks; Peaceful character

It is a crucial factor that the park should be large, with an open well-maintained grass area, and does not provide a permanent activity (Grahn, 1991). The vegetation includes large trees in a small group or individual form. The park represents a quiet calm place where one can meet their need for silence and secure scenery (ibid).

4.4.7. Intensive parks; Festive character

This character represents an active social life and it has the exact opposite properties of the peaceful character (Grahn, 1991). People can meet and interact in this park and a variety of activities, entertainments, and amusement in these parks is welcome and expected (ibid).

4.4.8. Intensive parks; Square character

This character is a reminder of garden culture in combination with building culture (Grahn, 1991). It represents a small proportion of nature in the middle of a crowded area. They are not usually large, but they may include different expressive elements such as a fountain, statue, or flowerbed. The square character mostly represents the mysteries of our culture and appears as a place of social life and social interactions (ibid).

4.5. Personal reflection on the theoretical framework

Not only these eight park characters can be found in different combinations but also there is a significant overlap of social values among the different theoretical approaches that enable the possibility of integration of different characters. In fact, according to Grahn (1991), the combined form of the characters is more common in practice. The structure of the park, its location, and also the vegetation composition can provide a variety of characters in one place. For instance, occasionally the parks with the festive character may also offer a square character in some parts and suggest a forest character in other parts (ibid).

Regardless of the categorical variations in different approaches, the combination of different categories not only enhances the social values but also provides environmental benefits. For instance, the 'variety of species' character (introduced by Grahn, 1991) in district areas (introduced by Rydberg and Falck, 1999) with specific plant composition and proximity to the residential area (introduced by Ryan and Simson, 2002) can enhance the educational aspects of the forest, provide more recreational values, enrich the sense of place, provide more aesthetics, and also add to the environmental values (Figure 4.5).

Figure 4.5. Combination of different characters in one place, Mojtabaei, S., Berlin, 2019. To the left; forest character+square character. To the right; a Rich variety of species+forest character.

According to Rydberg and Falck (1998), people's preferences and needs for different green areas should be strongly considered by forest managers. A better understanding of people's preferences or their concerns about the problems associated with urban forests can also reveal why they use or do not use a particular urban forest area. In this context, Grahn (1991) mentions that parks can also negatively impact visitors. Surveys indicate that the most discouraging reason to visit a park is a feeling of insecurity. Insecurity is not only associated with vandalism or poorly maintained green areas but also is related to a large, empty park where there is not a chance to meet other people or have the stamp of an industrial area. These parks that people either avoid visiting or rarely visit are described as 'decayed' or 'nonresidential' green areas that only enhance loneliness and the feeling of insecurity. Studies indicate that provision of both nature and culture along with proper maintenance and choice of plants plays an essential role in their positive impact on people and adds more value to the qualities of the place (ibid).

The main outcome of this chapter for creating the conceptual design models is the strong basis that theoretical approaches could provide. The focus of studied theories in this chapter is on the social values and their interconnection to the urban forests. Therefore, these theoretical approaches are the supportive theories behind forming the conceptual design models.

Learning about the social values of urban forests can make a significant difference in both the planning and quality of the green network that is supposed to meet public requirements. In this context, studying the social values of urban forests and the theoretical approaches was the most important focus of this chapter and they were both thoroughly discussed. Moreover, data analysis from both focuses contributed to achieving part of the aim of the study, which is to develop a deeper understanding of the social values of urban forests in everyday urban life. Both focuses could also address another study question; What social values can contribute to urban forestry? And their interrelation could provide a strong perspective behind the design principles for the design concepts in chapter seven.
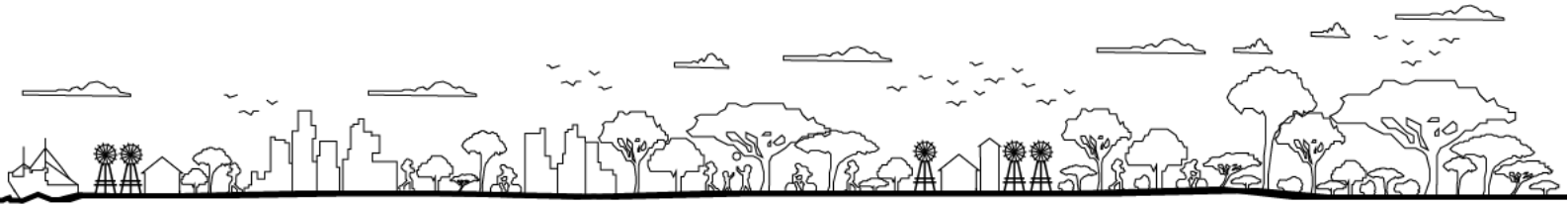
CHAPTER 5

UNDERSTANDING SUNDSVALL; URBAN FORESTRY IN SUNDSVALL
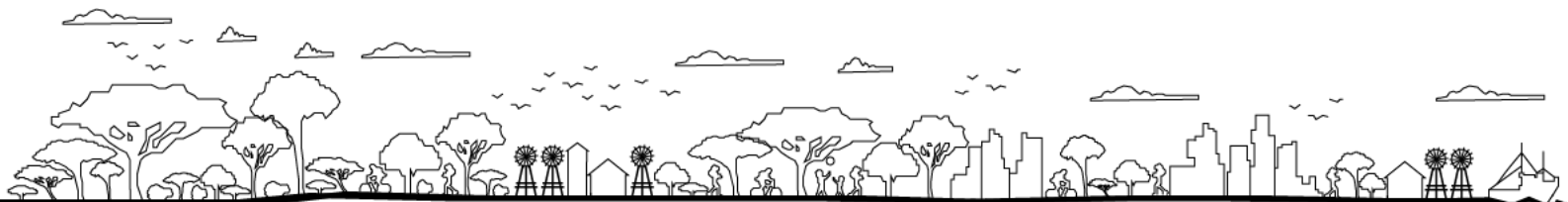
The main purpose of this chapter is to study the municipal documents and their objectives regarding urban forest policies, green strategies, and green visions they set and follow for the city. In order to know Sundsvall better, the history and landscape of Sundsvall are briefly explained in the beginning, and later on, studying the visions and strategies would contribute to finding the most expected social values of urban forests for creating a greener city.

5.1. Sundsvall City; location, history, and background

Sundsvall municipality is the only major town of Västernorrland county situated in Medelpad province (Fakta och Planeringsunderlag, 2017). Sundsvall lies in the middle of Sweden's east coastline, 390 km North of Stockholm. The city has a port by the Gulf of Bothnia. (Figure 5.1). Sundsvall municipality's total area is 3,453 km^2, of this, 3,190 km^2 is land.
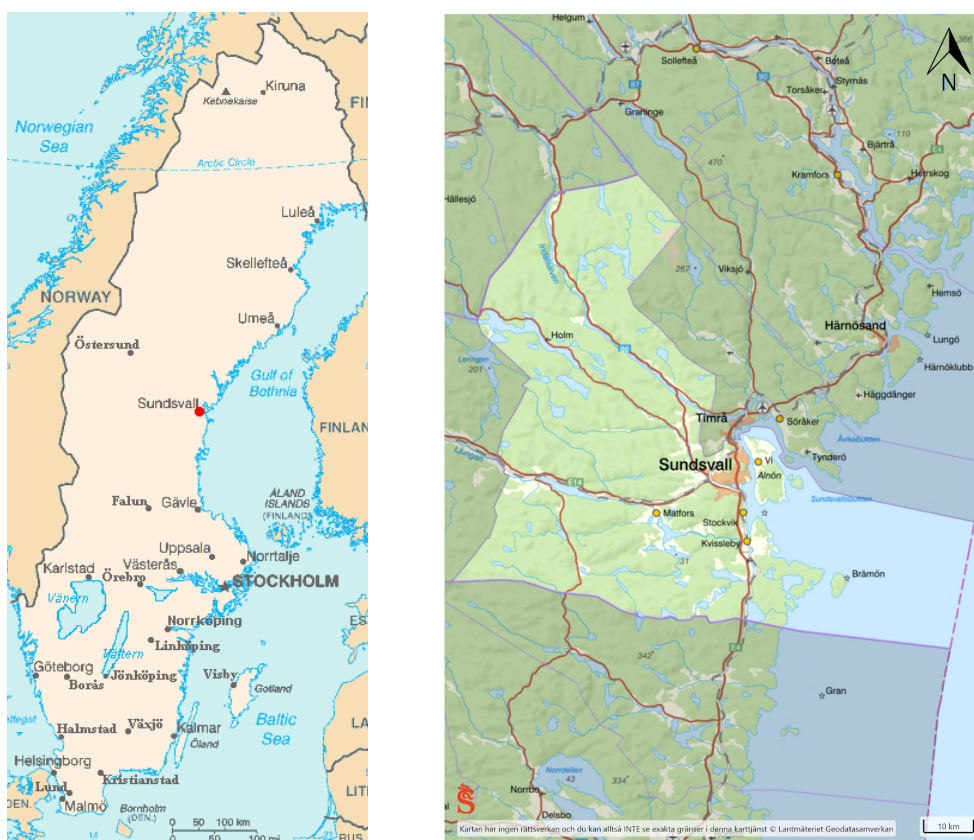
Figure 5.1. To the left; the location of Sundsvall City on the map of Sweden. Wikimedia, 2007. To the right; Sundsvall's municipal borders. Sundsvall comprehensive plan, 2021.

In 1621, despite the great dissatisfaction of many local farmers, king Gustav II Adolf founded the town in order to develop Sweden and gave Sundsvall privileges to make the Baltic Sea region more powerful (Sundsvalltown website, n.d.). However, the first documented urban plan for Sundsvall was created by the city planner Olof Bure in 1642 (Ahlberg, 2005). A century later, in 1721, Sundsvall was invaded by Russian troops and except for the church and the bell tower, the whole city was set on fire and burned to the ground, so the residents of the city had to build up the town (Sundsvalltown website, n.d.). It is estimated that only 500 people lived in Sundsvall at the time of the destruction of the city by the Russian army (ibid).

During the 1800s, at the time of the industrial revolution, other than the agricultural-based economy, the foundation of Sweden's wealth was formed by its natural resources such as timber and iron ore. Due to the blooming timber industry in the 1850s-1860s, and Sundsvalls' position as Sweden's largest timber production area, the city became the industrial center for trade in the region of Norrland (Sundsvall town website, n.d.). Historical reports indicate that in the 1810's the population of Sundsvall was not more than 1500, yet by the end of the 1800s, the population had increased to more than 10,000 people (ibid).

On the 25th of June 1888 due to the dry conditions both Sundsvall and Umeå caught fire and strong wind caused the fire to spread (Figure 5.2) and because the houses were made out of wood, the destruction of the city became devastating and most of the city was completely wiped out by the fire (Sundsvall municipality website (Fire of 1888), 2014). According to Eleonora (2011), this fire became a reason that the city was rebuilt in stone this time and since then the central part of the town has been called "the stone city" (stenstaden).

Figure 5.2. To the left; View over Sundsvall two days after the fire in June 1888. To the right; Tent camp for the homeless people after the fire of 1888. The burnt-down church Lovisa Ulrika was captured in the background. Digital Museum, 2021.

During the 1900s Sundsvall continued to grow and the population rapidly increased to more than 92,000 people by the end of the 1990s (Sundsvall town website, n.d.). According to the population statistics and overall facts reported by the Sundsvall municipality in 2019, the population of the city has remained stable over a couple of decades. By 2018, Sundsvall was the 19th biggest municipality in Sweden with 98,850 permanent residents (Population statistics and overall facts, 2019).

Forestry and agriculture have been dominant industries, where the sawmill era made the municipality one of the world's largest industrial areas (Fakta och Planeringsunderlag, 2017). Since then, Sundsvall has been the place for industries such as paper mills, aluminum smelters, oil ports, and sawmills. Today the most prominent business areas are cellulose, wood, timber, IT and Telecom, and also banking (ibid).

5.2. Sundsvall municipality landscape

The land as the combination of the mainland and archipelagos is characterized by hilly terrain and here flows two large rivers; Ljungan and Indalsälven (Fakta och Planeringsunderlag, 2017). Ljungan is a 367-kilometer long river that originates near the Norwegian border and runs through Jämtland and Västernorrland counties, and Indalsälven is one of Sweden's longest rivers with a total length of 426 kilometers (Ehlert, 2006), (Figure 5.3). The municipality has over 400 lakes, most of which are clear water or bog lakes. Because Sundsvall municipality is located within the vegetation zones between boreal and southern boreal, coniferous forests dominate the land and Spruce is the most common species, but the south-facing mountains and slopes allow deciduous trees such as linden, maple, and hazel to grow and add more diversity to the area (Fakta och Planeringsunderlag, 2017).

Some specific species -especially the ones that grow slowly and are linked to the environments that normally change very slowly- are strongly linked to certain specific environments with a continuity character, such as the old forests, and they are needed to be protected and preserved. Some other species require disturbances, such as fire, which were formerly common in forests. Forest fires are currently only allowed for special measures, which is why these species find it difficult to cope (ibid).
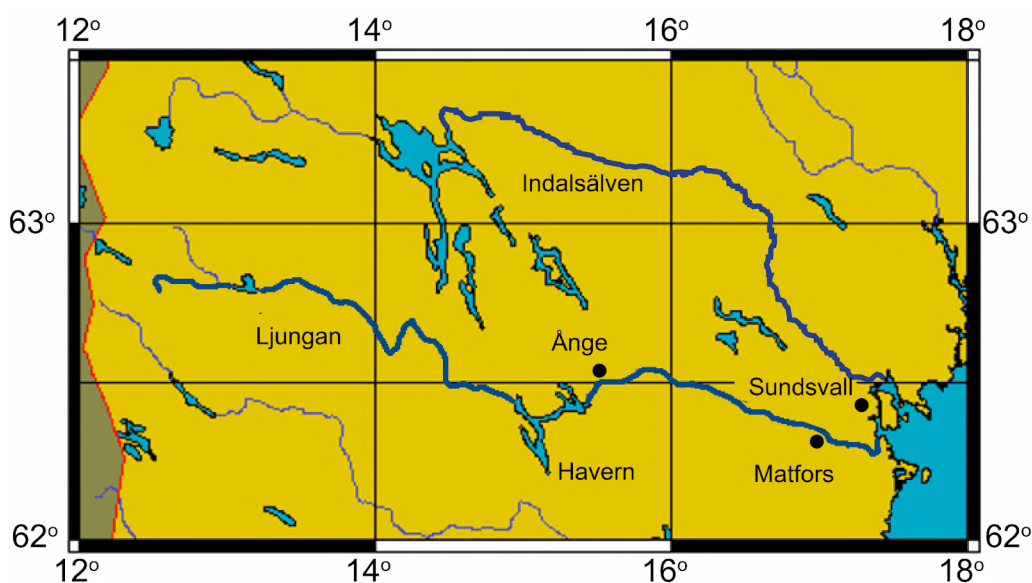
Figure 5.3. Ljungan and Indalsälven rivers. Modified by Mojtabaei, S., 2021 from Wikipedia, 2007.

The landscape mostly consists of a wavy rocky terrain on bedrock, covered with wooded moraine (Fakta och Planeringsunderlag, 2017). It is characterized by parallel valleys and is rich in lakes, marshes, and spruce forests. The relatively wide extension from the coast and inland, and the large height differences between coast and inland, cause large climate differences. The hilly terrain gives the short stretch of coast partly shelter, so hurricane strength has never been registered. There is also a strong wind-exposed coast such as northern Björkön and Galtström. Snowstorms and remarkable snow depths have also unusually occurred in May (ibid).

Sundsvall has a unique and beautiful landscape (Figures 5.4 and 5.5). The studies have been carried out in search of a distinct strategy for the preservation of the natural environment under the town's development and advancement (Comprehensive plan, 2021). The municipality's growth strategy Autumn 21/RIKARE (version 2016-12-08) emphasizes the need to manage including climate threats and biological depletion diversity (Sundsvalls kommuns Natur och friluftsplan, 2017). Sundsvall municipality has set its mission to improve welfare and quality of life for current and future generations of Sundsvall through preserving the earth's ability to sustain life with all its diversity. Nature and outdoor plans are supposed to strengthen the positive connections that exist between economic, social, and ecological development, which leads to sustainable development (ibid). Moreover, according to the comprehensive plan 2021, Sundsvall is a growing municipality with a growing population and there are big demands for infrastructure investments and further constructions in and around the city. Therefore, the importance of learning about their green strategies and outdoor plans seems essential for my studies.

Figure 5.4. Overview from Södra Stadsberget. Södra Stadsberget reaches 240 meters above sea level and is located south-southeast of the center of Sundsvall, south of the district Skönsmon. The mountain is 216 m high and on the north side which faces Sundsvallsfjärden, is a ski resort. Here conducts a slalom competition in the World Cup in alpine skiing 1992. Sundsvall webpage photo: Anders Thorsell, 2014. (with permission)

Figure 5.5. Overview from Norra Stadsberget. Norra Stadsberget is a municipal nature reserve with an open-air museum, cafés, and a variety of trails and exercise tracks. The mountain is used by schools for its natural pedagogical activities. Many pick berries and mushrooms in the area. Norra Stadsberget is also an important area for orienteering activities. Sundsvall webpage. Photo: Anders Thorsell, 2013. (with permission)

5.3. Sundsvall's green strategy for outdoor activities and sustainable growth

According to the municipality, the most essential vision of the green strategy in Sundsvall is offering nature and outdoor life in the top class for all municipal residents and visitors, as well as a varied and rich nature for animal and plant life (Sundsvalls kommuns Natur och friluftsplan, 2017, Rekreation och hälsa, 2018).

According to Online interviews with the key actors, 2021, the city is going to be developed to create an urban life and movement that can encourage face-to-face encounters and social interactions. With the requirement of 150-200 new residential places/year (if the current population indicates an increase of 5000 people until 2040) planning is to include quality of life and public health issues from an early stage in a way that most of the social values are met through the outdoor activities and presence of a good quality urban forest around the residential areas (Sundsvall comprehensive plan, 2021). Sundsvall residents will continue to play a part in the living dialogue on the town's development (ibid). In order to make the green visions come to life, these considered remits are relevant to my study for urban development and its green strategy (Sundsvall's plan until 2040);

> ➢ Making waterfront areas available for housing, activities, and business enterprise in order to bring town and water together.

> ➢ Spreading a network of greenery through the town by joining the green spaces and parks together in order to provide green corridors for social benefit and recreation.

> ➢ Allowing traffic on human terms by making a green boulevard of the current E4 highway to reduce the barriers in our town center.

> ➢ Developing the town sustainably through pedestrian and cycle paths to promote social values and sustainable public transport.

> ➢ Provide more meeting points for people.

In 2018, the City Council adopted a Nature and Outdoor Plan that contains green goals and strategies (municipality website, 2021). It is an overall governing document that will make the Sundsvall municipality better at nature conservation and outdoor life. Through its long-term work with outdoor life in order to promote the social values in the city, Sundsvall municipality has been named Sweden's Outdoor Municipality twice, most recently in 2018. Creating space and opportunities for physical activity outdoors in parks, forests close to the city and along popular movement lanes is an easy way for the municipality to invest in the health of its inhabitants (Figure 6.6). Equal access to free activity areas in the municipality evens out the differences between different social groups. In general, by more sports activities close to the residential areas come more events and experience arrangements, which leads to reaching a wider audience. In sports and event areas, access to land must be secured to be able to develop the areas. It is ideal to have the areas in central locations in the city so that everyone can easily get to facilities and at the same time contribute to city life (ibid).

Figure 5.6. Outdoor activity map of Sundsvall close to residential areas, 2021, Sundsvall comprehensive plan. The presence of outdoor activity in the area indicates its importance for the residents of the city and also shows that making such opportunities is important for the municipality.

Through the incorporation in the comprehensive plan for 2040, the municipality will have a politically adopted strategy that includes measures of what is considered a reasonable distance to green areas from homes, schools, and preschools based on research and Sundsvall conditions that can provide a long-term perspective in the planning of the city and its green areas (The Green strategic document for Sundsvall, 2020, (Grönytestrategiskt arbete samlingsdokument)). The green area strategic work has been conducted in parallel in five theme groups that have been responsible for various aspects of the green structure in order to come up with a green strategic plan for Sundsvall (Figure 5.7). The most relevant aspects to my study can be concluded in two important points:

➢ Provide conditions for an even distribution of good green values in Sundsvall's urban areas and districts by pointing out unequal distribution, surpluses, and shortcomings, so that all municipal residents have access to the greenery.

➢ The green areas and their existing structures in the city must be utilized so the built network of greenery can be extended in future urban development.
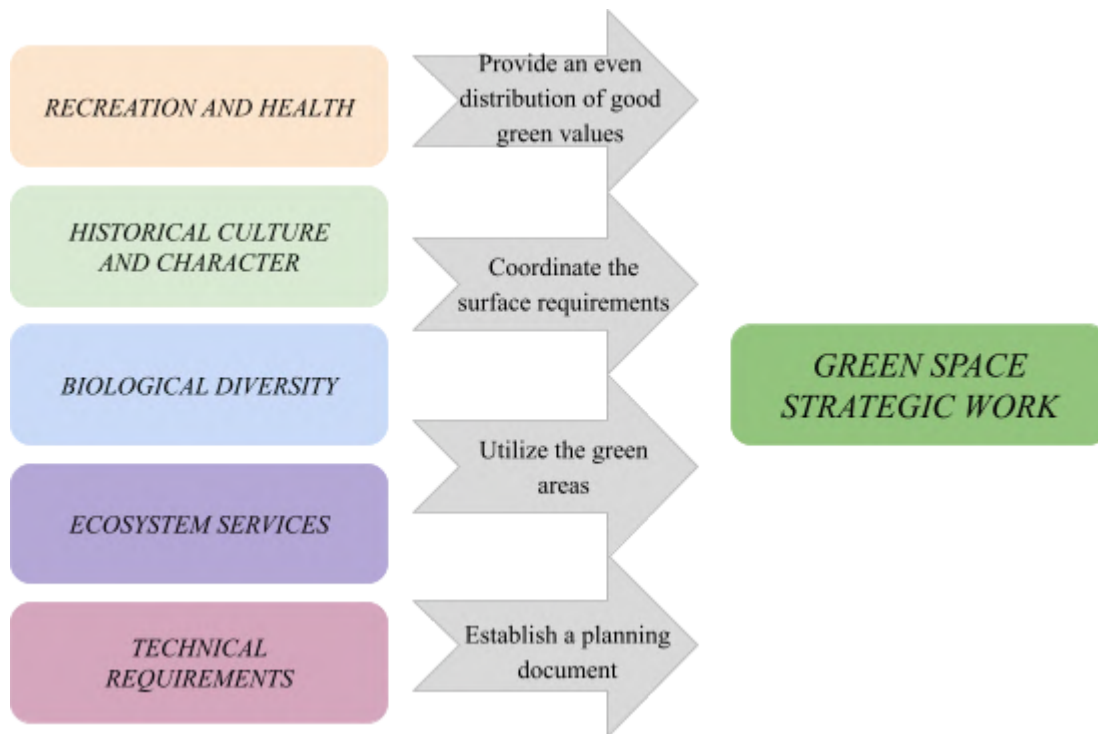
Figure 5.7. Five theme groups to develop guidelines for green strategy from Grönytestrategiskt arbete samlingsdokument, 2020. Mojtabaei, S., 2021.

The 'Recreation And Health' group has looked at the green structure from a public health perspective where proximity between housing and the green area has been the main focus. The group has looked at accessibility, suitable distances and sizes, possible connecting links (green recreational lanes), and acceptable barriers (The Green strategic document for Sundsvall, 2020). The group's work has resulted in a map showing the areas needed to cover the human need for community, seclusion, exercise, and rest, as well as access to the entire range from undisturbed wilderness to residential greenery (ibid).

The 'Historical Culture And Character' group has looked at the significance of green spaces for the character of different districts in order to assess the significance of the green areas for the municipal residents' sense of belonging (The Green strategic document for Sundsvall, 2020). The cultural-historical significance has been assessed based on old city plans, detailed plans from each area, historical maps, and also through a workshop with Sundsvalls museum to mark the areas of cultural and historical interest. The group's work resulted in a map showing the character-creating values that can be conveyed through greenery and green structure. From small places and rows of trees to large landscape rooms and views (ibid).

The 'Biological Diversity' group has looked at the green structure based on which environments can be assumed to contribute to biodiversity, either by offering different types of habitats and thereby increasing the number of species or by offering more of each habitat and thereby increasing the number of individuals of the same species (The Green strategic document for Sundsvall, 2020). The group's work has resulted in a map showing existing areas and possible reinforcements of the green structure to promote biodiversity, primarily through improved dispersal routes and changed management of existing areas (ibid).

The 'Ecosystem Services' group has been based on a division of ecosystem services made by the National Board of Housing, Building, and Planning (Boverket), (The Green strategic document for Sundsvall, 2020). The group's work resulted in a map for each ecosystem service, showing which existing areas convey the ecosystem service to the municipal residents (Sundsvall municipality, 2020). For many of the ecosystem services, the municipality is self-sufficient, but for food production, for example, they are dependent on external production. For other ecosystem services, they can contribute to other people's livelihoods outside the municipality's boundaries (ibid).

The 'Technical Requirements' group has looked at the green structure from a technical perspective (The Green strategic document for Sundsvall, 2020). The focus has been on stormwater management, flood surfaces, and places for snow storage. The starting point has been the areas that are problematic today and where existing systems would benefit from being strengthened with green solutions for the stormwater delay and purification. The group's work resulted in a map showing the areas where they need stormwater facilities and snow storage coincides with existing green areas and could therefore be given a green solution (Sundsvall municipality, 2020).

In the case of development, attempts should be made to avoid or minimize the impact on designated green areas, primarily by choosing alternative locations or adapting the design of the intended development so that the values of the green area can be maintained (The Green strategic document for Sundsvall, 2020).

5.3.1. Crucial natural areas close to the urban environment in Sundsvall

The crucial natural areas and outdoor life give unique qualities to the green areas in Sundsvall (Fakta och Planeringsunderlag, 2017). The areas such as Selångersån (Selånger river), Sidsjön (Sid lake), Södra Stadsberget, and Norra Stadsberget have high focus and high values to Sundsvall municipality in order to continue to invest in recreational benefits, outdoor activities, and biodiversity (online focus group meetings, 2021). Both Sidsjön and Norra Stadsberget are municipal nature reserves areas (Figure 5.8). The areas have different characters and purposes, but what they have in common is that they are large qualities for nature and outdoor life and therefore they must be protected from exploitation in the master plan. These areas require improvements that can be more beneficial to the Sundsvall residents and their social activities (online focus group meetings, 2021).
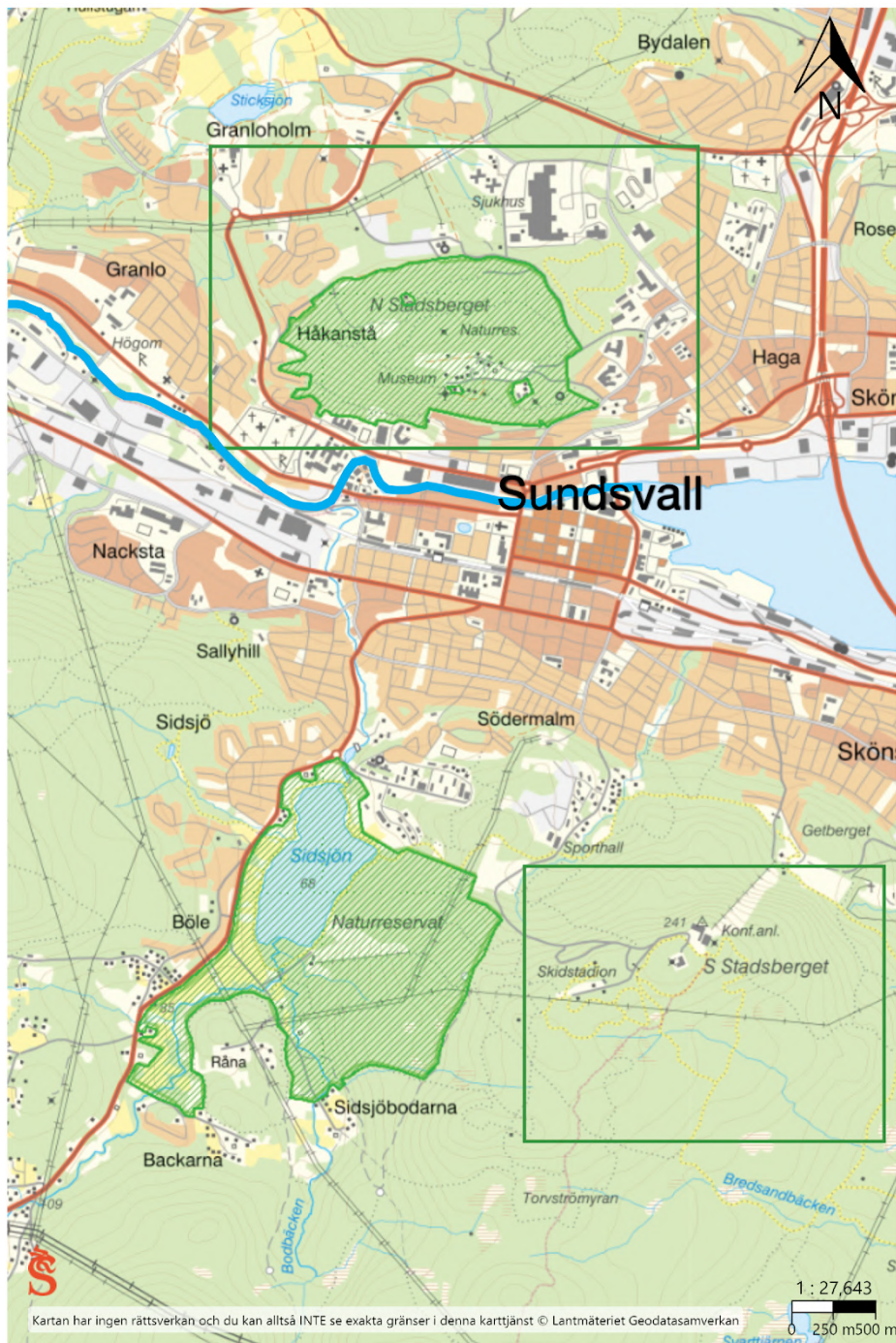
Figure 5.8. Crucial areas of the city. The nature reserves are highlighted in darker green color, Selånger river is highlighted in blue, Södra Stadsberget and Norra Stadsberget areas can be seen inside the green frame. Modified from Sundsvall comprehensive plan 2021.

* Norra Stadsberget is a municipal nature reserve that has good conditions for a rich outdoor life.

* Södra Stadsberget is a popular and large recreational area that can be further improved and get even more features to be attractive to everyone in Sundsvall.

* Sidsjön is a popular nature reserve and outdoor area that can be developed further and needs renovation.

* Selångersån is preserved and developed into a green corridor near the shore on both sides of the river from the sea and up around Norrfjärden and Selångersfjärden.

5.3.2. Outdoor life and outdoor activities in Sundsvall municipality

Outdoor life is today conducted largely unorganized and it is held mostly simple and private (Fakta och Planeringsunderlag, 2017). Nevertheless, the majority of outdoor activities happen in four areas;

1. Outdoor center Södra Berget;
From1990 to 1995, the foundation for the Outdoor Center on Södra Berget was built based on one feasibility study with several basic ideas for the area's development. Everything could not be built during the first intensive years, but the area has continued to develop (Fakta och Planeringsunderlag, 2017).

2. Norra Berget;
Norra Berget's city park and open-air museum were founded in the early 20th century, but they have been under construction in recent decades and developed greatly into a living open-air museum with animals, playgrounds, a large number of old buildings, handicraft sales, and catering. In 2014, Norra Stadsberget's nature reserve was established to make the area accessible, and preserve nature to protect it from further exploitation for the active outdoor life (Fakta och Planeringsunderlag, 2017).

3. North of Sundsvall;
During the construction of new residential areas in Granloholm between 1970-1980, great consideration was given to recreation in the area. The area is often highlighted as a good example of how the city parts can be built to provide proximity to both nature and recreation. The area was built like clusters connected to two major thoroughfares. Great forest areas and open agricultural land were left between the residential areas. For outdoor life, this also meant that ski tracks could be built parallel to the walkways. It also provided the opportunity for residents in the more central districts to move continuously through the forest and arable land out to the larger forest areas north of Granloholm (Fakta och Planeringsunderlag, 2017).

4. Älvdalarnas outdoor life;
Two large rivers, Ljungan and Indalsälven, pass through Sundsvall. The flotation ended in both rivers in the 1970s and gave outdoor life more accessible rivers. Activities such as canoeing in the Indalsälven river and paddling in Ljungan are now possible. Recreational fishing in Ljungan could also attract people (Fakta och Planeringsunderlag, 2017).

Outdoor activities in Sundsvall are very broad and depending on the time of the year, choices are different (online interviews, 2021). To promote outdoor activities, the municipality tries to make nature the focal point of planning and build around it in order to be able to provide more opportunities for the outdoor experience and also protect the habitats. Simpler activities such as walking, jogging, riding a bike, as well as private and semi-private gardening are more common in urban areas. Other activities that come with more adventures such as picking up mushrooms and wild berries, fishing, surfing, skating, mountain climbing, birdwatching, kayaking, hunting, and winter sports like snow skating are popular among people and increase tourism in the city (ibid).

Planning for recreational activities and a good quality outdoor life is important to Sundsvall municipality because through more diverse outdoor activities not only can they keep the balance between natural and built environments but also can promote the social values for the city. Therefore, knowing about existing activities and exploring their objectives for the future is considered essential for the study.

5.3.3. Coherence and continuance on meeting public demands

According to the series of seminars with various civic groups that was held by Sundsvall municipality for gathering information for the comprehensive plan 2021, 'how the town should develop in future' is an important matter for the majority of municipal residents (mentioned in the Urban Vision Sundsvall 2007-2037). The seminars that were open to the public gave people this opportunity to communicate their visions and opinions about the further developments in the town by putting them up on large scribble boards. The result of the seminars indicated that the provision of health and well-being, spreading a network of greenery all over the town, making more meeting points for people, and being effective towards climate change were the prioritized alternatives for the residents. Moreover, other values such as safety and security, and enhancing the town as a habitat for humans and non-humans could also catch the municipality's attention among the results (ibid).

5.4. Sundsvall's forest policy

Regarding the urban forest policy for Sundsvall, it was mentioned by some of the key actors that for park forests, no such a policy can be currently followed, however, for the forest that is not under detailed planning, there is one relatively old forest policy from 2003 and the relevant points to the studies is mentioned below (personal communication, 2021, available in the reference list). For the municipality's forest land, the following conditions shall apply:

➢ The forest land must meet the municipal residents' needs for recreation, outdoor activities, and education, be a land reserve for community development and rarely create employment.

➢ Forest holdings close to urban areas shall be given priority. Forestry must be environmentally certified following FSC's criteria (see Box 5.1.).

➢ The forest must be managed in an ecologically sustainable way where site-adapted forestry so far should be prioritized. Alternative felling and rejuvenation measures should be used appropriately. The use of the forest must provide conditions for the preservation of all species and recreate biological diversity. The municipality must be a role model in combining forestry with nature, culture, and recreational considerations.

➢ New construction of uniform stocks should be avoided to promote diversity and wide reforestation, a higher than normal leaf percentage should be sought (15-20%). Elements of coarse living and dying trees, as well as deadwood, shall be sought.

➢ Forestry must be conducted within the forest land close to urban areas with great regard for nature conservation and active outdoor life. In areas close to built-up areas, landscape care should be a priority. The considerations to be taken are decided on a case-by-case basis, depending on the natural conditions under which are available. When clear-cutting, the size of the felling should not exceed 0.5 - 5 ha depending on proximity to residential buildings. Where possible, seed trees and environmental trees (e.g. coarse deciduous trees) are left untouched. A change from single-layer to multi-layered stocks must be sought. One The overall goal is that forestry close to urban areas, despite the stated considerations, should provide one financial surplus.

➢ The felling of swamp forests must not take place and shore pine (Pinus contorta) must not be planted.

➢ Special consideration must be given to measures in certain areas with forests close to the shore where the following shall apply to moist soils:
• Create a forest that needs as little care as possible.
• The forest should primarily be a good environment for animal and plant life.
• Spruce establishment to a lesser extent must be tolerated.
• Elements of coarse living and dying trees and deadwood must be sought.

➢ For less moist coastal areas with elements of alder, birch, and spruce, the following should be used apply:
• Animals and plant life should be given priority, but landscape conservation measures should be taken in the vicinity of buildings and cultivated/grazed land.
• Any clearing thinnings must not be carried out so hard that sly spread occurs and there is a great need for sludge clearing. Spruce establishment to a greater extent must be prevented.
• Elements of coarse living and dying trees and deadwood must be sought.
• Openings for views of the water are allowed where there are no high natural values and where there are natural conditions for minimizing the need for measures aimed at keeping areas free from view-obstructing vegetation. Possibly maintenance agreement meets with residents who take responsibility for such future measures.

Box 5.1.

FSC (Forest Stewardship criteria) © *1994 Forest Stewardship Council all rights reserved. (with permission)*

FSC is an international organization that provides a system for voluntary accreditation and independent third-party certification. This system allows certificate holders to market their products and services as the result of environmentally appropriate, socially beneficial, and economically viable forest management. FSC also sets standards for the development and approval of FSC Stewardship Standards based on the FSC Principles and Criteria.

5.5. Discoveries from the municipal document analysis and focus group meeting

According to the online focus group meetings, (2021) with Sundsvall municipality, an urban forest concept should be able to contribute to forest management, provide recreational activities and be accessible to all age groups. Achieving the social values of urban forests, promoting existing recreational benefits, and also the provision of the educational aspects of the natural environment are the most crucial goals under urban development in Sundsvall.

Study of the current comprehensive plan for Sundsvall along with other municipal documents about the green strategies and visions for the city revealed that there has been an ongoing discussion from 2005 about how the conservation of land and water resources can contribute to the ecosystem services and provide more social values for an active outdoor life in the city. Every aspect of the green network along with the social benefits they provide is held important for the Sundsvall municipality (online focus group meetings, 2021). When it comes to the green strategy and green visions for Sundsvall, there are so many similarities between the comprehensive plan for 2021, the primary considerations for 2040, and also the Visions for Sundsvall between 2007-2037. Of the highest priorities for further developments, spreading a good quality green network over the city -especially in the center- is at the top of the list and because one of the greatest goals of the city is to be a fossil-free municipality by 2040 and use only renewable energies the sustainable urban development has come into the spotlight and been paid special attention to setting green goals for Sundsvall (Table 5.1).

THE MUNICIPALITY'S PRIORITIES	OUTCOMES AND EXPECTATIONS
Creation of a good quality green network	✓ Be more accessible than the comprehensive plan/s ✓ Provision of a dense green city ✓ Provision of equal opportunity for all ages ✓ Provision of ecosystem services ✓ Provision of security and proximity to the living areas ✓ Being an eventful and exciting place to meet ✓ Contribute to the green-blue infrastructure ✓ Lift the recreational values ✓ Can connect the city to the forest's nature ✓ Enhance the tourism values ✓ Connect to the socio-cultural events and values
Using sustainable energy	✓ Be effective towards the climate change ✓ Be the fossil-free municipality by 2040 ✓ Developing the town sustainably
Provision of outdoor recreation	✓ Provision of spontaneous sports and outdoor activities ✓ Develop activities close to the urban areas ✓ Separate the traffic and being secure ✓ Provide outdoor activities and social interactions ✓ Being easily manageable
Education opportunities	✓ Provide educational activities for children and youth ✓ Provide learning opportunities through outdoor activities ✓ Promote early human connection to nature ✓ Provide learning opportunities to protect nature

Table 5.1. Sundsvall priorities for sustainable development by 2040. The table is based on the comprehensive plan studies and online focus group meetings with the key actors in Sundsvall municipality, Mojtabaei, S., 2021.

According to the Nature and Outdoor plan for Sundsvall, 2018, not only the Sundsvall green vision offers nature and outdoor life in the top class for all municipal residents and visitors, but also online focus group meetings on the 24th and 25th of Feb. 2021 indicated that many of the strategies in nature and outdoor plans that lead to the provision of more social values are directly linked to green area planning at the general plan level. Therefore, having a solid concept before the planning process is now extremely needed. The concept of urban forest design for the city should be able to reach these important followings:

➢ All living environments have access to local recreation and nature experiences.

➢ Crucial areas for nature/outdoor life that were discussed under section 5.3.1, and identified in Sundsvall's master plan must be easy to reach for Sundsvall residents and continue to be developed for nature and outdoor life while preserving values.

➢ Work to transform hardened surfaces, open up culverted streams, recreate beaches to increase the availability of green/blue surfaces in urban and urban areas.

➢ The conditions for nature tourism and outdoor activities should continue developing.

➢ Natural conditions are the basis for planning new residential areas and major developments. The municipality will build the residential blocks next to and not in crucial areas, green-blue lanes, valuable natural environments, and outdoor areas.

➢ The beaches should be protected and public access to beach areas should increase.

➢ Further developments and recreation of green/blue infrastructures that strategically connect important areas and reduce barrier effects should be ensured. The green spaces that exist today in the city of Sundsvall will be strengthened.

➢ Valuable areas for landscape, nature, and outdoor life should be protected and negative impacts on biodiversity and outdoor life should be avoided.

➢ Unaffected areas should be seen as an asset for the public, the hospitality industry, and wildlife. Disturbing activities and facilities must be avoided.

➢ Watercourses and their environments, including ravines, should be protected.

In conclusion, the social benefits of urban forests not only are considered as the heart of city planning but also a green concept that can contribute to the visions and bring more values to the place is now needed in Sundsvall (online focus group meetings on the 24th and 25th of Feb. 2021). It is also ideal that the green concepts enhance ecosystem services and green/blue infrastructure plans for the city as well as support a better outcome for stormwater management as an important part of further green planning (ibid).

Series of private communication with some of the forest managers in Sundsvall revealed that dealing with rehabilitative aspects of urban forests that directly target health and well-being has been a case now in Sundsvall. Moreover, studying the municipal documents also indicated that the most essential social values that are targeted by the municipality, can be mentioned in these categories; promoting health and well-being, provision of recreational activities, and enhancing social interactions. Along with these three major categories, other social values such as improving the socio-cultural activities, educational benefits, and also provision of aesthetics and promoting the sense of place among residents are held important and should be reached through the concepts of urban forest planning for Sundsvall (ibid).

Every city has its own social demands to be reached. Learning about the most desired social values of urban forests that Sundsvall municipality seeks for the city, their green strategy, and the forest policy were the most important focuses of this chapter. Moreover, data analysis from the future green visions for the city, the forest policies, and online interviews contributed to reaching, on one hand, the second aim of the study, which is to propose conceptual models for urban forestry that can meet the desired social values through designing urban forests, and on the other hand, could address another study question; What social values are considered to be achieved through urban forestry and forest policy [in Sundsvall]?
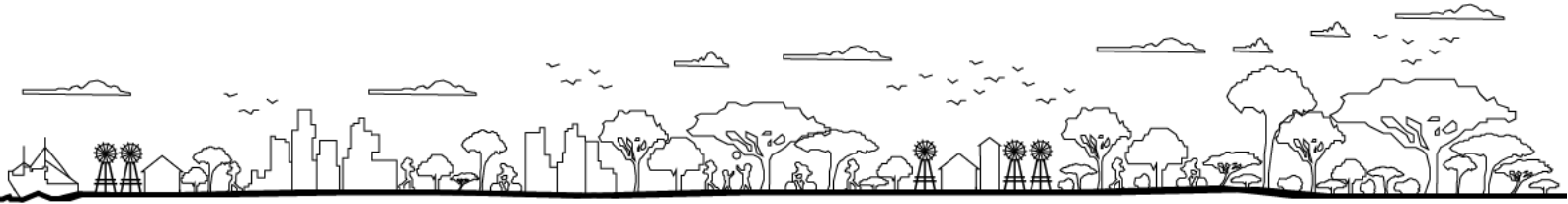
CHAPTER 6

DATA ANALYSIS
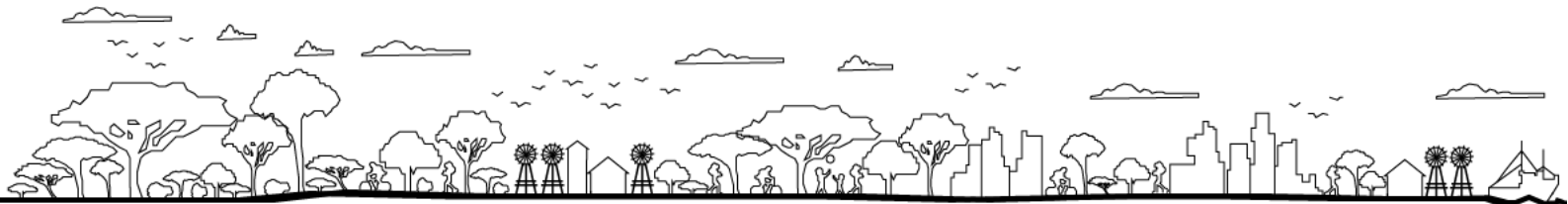
A massive part of data analysis belongs to the online focus group meetings with the key actors in Sundsvall municipality and also the municipal documents analysis. Among the methods of study, analysis of the online meetings and municipal green strategies for the future of the city indicated that the social values of urban forests play a great deal in planning for the future of the city.

In order to be able to reach the design concepts that contribute to achieving social values through practice, related information was gathered through a qualitative study of the current comprehensive plan for Sundsvall City, analyzing related documents, maps, and plans about green strategies. The most forwarding strategies for the city and urban forestry policies were recognized through the in-depth studies of municipal plans and documents. Data analysis from the municipal documents and online focus group meetings indicated that proximity, accessibility, recreational activities, and educational aspects of urban forests are important for Sundsvall.

Analysis of the theoretical studies also indicated that social values of urban forests are considered as the crucial part of green space planning in Sweden. Further data analysis based on the collected materials and summarized information from theoretical approaches indicated that different methodologies towards urban forest establishment can be influenced in terms of their naturalness, the state of public approach towards them, the level of human impact on the distribution of species, and also the content of species habitat.

Analysis of the theoretical approaches, summary of the meetings, and also the desired values of urban forestry in Sundsvall municipal documents contributed massively to form the conceptual design models that could be generally considered as the very first step to design or develop a good quality green network over the city.

The complexity of using forests around Sundsvall for recreational purposes along with the plans for the city revealed that due to the great need for a multifunctional green network near the center, the current focus of the municipality is mostly on the creation of a decent urban green environment for the public that on one hand can satisfy their daily social activities and on the other hand be accessible to all the age groups. Based on the meetings, the form of flora and fauna near the residential areas along with a good quality green environment for elderlies and children that can provide recreational activities, and also the accessibility and proximity to those outdoor activities were defined as the current goals of urban forest planning for the municipality.

According to meetings with the municipality, other than the central part of the city that is the main target for future green network plans, Norra Berget, Södra Berget, and Sidsjön are currently important targeted places for working with the green strategies and creative planning for the public (see chapter five). Also, planning for a suitable green character around the current construction sites has a great value to the municipality. The most important points of the online focus group meetings and discussions that could contribute to setting the design principles and forming the conceptual design models can be summarized in the table below.

THE MOST IMPORTANT DISCUSSIONS	MUNICIPALITY'S OBJECTIVES AND RESPONSE
What are the important values of urban forests to the municipality and Sundsvall's residents?	✓ The ecosystem services they provide ✓ Proximity to the living areas ✓ Possibilities for outdoor activities ✓ More recreational activities provision ✓ Provision of equal opportunity for all ages
What services are expected from the urban forests?	✓ Provision of outdoor activities ✓ Being an eventful and exciting place ✓ Being considered as the heart of the plan ✓ Being close to the living area ✓ Contribute to the green-blue infrastructure ✓ Lift the recreational values ✓ Appear as a learning platform for the youth ✓ Can connect the city to the forest's nature ✓ Being easily manageable ✓ Develop close to the urban areas ✓ Add to the free movement around the center ✓ Enhance the tourism values ✓ Connect to the socio-cultural events and values ✓ Can separate the traffic and being secure

Table 6.1. The most important discussions during the meetings with Sundsvall municipality, February 25, 2021. The meeting revealed that proximity, accessibility and recreational activities are the desired social values of urban forests within the city. Table by Mojtabaei, S., 2021.

In addition to the mentioned points and also based on the public's viewpoints (accessible through Sundsvall's official website), the presence of the urban forests weighed a great value to Sundsvall, especially to the central part of the city that suffers from a lack of enough green network. In general, different aspects of the green strategy for the city are closely connected to the social values that an urban forest can provide. However, according to the interviews with the municipality, the practical decisions about the variation of the forests, possible ways of forest management, and also the quality of the green space can be strongly affected by knowing the limits and possible characteristics of the urban forests in the early planning process.

In conclusion, the chosen study methods appeared sufficient and constructive. Data collection and data analysis from literature review and theoretical approaches could form the backbone of work through the recognition of social values of urban forests and their contribution to urban forestry. Later on, studying the current municipal documents and interviews revealed that not only is there a great requirement for parks and green networks near the center but also neighborhood parks, green corridors, and district parks hold the most important values to the public for everyday outdoor activities and recreational purposes. Moreover, according to some of the forest managers in Sundsvall, dealing with rehabilitative aspects of urban forests in order to provide people with rehabilitation and recovery from fatigue syndrome and other stress disorders has been one of the goals of urban forestry in Sundsvall. Lack of sufficient green areas was mentioned in interviews and also it was emphasized that these parks need to be lifted in planning priorities from the beginning.

CHAPTER 7

CONCEPTUAL DESIGN MODELS;
ONE STEP CLOSER TO THE SOCIAL VALUES
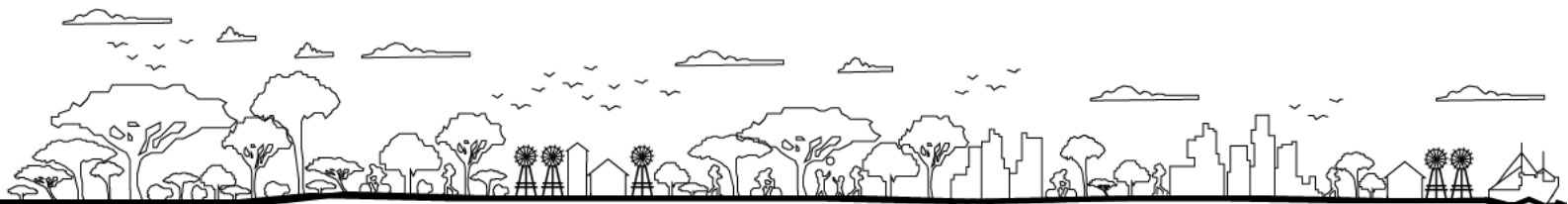
As it was mentioned in chapter four, the quality of urban forest design has a direct effect on how often people visit them, how safe they feel when they are surrounded by green space, and how much they enjoy the experience. This chapter is built on findings from the online interviews, theoretical approaches, as well as Sundvall municipality's objectives and visions. This chapter aims to take one step closer to applying social values in practice. The main design principles are initially explained in order to mention the most important foundation behind the concepts that are classified into four major categories (Table 7.1). These classified areas are considered as the most connected areas to people's everyday life and activity and because the concepts target the quality of the green spaces that include neighborhood parks, green corridors, main and local streets, etc. the most essential purpose behind forming this specific classification is to provide an easy framework upon which a functional design for the social values of urban forests can be achieved.

Based on the interviews with Sundsvall municipality and the current visions and plans for the city, working with the social values of the adjacent green network around the new residential blocks is extremely important. Moreover, not only interviews revealed that there is a great need for a better functional green network in the city but also several types of research by Lundell et al., 2015 indicated that staying in a forest environment can provide people with rehabilitation and recovery from fatigue syndrome and other stress disorders which according to some of the forest managers in Sundsvall, they are also dealing with this aspect of urban forests for the city. In this context, the targeted audience for these conceptual design models is mostly city planners, project management consultants, design consultants, and more importantly governmental departments that are involved in urban forest planning consent.

CLASSIFIED CATEGORIES	SUB-CATEGORIES
1. Urban residential	Residential areas
	Buffers and edges
	Shared open space
2. Civic centers	Main streets
	Local streets
	Neighborhood parks
	Semi-public squares
	Green corridors
	District forests
3. Industrial/contaminated areas	
4. Sub-urban residential	

Table 7.1. The classification of the conceptual designs is based on the targeted objectives according to the interviews with the Sundsvall municipality and it is done to make them easy to understand, Mojtabaei, S., 2021.

7.1. Design principles

The design principles were formed based on the theoretical approaches (see chapter 4), municipal documents, and supported by the analysis of interviews with the key actors in Sundsvall municipality (Chapter 5 and 6). These principles will assist the design and delivery of functional spaces with prioritized social values. Although there might be some overlapping between the principles, they must be understood in their totality.

7.1.1. Be a meaningful place to the community

The establishment of urban forests relevant to people's everyday life and activities can help people connect to nature, feel safe, and develop a sense of place attachment for interacting with each other. Integration of natural/historical heritage features with existing natural elements such as water bodies, giant boulders, old trees, or any topographic feature into the new design can create an exciting place to visit, enhance their values, and add more to the environmental benefits.

7.1.2. Be multifunctional and adaptable

It is important to note that communities and their recreational requirements are under constant change over time, and the adaptability of the place to the inevitable changes allows the visitors to enjoy the same space under different circumstances. Usage of robust materials, proper night light, and installing outdoor gyms, can also add to the multifunctionality of the design during planning.

7.1.3. Provide diversity

Every community has a diverse character and consequently diverse needs. So the diversity of urban forests will have to meet a wide range of those needs and at the same time make unique places. Addressing the design-related issues (introduced by Ryan and Simson, 2002, see chapter 4) such as accessibility, strong structure, and plant composition along with being adaptable to the socio-cultural backgrounds are the crucial factors that can provide diversity in designing urban forests. The basic form of recreational facilities (e.g. trees, lawns, paths, seats, picnic facilities, etc.) should also appear welcoming and available to everyone.

7.1.4. Provide equity and accessibility

The notion of accessibility and proximity to urban forests for all community groups must be the heart of a design. Multiple recent pieces of research indicate that proximity is what the majority of visitors seek (Tyrväinen, 2021). Accessibility not only motivates people to be more socially and physically active but also directly leads to better health conditions and social connections (ibid). Designing an attractive public or semi-public green space nearby, adding recreational opportunities, and maximizing connectivity to the space functions can provide good equity and improve accessibility to the urban green for the public.

7.1.5. Encourage social interaction

A good quality urban forest is the choice of a majority of people to have outdoor meetings, especially after lockdowns due to the COVID-19 pandemic (Derks, 2021). Multiple types of research indicate that urban parks and open green spaces have been a strong choice for the public to socially interact since the pandemic, and have brought these spaces to the fore again. Moreover, around the newly constructed residential areas that new groups of people join the existing communities, the cultural benefits of urban forests can encourage social interactions and form new relationships, and enhance the sense of place attachment (ibid).

7.1.6. Promote health and well-being

Ongoing studies around the globe indicate that a direct connection to nature can significantly affect people's life quality and well-being (Braubach, 2021). Every natural element from a singing bird on trees to a peaceful lake at the edge of a park can physically and mentally improve health indicators. There are also different organizations in European countries that provide health programs by establishing a direct connection to nature in order to enhance health benefits (ibid). Designing pedestrian paths, cycle connections, sports fields, space for relaxation, varied plant composition, safe and secure structure, along with keeping the natural elements as much as possible can promote people's well-being.

7.1.7. Integrate with environmental sustainability

Urban forests have a wide range of environmental values (see chapter 3). They are commonly described as 'the lungs of the city' because they actively produce oxygen, absorb carbon dioxide, provide fresh air, and improve air quality for breathing. Urban forests' environmental benefits can directly impact human health and well-being, add more value to the aesthetic aspects and restore ecological values in the urban environment (Späth, 2021). Therefore it is important to consider a sustainable environmental plan during design. In order to reach this integration, it is essential to extend the natural values by keeping the existing flora and fauna habitat, protect conservation areas and buffer zones, improve the energy and water restoration, and also provide learning opportunities that contribute to the environmental values to be interpreted and understood as educational resources.

7.1.8. Safeguard financial sustainability

Long-term financial sustainability is one of the desired components during the design of an urban forest. Maintenance and management costs are the most considered dimensions of a financial plan. If the minimum changes of the natural environment are considered from the beginning of the design process, the management costs will consequently decrease over time. For instance, most of the basic elements like trees, stones, paths, grass, and occasionally seats are the simple features of a green area that often exist in the first place and to reduce the maintenance costs it is smart that the designing plans are made around them by including them in the plan and forming the ideas. However, different urban forest characters need different financial plans to be able to support long-term management costs.

7.2. Planning urban forests; objectives, expected social values, and perspectives

The interviews with Sundsvall municipality revealed that the most important goal they seek of a green strategy for the city is to save the existing greenery in a way that on one hand can lift the social values for outdoor activities, and on the other hand improve ecosystem services and contribute to the green-blue infrastructure of the city. Moreover, from a long-term perspective, it is expected for the urban forests to reach their full potential after a specific time and also be easily manageable and adaptable to changes (Table 7.2).

OBJECTIVES	✓ Nature conservation ✓ Provision of recreation ✓ Provision of educational benefits ✓ Contribute to ecosystem services ✓ Contribute to the management process ✓ Contribute to the green/blue infrastructure ✓ Be useful and open to all groups of people ✓ Be accessible and close ✓ Provide diversity ✓ Have a good quality ✓ Provide safety and security
EXPECTED SOCIAL VALUES	✓ Health and well-being ✓ Social interactions ✓ Aesthetics and sense of place ✓ Recreational benefits ✓ Educational benefits ✓ Socio-cultural values
LONG-TERM PERSPECTIVES	✓ Fully functional over time ✓ Add more values to the environmental benefits ✓ Be adaptable to the future changes ✓ Be sustainable and work sustainably ✓ Have a manageable maintenance cost ✓ Contribute to the green/blue infrastructure ✓ Be adaptable for different seasons

Table 7.2. Objectives, expected social values, and long-term perspectives for Sundsvall based on both the green strategies for the city and findings from online focus group meetings with the key actors, Mojtabaei, S., 2021.

An appropriate design for the green structure of Sundsvall should maximize the benefits of urban forests. A well-designed urban forest can not only enhance social values but also can improve environmental conditions, protect nature, and improve biodiversity.

However, in order to provide designs, it is essential to study the current shortcomings and ensure that existing green spaces are carefully reviewed to meet the public needs, and also see how the related benefits should be evaluated to shape the plans. Based on meetings with representatives of Sundsvall municipality, the result of the urban forest concept should be concluded into granting the demand for a fully functional green network in the city -especially the crucial areas (see chapter five)- and equally, provide more outdoor activities and recreational opportunities around the residential areas for all groups of people.

7.3. What is the conceptual design?

Conceptual design is the very first stage of the design process, in which the broad outlines of function, illustrations, and general forms are articulated (Jensen, 2016). Conceptual designs provide an illustrative description of interactions, experiences, and strategies in terms of integrated ideas and concepts about what the design should do, or how it should look in a way that is understandable and fully functional for the users. The most essential point of the conceptual designs is to involve an understanding of people's needs that can meet the visions for the outcome product (in this case, urban forests) and also create the possibilities to meet their needs through the process. Common artifacts of conceptual designs are concept sketches and general models until a detailed design is ready to be created, (ibid).

7.4. Why the conceptual designs for Sundsvall?

According to meetings with representatives of Sundsvall municipality, many of the green strategies in outdoor plans that lead to the provision of more social values are directly linked to future planning based on informed decisions by guidelines. Therefore the existence of a solid concept prior to the planning process is considered beneficial and favorable.

The focus of further developments in the city is currently in four crucial areas; Södra Stadsberget, Norra Stadsberget, Sidsjön, and the central part of the city, especially along the river (see chapter 5). Those three first areas are marked as the nature reserves that provide recreational activities and several social values for the surrounding residential blocks and frequent visitors. Further urban development in these areas would affect both the natural environment and the quality of the social life in the area. Therefore, the analysis of theoretical approaches together with the analysis of interviews and plans for Sundsvall contributed to forming the design principles behind the primary concepts that can be considered as a helping hand before the planning, especially when it comes to these areas. However, the concepts are not only specified for applying in these particular areas.

The classification of the designs, while based on findings from this study, are represented in forms that do not necessarily correspond with current housing models or further development plans for the city. My proposals suggest different alternatives in different ways, especially in the case of basic similarity between the proposed concept and the project location. Accurate form of the blocks, the built environment, and/or gray structures is not the goal of concepts, they are only pedagogical tools aimed at making the concept easier to understand. In this context, the opportunity to show what possible forms of urban forests can be discussed and/or preserved, in order to provide the social values through the designs is considered as the most essential reason behind working with such concepts. It is important to know that the designs are genuinely inspired based on the social values lifted through the theoretical framework and the targeted objectives according to the interviews with the Sundsvall municipality. Although these categories are customized to reach the goals of this particular chapter, the concepts are applicable in similar conditions and/or locations in other cities.

7.5. Conceptual designs; Urban residential

According to the analysis of existing municipal documents and current comprehensive plans, the development of a green network with its positive environmental and social effects should be planned close to the living areas. It means that urban development should be able to provide a meaningful and yet enough green space close to the residential areas that are accessible to everyone and promote better social interactions in the neighborhood. To reach this vision, the urban residential concept is divided into three major categories (see table 7.1) and they are separately explained.

7.5.1. Urban residential; Residential areas

The concept for the residential areas allows design for the areas between the blocks in the same neighborhood for the residents and occasional visitors (Figure 7.1). The purpose of this concept is to allow the traffic to be local on the pedestrians' terms as much as possible and the social activities are accessible to all ages. The design principles behind such urban forest concepts contribute to achieving the increased affordable housing in the area via higher residential density (densification). The concept also leads directly to the provision of various social values while the ecosystem services appear profitable through the good quality green network around the residential areas.
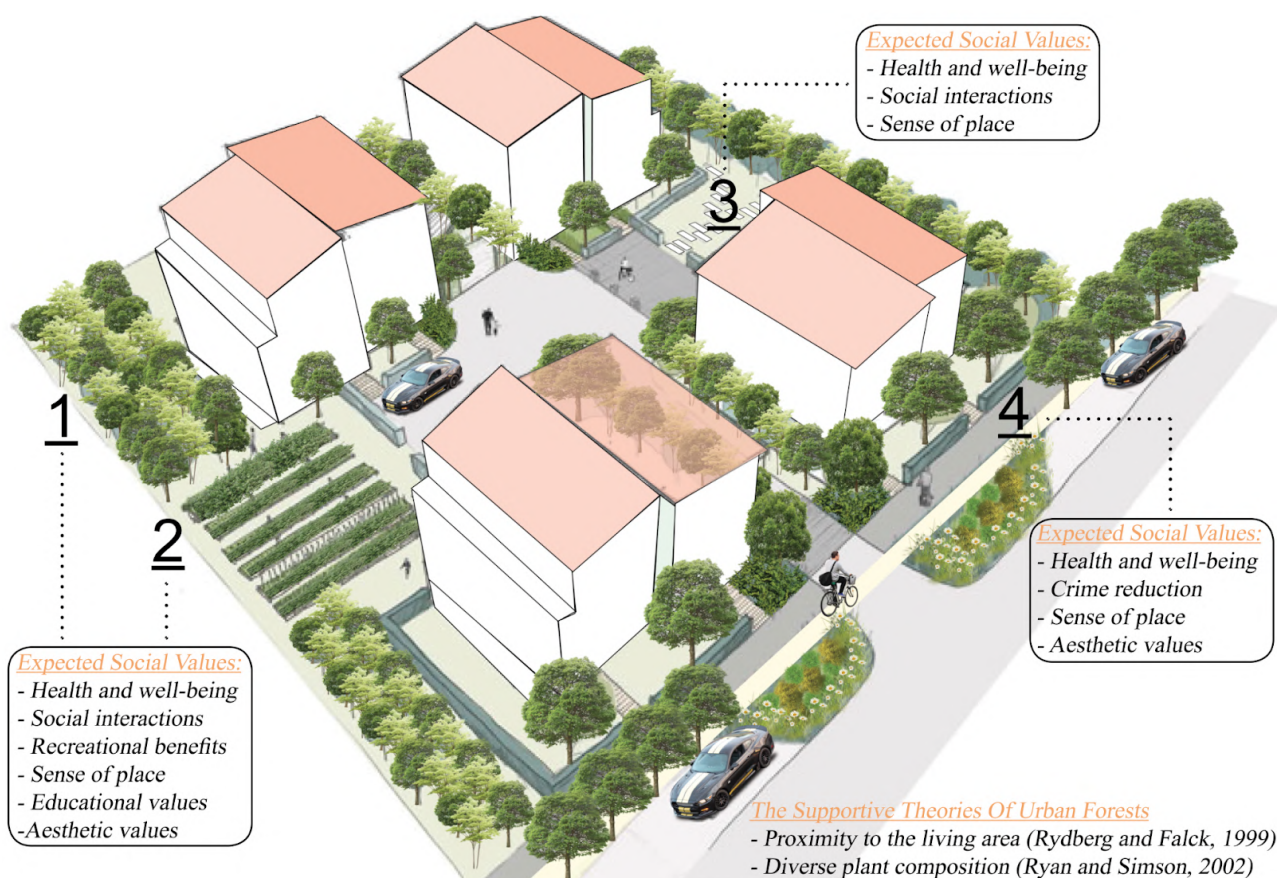
Figure 7.1. Residential areas concept, Mojtabaei, S., 2021.

1 and 2. There should be enough room for the greenery around the blocks so that different characters can be applied in the neighborhood. For instance, Community gardens can appear as the focal point for social interactions and educational benefits while they are surrounded by little groups of trees that can provide a calm place to sit and enjoy the scenery. Informal open spaces can create a centralized public gathering area for residents and local community members.

Moreover, the presence of different characters in the neighborhood can maximize the positive effects of the green space, because, on one hand, they can attract different groups of ages, increase the sense of place, and promote social interaction, and on the other hand, they can contribute to the green/blue infrastructure, improve ecosystem services, and consequently enable smarter local stormwater management.

3 and 4. The plant size and plant composition along with the structure of urban forests around the blocks might strongly depend on the block's location and more importantly surrounding existing plants in the area. Urban forest concepts for the residential areas can be customized based on the residents' requirements in order to provide the best opportunity for safety, accessibility, and health promotion. Smaller-scale pocket parks close to the blocks can increase access to the greenery and provide pleasant settings for the neighborhood, residents, and visitors to play, relax or have a friendly picnic.

In case if the site is newly under construction, it is recommended to study the existing plant composition and use the same species for the design concept to save as many natural habitats as possible in the first place. But if the residential blocks have already been constructed and occupied, it is recommended to consider the residents' needs as the first step to reach more social values and environmental benefits through planning.

THE SUPPORTIVE THEORIES	Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002)
EXPECTED SOCIAL VALUES	Health and well-being Social interactions Crime reduction Recreational benefits Sense of place Aesthetic values Educational values

The summary of the concept for residential areas, Mojtabaei, S., 2021.

7.5.2. Urban residential; Buffers and edges

The concept for buffers and edges includes the design for buffer zones close to the rivers and natural/protected environments and forest areas that are located near the residential areas and can provide so many social and environmental benefits in the neighborhood (Figure 7.2). Since one of the green visions for Sundsvall is to bring town and water together in a way that is accessible for everyone and provide recreational activities and well-being for the residents

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and occasional visitors, this concept inspired by the supportive theories (see chapter four) to provide enough room around the blocks so everyone can benefit from the presence of natural characters and a variety of possible outdoor activities in the area.

Expected Social Values:
- *Health and well-being*
- *Social interactions*
- *Sense of place*
- *Crime reduction*

Expected Social Values:
- *Health and well-being*
- *Educational values*
- *Sense of place*
- *Aesthetic values*
- *Recreational benefits*

Expected Social Values:
- *Health and well-being*
- *Recreational benefits*
- *Sense of place*
- *Crime reduction*

The Supportive Theories Of Urban Forests
- *Proximity to the living area (Rydberg and Falck, 1999)*
- *Diverse plant composition (Ryan and Simson, 2002)*
- *Activity parks; play-inspiring character (Grahn, 1991)*
- *Forest character (Grahn, 1991)*
- *Wilderness character (Grahn, 1991)*
- *Rich variety of species character (Grahn, 1991)*
- *Peaceful character (Grahn, 1991)*

Figure 7.2. Buffers and edges concept, Mojtabaei, S., 2021.

1 and 2. The residential areas close to the buffers and natural environments can benefit from the existing forms of greenery and having small pocket-parks and trees around the neighborhood that can provide accessibility and activity to all the groups. The area can be customized and adaptable to the public needs; a possibility for having additional settings such as playgrounds close to these natural areas would also contribute to social interaction and educational aspects of the environment especially for children. The adjacent streets/local streets to the buffer zones can appear as transitional passages that represent nature close and bring the town and nature together. Moreover, saving/planting as many trees as possible can provide both economic and environmental values.

3. The focus of this concept, on one hand, is of course to save the coastal environment and provide a natural place close to everyone, and on the other hand, allow the urban context to integrate the green network in harmony. In addition to the social values, coastal areas adjacent to the river flow provide a buffer that can protect ecosystem services and support the close urban green/blue infrastructure and handle stormwater wisely. The presence of different characters and values nearby can benefit all groups of people and provide a variety of outdoor activities that can directly result in well-being promotion. Therefore, it is recommended to keep the existing natural environment during planning -especially the buffer zones- and for further urbanization, outward development is recommended to be replaced by densification.

	Activity parks; play-inspiring character (Grahn, 1991)
THE SUPPORTIVE THEORIES	Forest character (Grahn, 1991)
	Wilderness character (Grahn, 1991)
	Rich variety of species character (Grahn, 1991)
	Peaceful character (Grahn, 1991)
	Proximity to the living area (Rydberg and Falck, 1999)
	Diverse plant composition (Ryan and Simson, 2002)
	Health and well-being
EXPECTED SOCIAL VALUES	Social interactions
	Recreational benefits
	Sense of place
	Aesthetic values
	Educational values

The summary of the concept for Buffers and edges, Mojtabaei, S., 2021.

7.5.3. Urban residential; Open shared space

The concept for open shared space includes the design for a shared low-traffic or no-traffic space that allows people to move freely (Figure 7.3). Space can strongly be a part of the green strategy for outdoor activities that not only provides opportunities for more physical activities close to the city but also turns into a potential meeting place for social interactions.
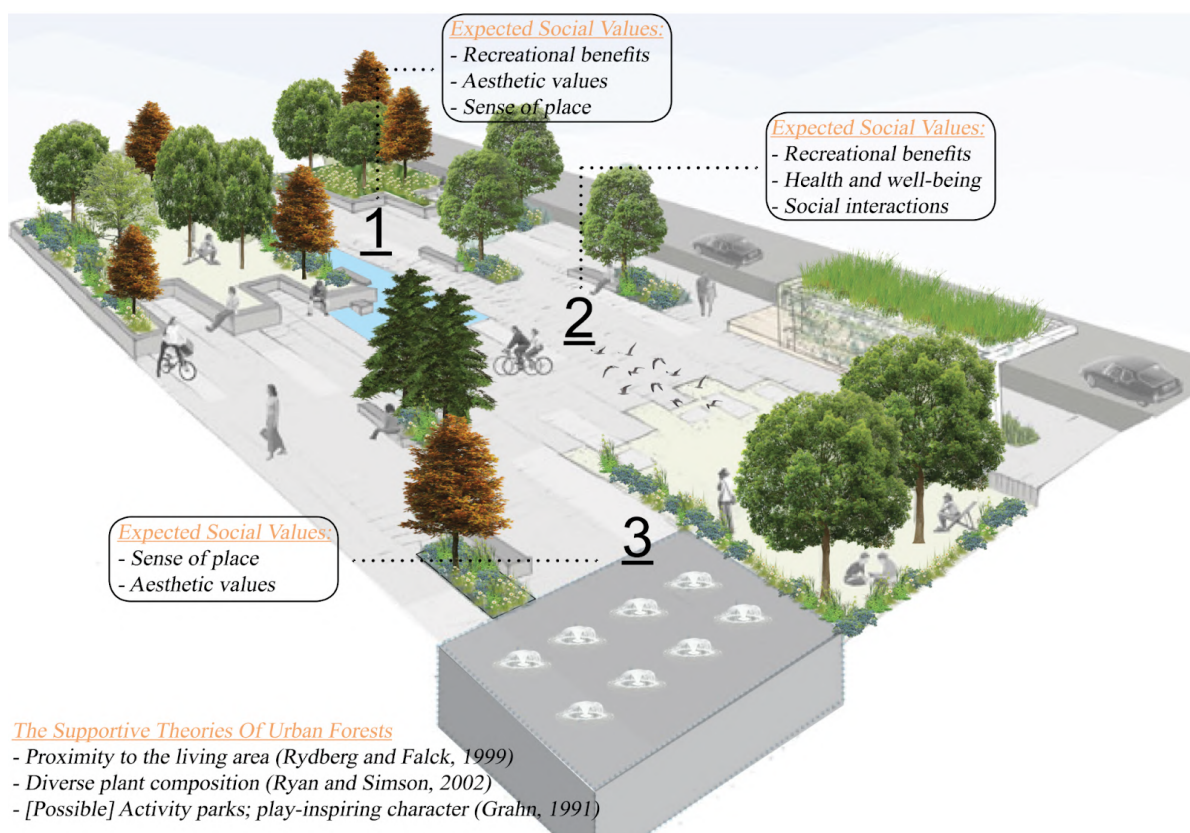
Figure7.3. Open shared space concept, Mojtabaei, S., 2021.

1. The main purpose of the concept is to provide this opportunity for the open space to include natural elements such as the presence of the trees, different forms of flora and fauna, water elements, maybe existing rocks and boulders in the place, etc. so that the area can be welcoming and provide a fresh sense of nature. Moreover, natural elements in addition to their visual aesthetics can also engage with other senses such as hearing and smell. In this case, different forms of water features and different compositions of the plants can be applied in a creative way to engage with those senses.

2 and 3. Space should provide enough room for pedestrians, bicyclists, people to rest and sit, and even a big enough place for a small group of people that gather together for meeting purposes or social interactions. Such a concept can reduce the dominance of vehicles, and improve safety for other users. The design can take many different forms depending on the level of demarcation and segregation between different transportation modes. Variations of shared space are often used in urban settings, especially those that have been made nearly car-free and as part of living streets within residential areas.

The goal of shared space is both to make more meeting points for people and also to improve road safety. The concept can generally function in streets with low traffic at peak times. However, the goal behind the concept also is to remove the conventional traffic elements such as curbs in order to re-prioritize pedestrians above vehicle movement and also to have a welcoming open space for everybody who can have physical activities on their terms. Open shared spaces with a focus on bicycle/pedestrian greenways can provide connections between all neighborhood districts and larger communities. The water features, green lawns with meadow-like edges, and the open landscape can slow down the traffic, inspire people to walk, ride a bike, and have more physical activities. The concept is based on civility and equitable use of public open space by all users. Pedestrians' engagement with open shared spaces can encourage recreation, gatherings, and all users to think responsibly about the needs of others.

THE SUPPORTIVE THEORIES	[Possible] Activity parks; play-inspiring character (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002)
EXPECTED SOCIAL VALUES	Health and well-being Social interactions Recreational benefits Aesthetic values Sense of place

The summary of the concept for Open Shared space, Mojtabaei, S., 2021.

7.6. Conceptual designs; Civic centers

Civic centers have always been the focal point for social interactions in the communities and a good quality green network that can provide social values and add to the natural/cultural activities is now a priority in Sundsvall (Urban Vision Sundsvall, 2007-2037). The concept for the civic centers is divided into six major categories and they are separately explained.

7.6.1. Civic centers; Main streets

The concept for the main streets includes the design for more crowded streets, mostly located near the central stations, shopping centers, and business/commercial areas. Although the higher percentage of the gray structure occupies the place, the contribution of green roofs, green walls, and also planted passages and entrances can maintain the balance between natural features and the built environment (Figure 7.4).
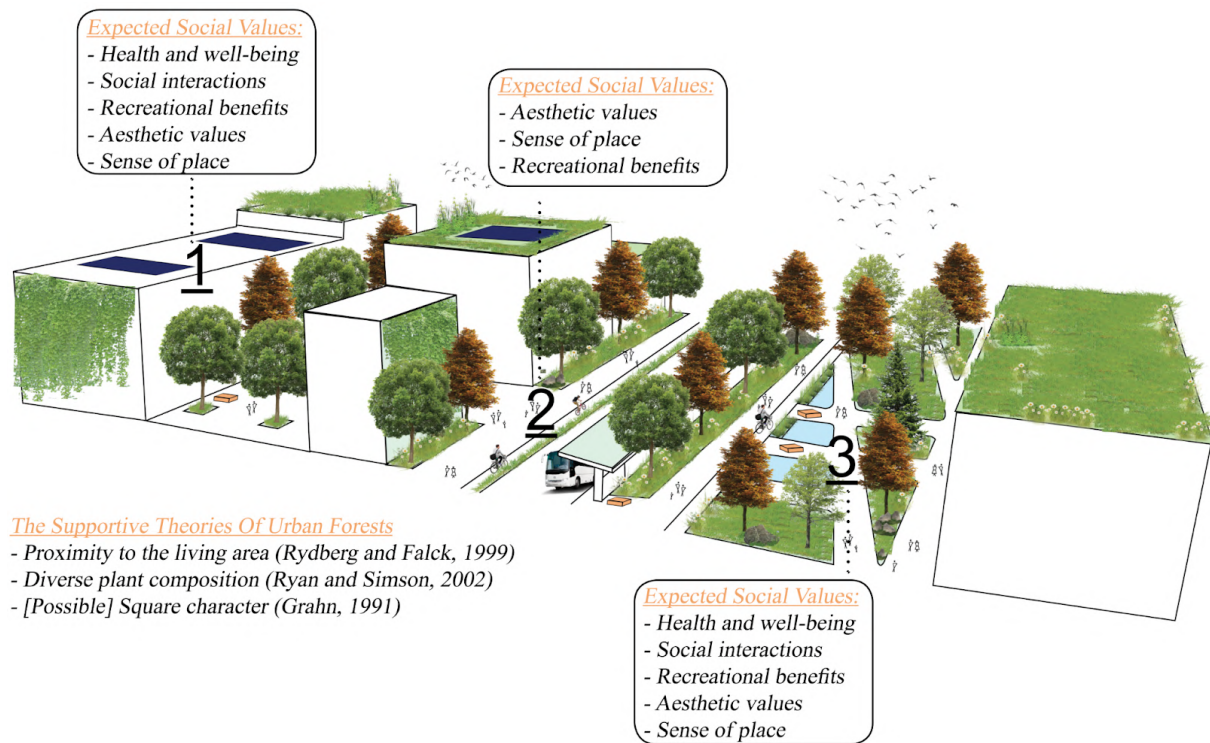
Figure 7.4. Main streets concept, Mojtabaei, S., 2021.

1 and 2. The concept can easily embrace further developments in the form of densification and also integrate new technologies such as installing green walls and solar panels on green roofs. Depending on the traffic condition, enough space for pedestrians and bicyclists can be considered and spacious passages between the blocks can also include the concept of open shared space which was mentioned earlier. The presence of different natural elements such as small or medium-size boulders, water ponds, and local vegetation can create a sense of place and add more value to the scenery.

3. Although the increased density and impervious surface areas that are associated with civic centers generally results in fewer environmental values and increased stormwater flows and pollutants, increasing greenery in every possible shape -especially green roofs on bigger buildings and blocks- and/or saving the existing local plants during further developments can appear as a huge contribution to stormwater management that is challenging in the built areas, especially in central parts of the city. The focus of the concept in this part is to provide a square character type of space that can include natural elements such as water features and different species of trees, especially adjacent to the public buildings, that can be accessible and open to everyone. The concept is adjustable based on the place requirements.

THE SUPPORTIVE THEORIES	[Possible] Square character (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002)
EXPECTED SOCIAL VALUES	Health and well-being Social interactions Recreational benefits Aesthetic values Sense of place

The summary of the concept for the Main streets, Mojtabaei, S., 2021.

7.6.2. Civic centers; Local streets

The concept for the local streets includes the design for the smaller streets between the blocks in the same neighborhood for the residents and occasional visitors (Figure 7.5). The traffic should be considered local on the pedestrians' terms.
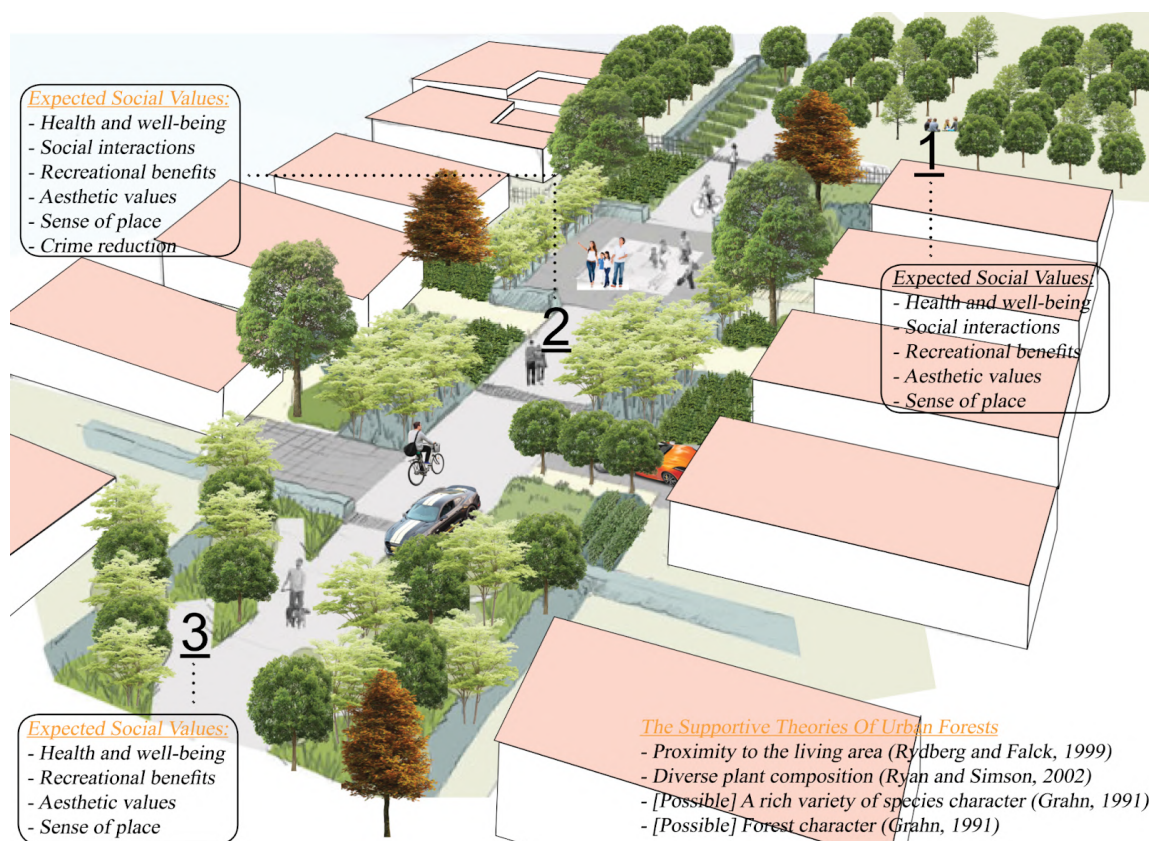
Figure 7.5. Local streets concept, Mojtabaei, S., 2021.

1. Around the less developed areas -especially in smaller cities that nature is deeply cherished- part of an old forest might have remained untouched and accessible to the residents. Remaining forests and natural areas after developments can create a great opportunity for recreational activities close to residential blocks. Any possible activity from

outdoor picnics to simply walking through the area provides better mental and physical health. Depending on the neighborhood interest, a series of community gardens can be considered to be installed at the edge of the forest or the pocket-parks close to the blocks and provide a small gardening possibility for the local community. The concept can be adjusted in order to be applied to either low-populated residential and small commercial areas, or to be considered for a denser area.

2 and 3. A transitional plantation similar to the adjacent forest and also proximity to the forest character, in general, can provide a play-inspiring environment for the kids along the street and also promote possible recreational values such as walking, jogging, riding a bike, etc., in the neighborhood. One of the goals behind such a concept is to introduce the local streets that have the lowest speed limit based on the pedestrians' terms and carry only low volumes of traffic. In some areas. Another goal of this concept is to reduce the safety risks and improve amenities for residents and/or businesses in the area.

The key ingredient here is the street trees that in addition to their aesthetic values they can also perform a range of other functions such as shade or pollution mitigation. Although the plant composition can also depend on the local's condition and its native species, to carry out the function of aesthetics and sense of place it is recommended they are selected and planted of a form and function that complements the built setting in the street and enhances the urban design. The choice of species, the natural tree architecture, and also maintenance are crucial factors to ensuring success.

THE SUPPORTIVE THEORIES	[Possible] A rich variety of species character (Grahn, 1991) [Possible] Forest character (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002)
EXPECTED SOCIAL VALUES	Health and well-being Social interactions Recreational benefits Aesthetic values Sense of place Crime reduction

The summary of the concept for the Local streets, Mojtabaei, S., 2021.

7.6.3. Civic centers; Neighborhood parks

The concept for neighborhood parks includes the design for the combination of different urban forest characters that are meant to provide different activities and a variety of social values in the neighborhood (Figure 7.6). The focus of the concept for the neighborhood parks is mostly on the combination of two theories; classification of urban forests by Rydberg and Falck, (1999) and different park characters by Grahn (1991). According to Rydberg and Falck, (1999), small forests within residential areas - either the existing ones or the newly implemented ones- can provide an opportunity for children to play around nature. Moreover,

the immediate accessibility to natural areas provides an equal possibility for every age group to have different activities close to their home.
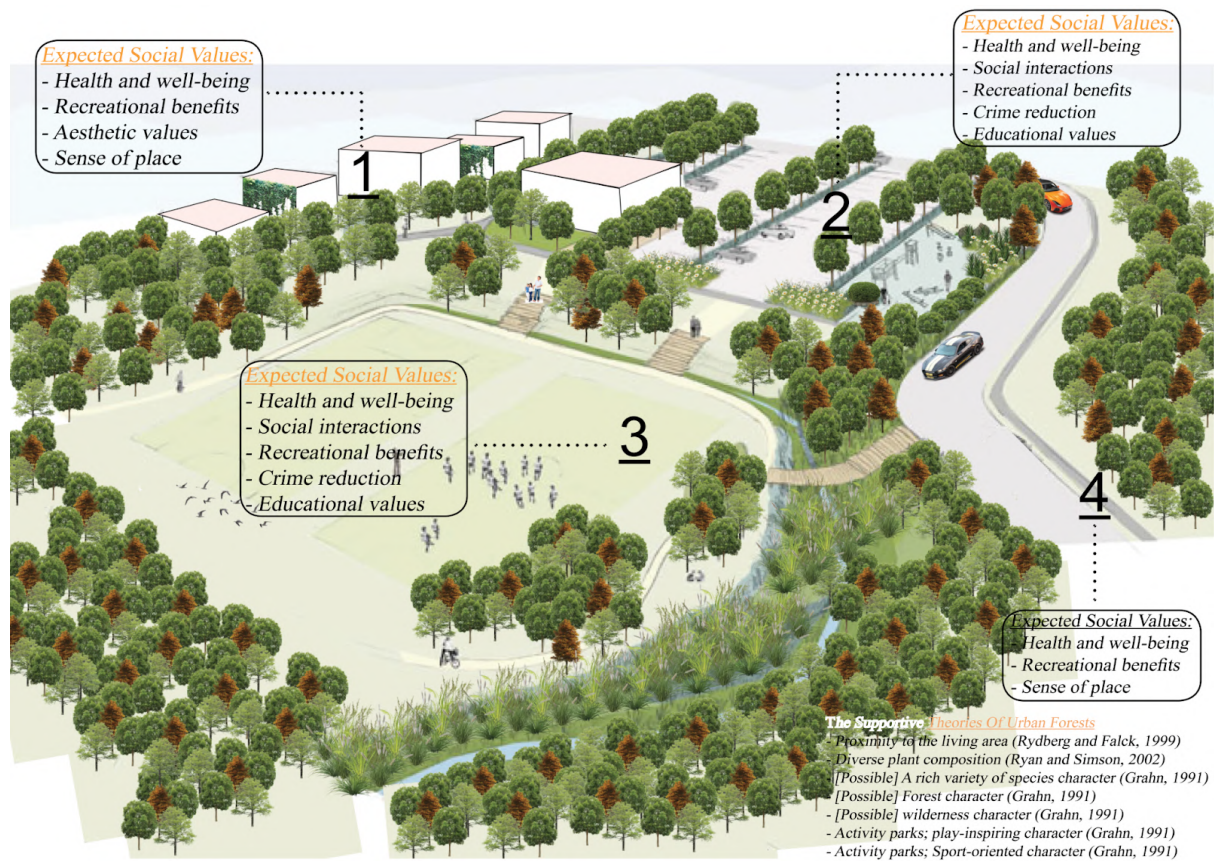
Figure 7.6. Neighborhood parks concept, Mojtabaei, S., 2021.

1 and 2. Neighborhood parks should be open and accessible to everyone and allow them to be active and socially engaged. Depending on the size of the area and its surrounding structure, from a well-planned street suitable for walking, jogging, etc., to a playground, the choice of recreational activity can be different for different age groups. However, some activities can be planned permanently and some others bloom seasonally. Several studies indicate that the presence of parks in the neighborhood can strongly encourage social interactions and promote recreational benefits (see chapter five) which both are considered important in green strategies for Sundsvall.

3 and 4. The proximity of the neighborhood parks to the forests can provide a great opportunity for a variety of recreational and social activities. For instance, from a simple everyday walk in the forest to seasonal activities such as mushroom pickings, annual cultural festivals, and sports events, the combination of forest character and neighborhood parks can provide enjoyable and yet social activities for the public. Moreover, accessibility of the place to everyone is going to attract all ages and encourage social interactions which consequently lead to crime reduction, mental well-being, more physical activity as well as probable educational opportunities.

THE SUPPORTIVE THEORIES	[Possible] A rich variety of species character (Grahn, 1991) [Possible] Forest character (Grahn, 1991) [Possible] wilderness character (Grahn, 1991) Activity parks; play-inspiring character (Grahn, 1991) Activity parks; Sport-oriented character (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002)
EXPECTED SOCIAL VALUES	Health and well-being Social interactions Recreational benefits Aesthetic values Educational values Sense of place Crime reduction

The summary of the concept for the Neighborhood parks, Mojtabaei, S., 2021.

7.6.4. Civic centers; Mixed-use semi-public squares

The concept for the mixed-use semi-public squares includes the design for the mixed-use residential and occasionally commercial areas that have good access to the main and local streets, and they can also provide gathering, relaxing, and outdoor picnic space for residents and occasional visitors. The green squares are the civic heart of the neighborhood that usually serves as the primary public open space and activity hub for the local community members (Figure 7.7).
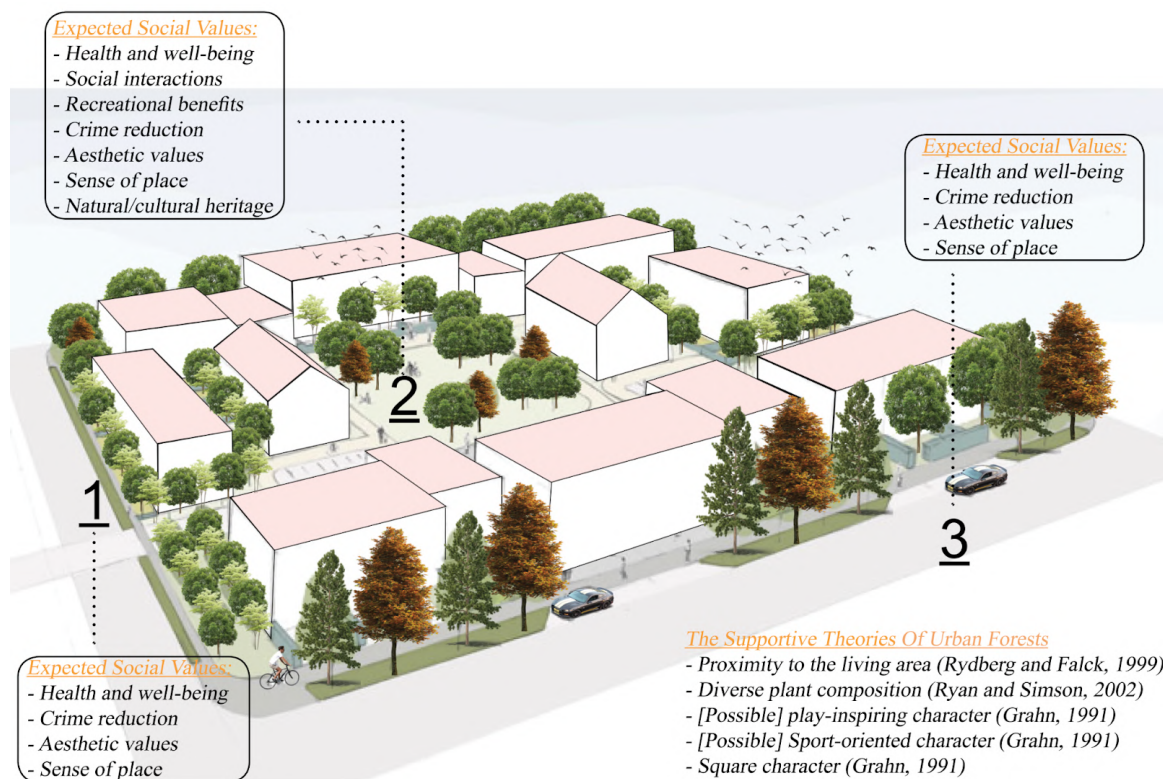
Figure 7.7. Mixed-use semi-public squares concept, Mojtabaei, S., 2021.

1 and 3. Enough room for the greenery around the blocks should be considered so that the residents can experience a calm and enjoyable scenery in addition to the environmental benefits of the trees which in this case can include noise and pollution reduction. Different species can be applied in the neighborhood and the existing ones are recommended to be saved.

2. Informal open spaces can create a focal point for social interactions with residents, occasional visitors, and local community members. Although walkability is the heart of the semi-public square concept, these areas are usually zoned out for more than one activity varied between a range of commercial and residential options. This concept is meant to locate residents close to work/ local shops and also be close to public transportation. Further developments can be available in some areas, and they may appear as a transition for broader use of the zoning area without disturbing the spirit of the place. Of the available opportunities for the redevelopments, densification of the blocks can be considered.

THE SUPPORTIVE THEORIES	[Possible] Play-inspiring character (Grahn, 1991) [Possible] Sport oriented character (small sports), (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002) Square character (Grahn, 1991)
EXPECTED SOCIAL VALUES	Health and well-being Social interactions Recreational benefits Aesthetic values Educational values Sense of place Crime reduction Natural/cultural heritage
OTHER CONSIDERATIONS	Contribute to green/blue infrastructure

The summary of the concept for Mixed-use semi-public squares, Mojtabaei, S., 2021.

7.6.5. Civic centers; Green corridors

The concept for the green corridors includes the design for residential and/or commercial areas that can appear in a variety of shapes and scales located close to the streams, trapped green patches, linear small pocket parks, even small-scale wetlands, and/or natural buffer zones (Figure 7.8). Green corridors are one of the most important forms of nature inside the city that can contribute to the green/blue infrastructure of the city (Lock, 2021). These linear parks help re-nature cities by connecting other green areas in order to form functional urban green infrastructure networks (ibid).
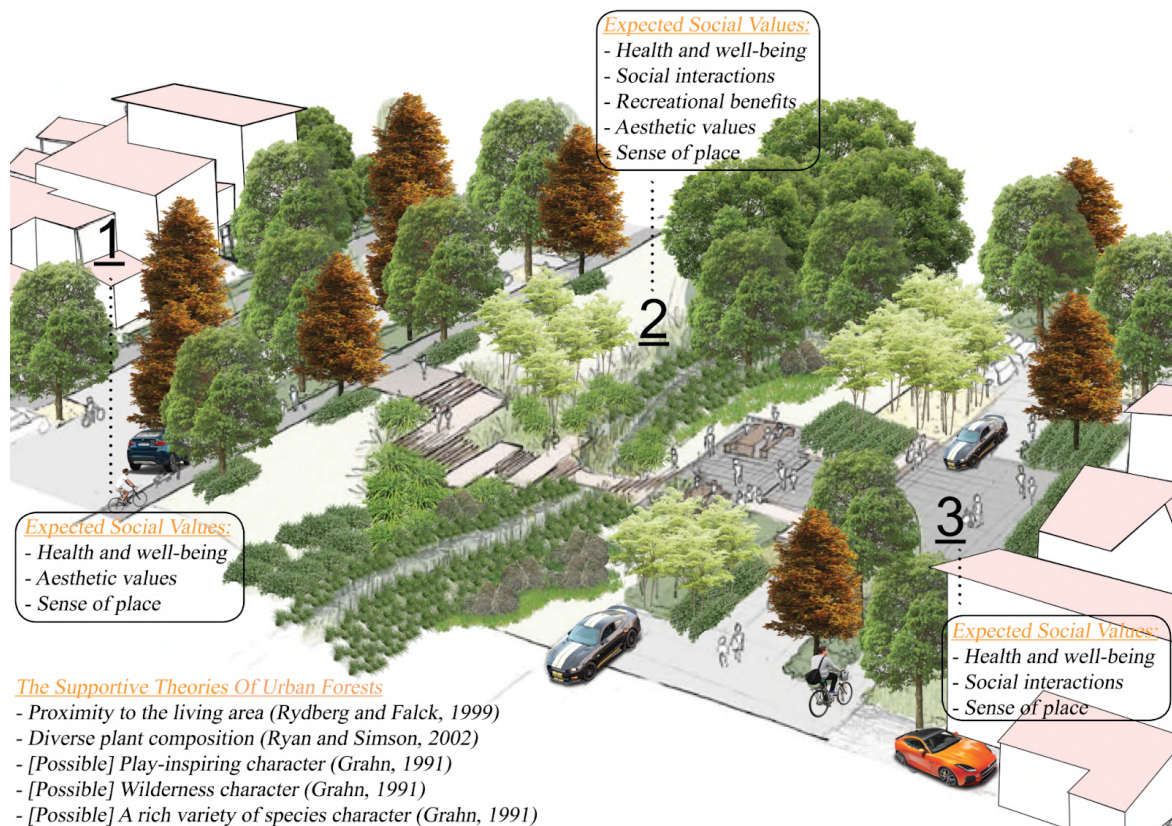
Figure 7.8. Green corridors concept, Mojtabaei, S., 2021.

1. In order to add social values to the green corridors, adjacent streets and roads should also benefit from a proper transitional form of greenery. Areas with continuous tree canopy can on one hand provide habitat for wildlife and on the other hand mitigate noise and air pollution around the residential blocks (Lock, 2021). It is also important to mention that choice of species and appropriate canopy/crown shaping produce an effective sense of place that can generally complement the green corridor.

2 and 3. The green corridors concept is meant to integrate urban life and the natural environment in a way that space can be planned wisely for all sorts of transportations on pedestrian terms, encourage exercise, social interactions, and link fragmented sites of biodiversity. Coastal edges, open streams, and natural buffers that are recommended to remain open, untouched, and available to all people are great contributors to the natural open space for spontaneous passive recreation, the provision of ecosystem services, and also include the naturalized habitat areas.

However, To identify potential spots for this concept in the future or enhancing the existing green routes, there is a need to understand and evaluate the existing space provision and distribution in terms of location, the role it has in the community, and more importantly how development in the future may impact upon a specific area in the city. Also to enhance the public realm through planting, exploring the potentials of the area, protecting the quality of the green corridor, and improving connections to adjacent residential areas are recommended.

THE SUPPORTIVE THEORIES	[Possible] Play-inspiring character (Grahn, 1991) [Possible] Wilderness character (Grahn, 1991) [Possible] A rich variety of species character (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002)
EXPECTED SOCIAL VALUES	Health and well-being Social interactions Recreational benefits Aesthetic values Educational values Sense of place
OTHER CONSIDERATIONS	Contribute to green/blue infrastructure

The summary of the concept for the Green corridors, Mojtabaei, S., 2021.

7.6.6. Civic centers; District forests

The concept for district parks includes the design for the existing natural areas close to the urban environment that are meant to provide recreational activities and in addition to the everyday activity, they are suitable for frequent visitings, weekend picnics, etc. (Figure 7.9).

Figure 7.9. District forests concept, Mojtabaei, S., 2021.

District forests can be either the remaining parts of the old forest or they can be newly planted or maintained in some parts. In the case of a new plantation, the design concept would be a little different because the spatial layout of trees and tree clumps as well as access provision need to be considered. These areas can provide a high level of biodiversity and save habitats along with being meaningful and multifunctional for recreational activities. District parks are generous in providing a peaceful environment away from the crowded city and at the same time can appear as a natural place for group activities and social interactions.

THE SUPPORTIVE THEORIES	[Possible] Peaceful character (Grahn, 1991) [Possible] Play inspiring character (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002) Rich variety of species character (Grahn, 1991) Forest character (Grahn, 1991)
EXPECTED SOCIAL VALUES	Health and well-being Recreational benefits Aesthetic values Sense of place Natural/cultural heritage Social interactions Educational values
OTHER CONSIDERATIONS	Contribute to green/blue infrastructure

The summary of the concept for District forests, Mojtabaei, S., 2021.

7.7. Conceptual designs; Industrial/contaminated areas

Sundsvall city has large industrial areas and they should not be overlooked in planning. The concept for industrial areas includes the design for the industrial and/or heavy business areas with activities that might result in soil and water contamination due to industrial processing, vehicle use, etc. In a site that is storing contaminants of concern, the potential source should be isolated and any stormwater runoff should be separated either to an appropriate discharge location or storage for re-use in industrial processes.

In industrial/contaminated areas, the environmental effects of urban forests are far more important than the social benefits. The design principles would mostly focus on integration with environmental sustainability and safeguarding financial sustainability. The most essential social benefits an urban forest can provide around such areas can be human health and well-being as well as add more value to the scenery around the site (Figure 7.10). The presence of trees and the green scenery they create, not only can contribute to environmental benefits but also provide mental calmness and cleaner air which consequently leads to physical well-being for people who work in these areas.
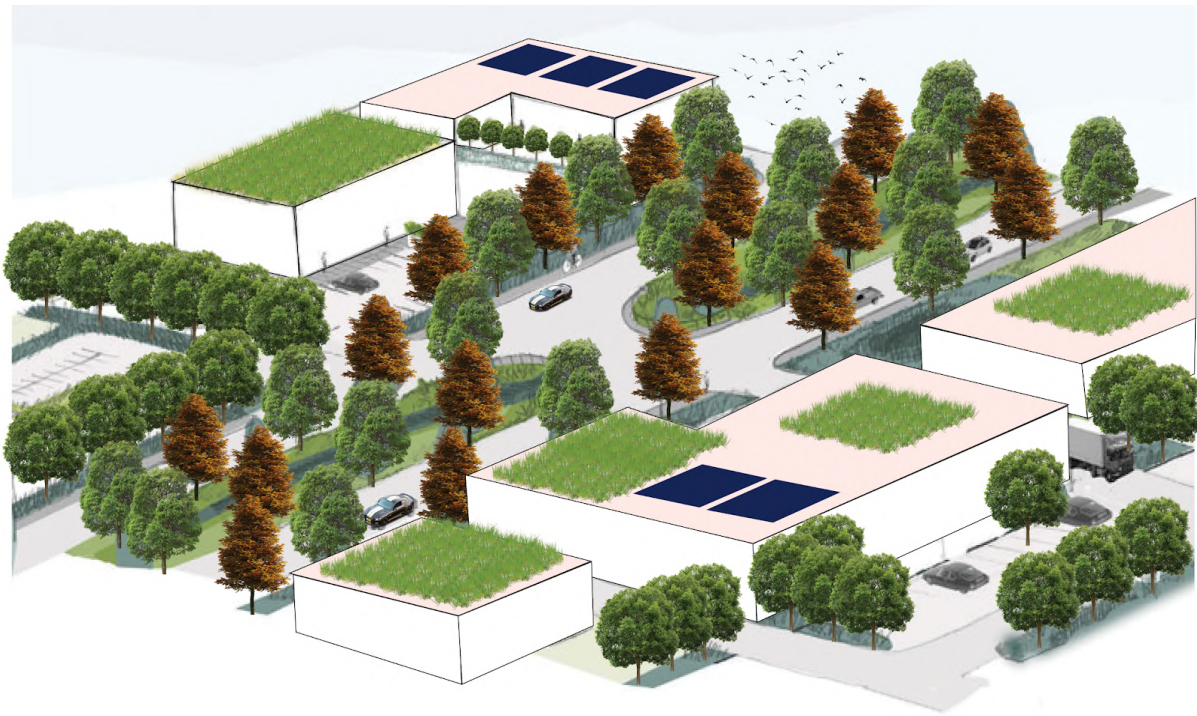
Figure 7.10. Industrial/contaminated areas concept, Mojtabaei, S., 2021.

For such areas, the proximity of the urban forest to the sites can appear helpful. It is generally recommended to plant more trees and plant species that are pollution absorbents and can mitigate the danger before the pollution spreads out via runoff stormwater. The new green technologies such as green/blue roofs with appropriate and adequate plant composition can on one hand contribute to infilter the contamination before it enters the ground and on the other hand, the volume of stormwater that is captured from large roofs and even the impervious areas can be re-used in the same industrial sites and handle the stormwater wisely.

THE SUPPORTIVE THEORIES	[Possible] Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002)
EXPECTED SOCIAL VALUES	Health and well-being Aesthetic values
DESIGN PRINCIPLES	Provide equity and accessibility Promote health and well-being Integrate with environmental sustainability

The summary of the concept for Industrial/contaminated areas, Mojtabaei, S., 2021.

7.8. Conceptual designs; Sub-urban residential

The concept for sub-urban residential areas includes the design for further developments around the natural areas located at the edge of the city. Suburban areas have traditionally been associated with unattached housing typologies, so flexible planning rules provide more untouched natural space and resilient systems for the community (Figure 7.11).

Natural environments should stay open and accessible to both residents and visitors. Proximity to pure nature can provide so many social values in the neighborhood. The natural character of the place already provides the best urban forest around the residential areas and in order to enhance open space areas, less vehicle traffic is recommended to be considered during planning. Also, the untouched spatial qualities of trees in these areas may present a greater sense of mystery and be more relaxing.
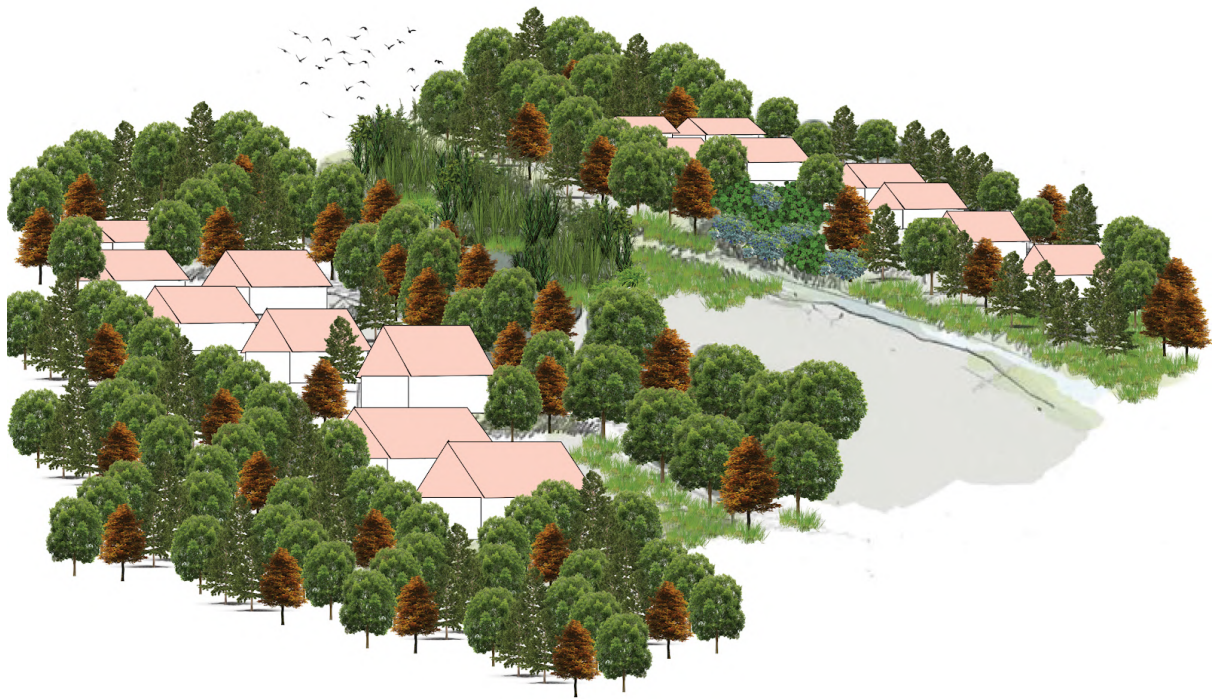
Figure 7.11. Sub-urban residential concept, Mojtabaei, S., 2021.

THE SUPPORTIVE THEORIES	[Possible] Play inspiring character (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002) Rich variety of species character (Grahn, 1991) Forest character (Grahn, 1991) Peaceful character (Grahn, 1991)
EXPECTED SOCIAL VALUES	Health and well-being Recreational benefits Aesthetic values Sense of place Natural/cultural heritage Social interactions Educational values
DESIGN PRINCIPLES	Multifunctional and adaptable A meaningful place to the community Provide equity, accessibility, diversity Promote health and well-being Integrate with environmental sustainability

The summary of the concept for Sub-urban residential, Mojtabaei, S., 2021.

7.9. Recreational activities around Sidsjön

According to the online focus group meetings with the key actors in Sundsvall municipality, (2021), the most common visitors of the lake are the younger generations who gather together because of its surrounding nature and the recreational opportunities the natural environment provides. Families and other groups of people also visit the area quite often and adding more diverse experiences around Sidsjön not only is favorable but also mentioned by the municipality.

The lake is a municipal nature reserve and a popular outdoor area that can be further developed (Sundsvall comprehensive plan, 2021). However, the connections to other crucial areas should be developed in order to add more social values to the place (Figure 7.12). Sidsjön is popular because of its boat cross-country and downhill skiing in winter as well as exercise tracks and mountain biking in summer. The importance of the area is in its proximity to the town center (Sundsvall comprehensive plan, 2021). The distance is only 3 km from the city center and visitors can easily reach the place by bike, walk, or bus (ibid).

Figure 7.12. Sidsjön location. Sundsvall municipality comprehensive plan, 2021.

At Sidsjön's shore, there are activities for all ages (Sundsvall comprehensive plan, 2021). Here one can swim in summer or ski on the ice in winter.

Fishing is available all year round from one of the handicapped-accessible piers around the lake or out on the ice.

Here one can run, ski, or just stroll in the 3.1-kilometer long exercise track which is just located after the edge around Sidsjön. The area is child-friendly and they can feed all the birds in Ankeborg, no matter what time of the year.

The walking track next to the ski track around Sidsjön is not sanded in winter and it can encourage visitors to have sleds along.

There is also the opportunity to rent a canoe, take a trip on Sidsjön, and paddle silently forward with the clucking towards the canoe.

7.9.1 Recreational idea for Sidsjön

What does walking on the lake sound like? Recreational activity is not only about engaging physically, but also mentally pleasing aspects of the activities can be considered. Neuroscience studies in Portugal indicate that variable perceptions can cause total distinct reactions and responses towards different design strategies of architecture and urban planning (Olszewska et al., 2015). The reflection of an immediate change of scenery in a beautiful landscape can bring a sense of well-being as well as intellectual and spiritual developments and consequently it would trigger creativity, promote learning ability, and initiate stress reduction mechanisms in our mind and body. A case study on the city park of Porto in Portugal -one of the multifunctional designed spaces which can provide mindfulness in visitors and it was designed by landscape architect Sidónio Parda- indicates that being close to natural elements such as water bodies can strongly offer comfort, significant mind recovery and soothing (Olszewska et al., 2015). This case study simply reflects an understanding of a well-designed space on human behavior and well-being.

The idea behind the concept of 'walking on the water' (Figure 7.13), has been in my mind for a long time since I used to go for a run into the forest, and at the point that forest and lake meet each other, I had this opportunity to continue my path through a wooden deck built on the side of the lake on water. A sudden change of scenery was an exciting experience for me and after the online focus group meetings with the representatives in the Sundsvall municipality, I decided to propose the concept for Sidsjön. During the meetings, it was mentioned several times that Sidsjön attracted a majority of people due to the different activities they were able to have around the lake. However, in addition to the existing activities, the main goal of the concept is to provide a pleasant human-friendly environment around the lake that on one hand can add more diversity to recreational values and on the other hand, enable the experience of different scenery on the waterscape (ibid).

Figure 7.13. A wooden deck can enable experience with the change of landscape, Mojtabaei, S., 2021.

THE SUPPORTIVE THEORIES	[Possible] Play inspiring character (Grahn, 1991) [possible] A rich variety of species character (Grahn, 1991) [possible] forest character nearby (Grahn, 1991) [possible]Peaceful character (Grahn, 1991) Proximity to the living area (Rydberg and Falck, 1999) Diverse plant composition (Ryan and Simson, 2002)
EXPECTED SOCIAL VALUES	Health and well-being Recreational benefits Aesthetic values Sense of place Social interactions Educational values
DESIGN PRINCIPLES	Multifunctional and adaptable A meaningful place to the community Provide equity, accessibility, diversity Promote health and well-being Encourage social interactions Integrate with environmental sustainability

The summary of the concept for the wooden deck on the lake, Mojtabaei, S., 2021.

Depending on the aquatic plant composition of the lake, the plantation inside the circle can be partly enhanced and/or be considered as a protected area/habitat for endangered aquatic species such as aquatic salamanders, grass snakes, etc. Further in-depth studies on the ecological aspects of the lake and its provided habitats are recommended before planning. The size, shape, and location of the circle deck can be changeable. The shape can change into a half-circle and/or be installed seasonally or be planned permanently. It means that the concept is not fixating on a particular location on the lake at this time and the purpose behind it is to bring the idea of more recreational and physical activities into the spotlight. Nevertheless, accessibility of the deck to all groups of visitors -especially children and handicapped people- was the priority behind forming the concept.

Without a doubt, the current natural condition of the lake and its surrounding area should be considered and even improved in case of further developments. Regardless of more possible recreational opportunities for humans by installing the wooden deck, saving the ecosystem of the lake is vital for the aquatic species and it should be prioritized. Moreover, the presence of the deck should not interfere with existing activities, except to enhance them and add more dimension and excitement to the place. Therefore, knowing the current condition of both social and environmental values around the lake can contribute to seeing the idea with an open mind and adjusting/applying the concept wisely.

## 7.10. Where on the map can the concepts be planned and considered?

The proposed concepts cannot be found anywhere out on the map, but they can be applied to different locations and parts of the city. It is important to consider that based on the location's potential or public demands the concepts can be changed and developed. The possible locations that the concepts can be applied to are indicated in Figure 7.14.

The concept for buffers and edges applies to locations close to the rivers, dikes, water streams, etc. There can be either an existing natural environment near the stream or implemented to create a more sustainable area.

The concept for industrial areas can be implemented inside and/or around the industrial areas and even be considered to change and/or enhance the existing green network in a way that can contribute to a resilient green infrastructure.
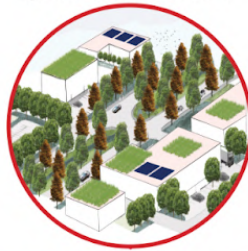
The concept for district forests is suited for the areas close to the city, located among some neighborhoods, accessible to everyone. The concept aims to save nature as it is and provide a variety of recreational activities for the visitors.

The concept for residential areas can be implemented close to the constructed housings and even the existing blocks. The whole concept is totally resilient to the changes and it can be developed based on the demands in the area.
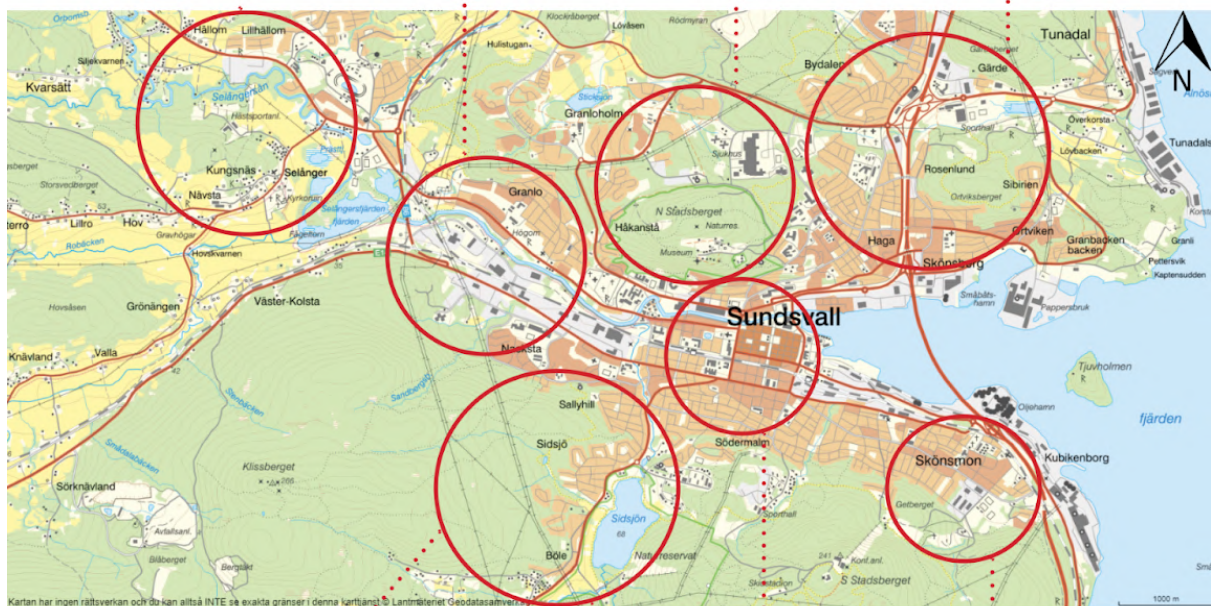
The concept for sub-urban residential areas applies mostly to parts of the city that are located close to the forests, untouched nature, and low-developed gray structures. These areas should remain natural and accessible to everyone.

The concept for Sidsjön can be planned in a variety of shapes & sizes, for similar locations where there is room for more recreational activities. New concepts not only can appear positive for the residents but also can attract tourism to the city.
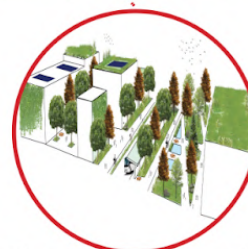
The concept for the main streets is suited for the central parts of the city that are located close to the shopping centers, and public stations. The concept can be integrated with the 'shared open space' concept based on the potential of the area.

The concept for neighbor-hood parks applies to the natural places between the residential areas in the same neighborhood. Based on the public demand and also the potential of the area, a variety of activities can be considered and planned.

Figure 7.14. Possible locations in Sundsvall that different concepts can be considered/planned, Mojtabaei, S., 2021. Depending on the different parts of the city, such as city centre, industrial areas, sub-urban areas, etc. the concepts can be considered in planning. Since the central areas of the city are already built, the concepts can be adjusted to the desired changes to enhance the provided social values of urban forests.

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7.11 Potential challenges and conflicts

Unintended conflicts can occur after any urban forest creation. The challenges should be considered from the very first steps during the planning process and possible conflicts should be monitored after implementations to enable early detection and countermeasures. Most of the challenges can be tackled through adequate concept planning, appropriate maintenance, and effective communication with local users. Potential conflicts may not necessarily appear at the same time and all in one place, but a consideration of the different range of challenges can help to form the concepts and set the design principles wisely from the beginning to avoiding the plans that may cause such conflicts in the future (Table 7.3).

POTENTIAL CHALLENGES	RECOMMENDED SOLUTIONS
Competition for space	✓ Early engagement with community's ideas and listen to their needs ✓ Providing appropriate green space for parallel activities to different groups ✓ Provide Mixed-use urban forest space for different activities
Degradation of urban forests due to overuse	✓ Providing local green space close to residential areas to lower the demand pressure ✓ Restricting planning to the size and capacity of the urban forest ✓ Ensuring adequate and frequent maintenance
Community dissatisfaction with urban forest services	✓ Early engagement with community's ideas and listen to their needs ✓ Involving local community members in the design ✓ Managing expectations during the planning ✓ Ensuring the community that some urban forests need time to deliver their full benefits
Safety issues, anti-social behavior, vandalism, and fear of crime	✓ Ensuring adequate and frequent maintenance of the place ✓ Providing adequate lighting to improve safety ✓ Scheduling regular patrol walks by local police ✓ increasing the sense of place by Involving residents in planning and maintenance ✓ Promoting social events and recreational use
Increase of health risk related to urban green spaces	✓ Maintaining urban forest spaces and associated equipment regularly ✓ Providing paths for elderly and handicapped people to minimize the falling risk ✓ Using plant species that do not produce allergic pollen or poisonous fruit or leaves ✓ Informing users about potential health risks and tell how to avoid them ✓ Considering protection from potential risks around lakes and rivers during the planning
Uncertain or reduced budgets for maintenance of urban forests	✓ Ensuring a low-maintenance design ✓ Finding innovative models of funding such as community ownership, foundations, etc. ✓ Ensuring local political support from the early stages ✓ Working with community groups and other organizations to support maintenance

Table 7.3. Potential challenges and usage of urban forests along with the recommended solutions, Mojtabaei, S., 2021. Depending on the location and/or the situation, multiple challenges can be considered during the planning to avoid future problems.

7.12. Summary of the results

The conceptual design models were formed based on the supporting theories, social values of urban forests that contributed to the design principles, online focus group meetings with the key actors, and also current visions and plans for green strategies in Sundsvall. As it was mentioned in chapter five, for planning urban forests in Sundsvall, the conceptual design models should be able to provide equal accessibility to all age groups, prioritize proximity to the residential areas, and be open and available to everyone.

Moreover, the concepts should also reduce barriers and enhance the connection between residential areas in a way that negative effects on the natural environment are avoided. It is ideal if the designs can provide as many social values as possible both around the coastal areas and also in the neighborhood. In order to reach the goals that are being held important to the Sundsvall municipality, the focus of the concepts is mostly around the residential areas and provided social values by the surrounding urban forest that can be applied in the different areas.

The genuine focus is on the provision of walkability, riding bicycles, social interactions through the public meeting places, community gardens, and possible picnic places around the blocks/neighborhood close to nature. The transitional network of greenery from an urban area to the coastal edges or surrounding forests can also enable other recreational opportunities such as mushroom/wild berries picking, forest promenade, jogging, birdwatching, fishing, or any other relevant outdoor activities that the surrounding area can offer.

It is important to mention that despite the concepts following the green strategies for the crucial areas in Sundsvall (see chapter 5), they are not customized for a specific location. However, a single concept or a possible combination of them (for instance, the concept of shared open space + the concept of main streets) can lead to better urban forest planning in any similar situation/location. In general, the conceptual design models indicate the possibilities for a greener development upon which the social values are strongly met and considered.

In order to save the existing ecosystem services and add more value to the environmental benefits, the combination of native plants and local vegetation is recommended. Moreover, the simplicity and yet functionality of the concepts depend on the shape and size of the plant composition, and therefore, it is wise if the possible combinations can be identified or the probable substitutes can be studied to guarantee the best choice for the plant combination.

Studying the municipal documents along with the online focus group meetings revealed that health and well-being, recreational activities, social interaction, and also educational benefits of a good quality green network are the most desired social values of urban forests in Sundsvall and in order to reach the green visions for the city, they need to be planned and understood from the very first steps of planning.
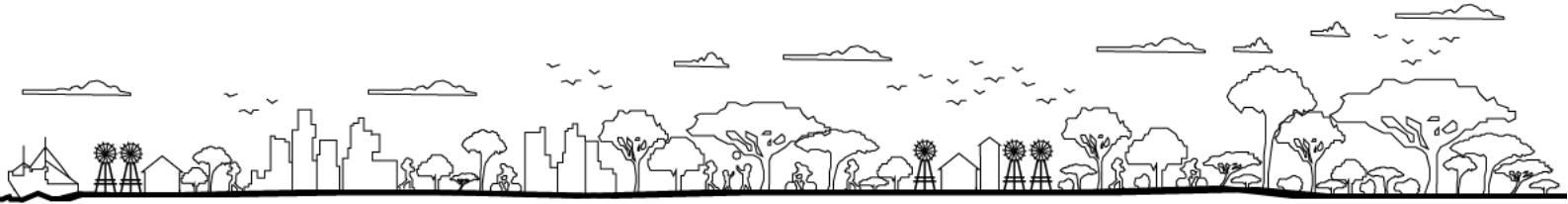
CHAPTER 8

DISCUSSION AND CONCLUSION
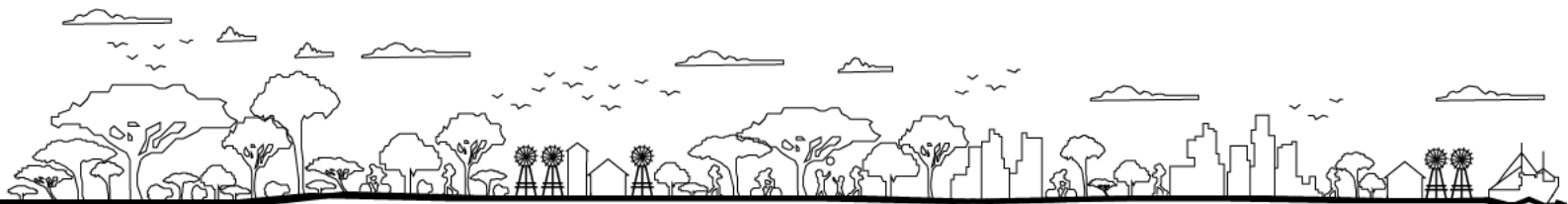
Urban development has become a progressing outcome of a growing population that wants to live in cities. Around three-quarters of the population in Europe have lived in urban settings by 2020 (International Urban Forestry Online Event, 2021). Under such rapid development, access to nature would be limited, and consequently, the provision of environmental benefits and social values of nature in the city should increase to keep human health and protect ecosystem services (ibid).

The main aim of my study was to develop a deeper understanding of the social values of urban forests in everyday urban life and apply that knowledge to propose a series of conceptual design models that can meet those social values through designing urban forests. To reach the goal, relevant theoretical approaches together with the literature studies, data analysis from municipal documents, multiple online international events about modern urban forestry, and also online focus group meetings with the key actors in Sundsvall municipality were the supporting methods to form the design principles and shape the conceptual designs that could take on the contribution of social values to urban forestry.

It is important to mention that the research questions that were targeting the benefits of urban forestry, social values of urban forests, and urban forest policy in Sundsvall were answered through the literature studies, relevant theoretical approaches, and meetings with Sundsvall municipality. Other research methods such as International Online Urban Forestry Events as well as studying Sundsvall's comprehensive plan and green visions could also contribute to understanding the importance of social values in urban forestry.

Scrutinizing the municipal documents resulted in revealing the most highlighted social values that the municipality seeks for Sundsvall city in urban forestry; accessibility, proximity, equity, recreational activities, and educational opportunities for everyone, especially around the residential areas and the most visited places in the city. Consequently, the introduced conceptual designs in this work are the result of studying both the theoretical approaches towards urban forests in Sweden (by Rydberg and Falck, 1999, Ryan and Simson, 2002, and Grahn, 1991) and also analysis of the green network plans and strategies that Sundsvall municipality wants to reach for the city. Among different theoretical approaches towards urban forests, these three approaches had the benefit of focusing on the social values of urban forests, being close to the general perspective of urban forestry in Sweden, and also consider distinctive possible characters in an urban context.

Studying the green visions for the future Sundsvall also revealed that on one hand, achieving sustainable plans for using energy and being effective towards climate change are prioritized goals until 2040, and on the other hand, the social values of urban forests should be recognized and enhanced from the very first step of planning.

In this context, the proposed conceptual design models for urban forestry [in Sundsvall] is the most important outcome of this work and conform with both the theoretical approaches and the desired social values of urban forests according to the online focus group meetings (2021) with the representatives of Sundsvall Municipality. From a general perspective, the proposed concepts are adapted to the required social values in Sundsvall. In order to meet the targeted

social values, not only can the conceptual design models offer a holistic approach to ensure that forest activities deliver social and environmental benefits, but also can identify the possible challenges in advance, enable planning for balancing public needs, and maintaining the forest functions -especially around the residential areas- in the city.

Although the proposed concepts are meant to target the social values of urban forests in Sundsvall and are generally based on accessibility, proximity, and recreational opportunities to all groups of people, further studies and considerations must be taken into account before making plans for a specific area. Moreover, the participation of the residents in the decision-making process can contribute to forming a better functional green space upon which not only their needs can be met but also the other dimensions of sustainable urban forestry such as environmental benefits and economic values can be reached and balanced.

According to the meetings with the representatives of Sundsvall municipality (2021), the city has a unique and rich nature that has always attracted tourists and visitors, especially during different annual festivals and sports events. Therefore, a good quality green network within the city that offers recreational benefits and accessibility to everyone can promote both outdoor visitings for the local community and increase the tourism industry that results in more economic benefits for the city (ibid). Preservation of the natural environment and enhancing accessibility to the existing nature should be considered the heart of every planning process, regardless of which city the plan belongs to. Adding nature and its diversity to everyday life can also bring more dimensions to the place and create a sense of belonging.

As it was revealed in chapters five and six, urban forestry and sustainable design concepts are essential to ensure that society's demands don't compromise natural resources and those resources are also managed wisely. The study of social values in this thesis indicated that for cities to provide healthy and sustainable living environments, urban forests are nature-based solutions that can offer innovative approaches to increase the quality of life in urban areas, enhance local resilience and promote sustainable lifestyles by improving human health and well-being. Protected forests, parks and pocket parks, playgrounds, and any good quality vegetated area are essential components of green/blue infrastructure for the city (Urban Vision Sundsvall for 2007-2037). Therefore, it is necessary to ensure that different kinds of urban forests are easily accessible to all people and they are distributed equitably in the city.

8.1. Further studies

Other than providing social values, to be able to develop an urban environment sustainably, environmental values and economic aspects of urban forestry should also be studied. As mentioned in chapter 3, urban forests can appear as a tremendous contributor to green/blue infrastructures and consequently affect environmental and economic benefits. Regarding the results from chapter seven, this study has explored several concepts focusing on providing accessibility, proximity, and more recreational opportunities relating to the design of urban forests occupying the network of public spaces. Although, the limited timeframe for this study would not let it dive deep into the detailed form of the concepts for specific location/s.

Therefore, working with additional details such as accurate measurements, height of the buildings, screening for native plant species, sunlight studies, green/blue roof structures, green walls structures, reusing the collected water by the vegetated area, etc. to make plans based on the nature of the area can all be considered as a variety of further studies that wasn't taken into account in my study. However, working with the detailed aspects and specific locations and/or conditions was not the aim of this study from the beginning. This study represents only the concept models and leaves the details out for the further steps.
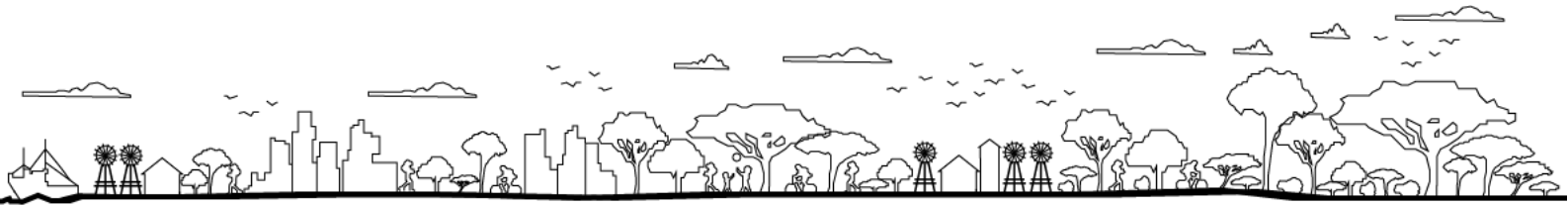
Nevertheless, depending on the developing area's situation the proposed concept models can provide a platform for further studies on the structure of the urban forest, plant composition, and its ecosystem services when it comes to the introduced categories over the city. The concept models have the potential to be combined in a broader context during the planning and expand the social aspects of the urban forests. The designer's job is to integrate the relevant concepts into a unified whole, achieving a balance among the social benefits, the functional aspect, and the ecological values.
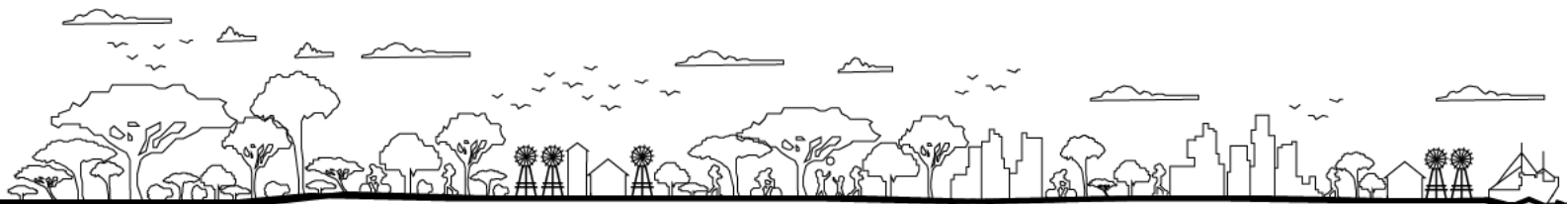
8.2. The design challenges

Functional urban forests do not happen by accident; a long-term perspective and specific forms of planning and design are needed to ensure that urban forests can provide the settings that are part of people's everyday life. Urban forests must represent a safe, welcoming, easy to access, and attractive natural place for a wide range of uses. As it was revealed in chapter five, proximity, accessibility, and recreation are also the case in Sundsvall. In this context, the major challenge of the concepts that comes from the design principles is to contribute to the development of a sustainable city by using trees in the best way that on one hand can provide these desired social values, and on the other hand, have the potential to enhance water and air quality, reduce energy costs and provide human and wildlife habitats.

Another challenge that should also be considered seriously in further steps is to preserve and manage the existing resources while adapting them to present and future needs. Also as it was mentioned in chapter 3, among the provided social values by urban forests, both a strong sense of place and well-being can play a crucial role in how different ethnic groups understand their local landscape. Therefore, it is crucial to make the urban forest accessible to everyone, regardless of their living location, age group, ethnicity, and economic situation. This means that urban forests should be placed where people live and work so that nature can become a constant part of every life in an urban environment.

The deep understanding of the social values of urban forests, their interrelation, and their importance in landscape planning not only was the core of this study but also would be held forever as the most rewarding outcome of this work to me. As someone who has worked mostly with the environmental benefits of urban forests through work experience, studying the social values which are going hand in hand with environmental aspects to create a livable sustainable city, opened new horizons for me to explore and learn beyond this study in the future. I would always cherish and carry the moments of this invaluable journey in my heart.
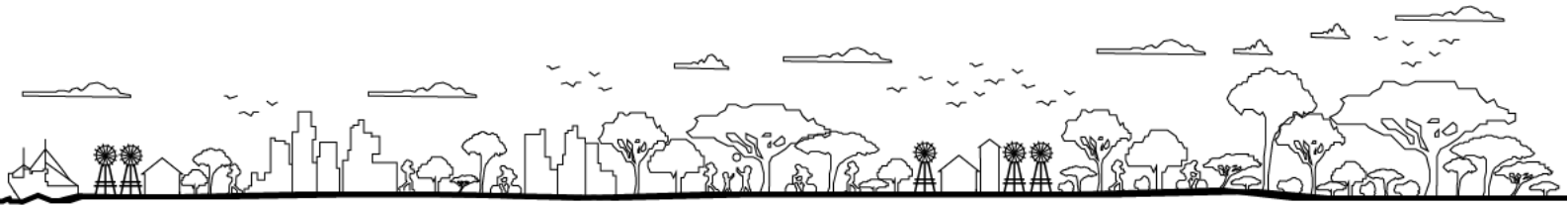
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