



Sveriges lantbruksuniversitet
Swedish university of Agricultural Sciences
Faculty of Landscape Architecture,
Horticulture and Crop Production Science

Hanna Holmberg

Independent Project • 30hp
Landscape Architecture
Alnarp 2022

HERBACEOUS VEGETATION FOR TRAFFIC ISLANDS

A design proposal in Bromma



Title: Herbaceous vegetation for traffic islands - a design proposal in Bromma

Swedish title: Örtartad vegetation för trafiköar - ett gestaltningsförslag i Bromma

Author: Hanna Holmberg

Supervisor: Karin Svensson SLU Department of Landscape Architecture, Planning and Management

Examiner: Petra Thorpert, SLU, Department of Landscape Architecture, Planning and Management

Biträdande examiner: Stefan Sundblad, SLU, Department of Landscape Architecture, Planning and Management

Credits: 30

Project level: A2E

Course title: Independent Project in Landscape Architecture

Course code: EX0852

Program: Freestanding

Place of publication: Alnarp

Year of publication: 2022

Cover image: © Hanna Holmberg

Online publication: <http://stud.epsilon.slu.se>

Keywords: Perennials, urban vegetation, design proposal, traffic environment, naturalistic planting design

THANK YOU!

First of all I would like to thank SLU-Alnarp for introducing me to the wonderful world of plants. This work is the result of five years full of new experiences and knowledge gained at the university. A special thank you to Karin Svensson for leading me through the process and to Bromma stadsdelsförvaltning for providing me with information about the sites. I would also like to shine a light on everyone who in one way or another, big or small, has contributed to this work. I appreciate every book, article, email and picture. Thank you all for your contribution and support.

Finally I would like to dedicate this work to my parents for always supporting and believing in me, thank you!

Abstract

Today many of us spend a big part of our lives in the grey hardscape that dominates our urban environments. There is research pointing towards the health benefits gained from nature as well as the ecological values that vegetation brings to our cities. Despite this a lot of the green spaces or patches within our cities are not being designed in a way that they reach their full potential. There is an over representation of mowed lawns and trees not well suited for the harsh environment. Whereas perennials are often overlooked or neglected altogether.

In this thesis the potential benefits of using herbaceous vegetation in the traffic environment is explored. Would it be possible to transform the larger and perhaps smaller traffic islands so that they provide both aesthetic and ecological values by using perennials? Through looking at existing research the topics of how people and plants are affected by the urban environment and how plants can impact people are explored. Further on the potential for using nature as a source for both inspiration and knowledge are looked into. As a way to test the result from the literature study three traffic intersections in Bromma, Stockholm, receive planting design proposals. These involve replacing the mowed lawns with a more diverse herbaceous vegetation. The thought to inspire municipalities and other professionals to embrace the herbaceous vegetation and incorporate it more in our urban environment.

Sammandrag

Idag tillbringas många av oss en stor del av våra liv i det övervägande grå och hårdgjorda miljöerna i våra städer. Det finns forskning som pekar på hälsofördelar med naturen såväl som de ekologiska värden som vegetation potentiellt kan bidra med i våra städer. Trots detta är många grönytor i våra städer inte designade så att de når sin fulla potential. Det finns en överrepresentation av klippta gräsmattor och träd som inte är väl lämpade för den tuffa miljön. Detta medan perenner ofta förbises eller försummas helt och hållet.

I denna uppsats undersöks de potentiella fördelarna med att använda örtartade växter i trafikmiljön. Skulle det vara möjligt att omvandla de större med hjälp av perenner så att de bidrar med både estetiska och ekologiska värden? Genom att titta på befintlig forskning undersöks ämnen så som hur människor och växter påverkas av stadsmiljön samt hur växter kan påverka människor. Vidare studeras möjligheterna att använda naturen som en källa för både inspiration och kunskap. Som ett sätt att testa resultatet från litteraturstudien får tre trafik korsningar i Bromma, Stockholm, förslag på ny vegetation. Dessa innebär att de klippta gräsmattorna ersätts med en mer mångsidig örtväxtlighet. Tanken är att inspirera kommuner och andra yrkesverksamma att omfamna de örtartade växterna och inkludera dem i större utsträckning i vår stadsmiljö.

TABLE OF CONTENT

INTRODUCTION	10
Background	10
Aim, research questions and delimitations.....	11
Method and materials	12
LITERATURE STUDY	12
Designprocess	13
Structure and reading guide lines	15
Credits	15
PART I - LITERATURE STUDY PEOPLE AND PLANTS IN URBAN CITIES	17
Qualities of the urban environment from a human perspective.....	18
Qualities of the urban & traffic environment from a plant's perspective..	19
Values of vegetation with a focus on perennials in the urban environment	20
Biomass	20
Diversity for ecology and health.....	20
Seasonal aesthetics: colour and and structure	22
Plants in the traffic environment	23
How people are affected by plants	24
CONCLUSION PART I	25

PART II - LITERATURE STUDY DESIGN AND NATURE	27
Nature as a source of information and inspiration	28
Climate	28
Soil.....	29
Plant strategies.....	30
Habitats	32
Steppe.....	33
Prairie	34
CONCLUSION PART II	36
PART III - DESIGN PROPOSAL	39
Design proposal - Introduction	40
Plantmixes	41
Climate	42
A garden city	44
The road	45
Locations	46



CONCEPT - GARDEN CITY 2.0	49
Alviksplan - site specifics	50
Inspiration ALVIKSPLAN - a hillside steppe	52
Conceptual sketches ALVIKSPLAN - a hillside steppe	53
Concept and Design ALVIKSPLAN - a hillside steppe.....	54
Plant combinations	56
ALVIK Planting plan	58
Ulv sundaplan - site specifics.....	60
Inspiration ULVSUNDAPLAN - a prairie passage.....	62
Conceptual sketches ULVSUNDAPLAN - a prairie passage	63
Concept and Design ULVSUNDAPLAN - a prairie passage	64
Plant combinations	66
ULVSUNDAPLAN Planting plan	68
Brommaplan - Site specifics	70
Infrastructure and change.....	72
Concept.....	73
Brommaplan Plants.....	74
Moodboard	75
Maintenance	76

PART IV - DISCUSSION	79
Life in the city, road safety and vegetation.....	80
Planting design and maintenance	80
Design proposal	81
Plant suggestions	82
Method discussion	83

PART V - CONCLUSION AND REFLECTION	85
Conclution and reflection on research questions	86
FINAL REFLECTION	87

PART VI - REFERENCES	89
List of references	90
List of figures	93



Introduction

BACKGROUND

During my time at SLU-Alnarp my knowledge regarding the benefits provided by plants has grown tremendously. A theme throughout my education has been plants with a focus on perennials. Courses in plant knowledge and planting design have given me a greater appreciation for the potential that lies within the herbaceous vegetation. That is if one manages to understand the plant material. Further on courses such as People and Environment brought a deeper understanding for the connection between plants and people.

With more knowledge came an awareness of the monotone plantings usually found in the urban environment in which many of us live our lives. One example is traffic islands that are often neglected when it comes to plantings. The most common vegetation is the "green dessert" also known as the cut lawn. In the right setting a lawn has great values. For example, research show that lawns encourage both activity, rest and social interaction. However, I think we can all agree that neither play nor a picnic will take place in the middle of a traffic intersection and that it can be seen as a waste of valuable land to have lawns where they can not be used. These patches of land could instead be designed in a way that brings aesthetic and ecological values greater than what is provided by the lawns.

When it comes to the choice of sites for the design proposals in this thesis, I chose to go back to my roots. I grew up in a suburb of Stockholm called Bromma. This is like many suburbs, a green district with gardens, parks and nature being a central part of life. However after studies at SLU and with the new knowledge mentioned above I look at the environment from a new perspective. Drottningholmsvägen, which is the main connection between Bromma and the city of Stockholm, is a road used by many for their daily commute. As mentioned I grew up in this district and have therefore traveled this road many times. I now see the potential in the lawn covered traffic islands along this road. By incorporating a more diverse vegetation in the larger traffic islands one could add both aesthetic and ecological values. At the same time these intersections could become welcoming gates to the district.

AIM, RESEARCH QUESTIONS AND DELIMITATIONS

With this work I wish to deepen my understanding of the harsh environment in our urban cities and see if and/or how we can improve these both aesthetically and ecologically by using perennials as the main material. My aim is to, with the help of a literature study, design plant communities for traffic islands that will add value to people as well as lowering the need for maintenance by the municipality. My hope is that this work can inspire municipalities and landscape architects to incorporate more diverse plant communities within the urban environment. Although this work focuses on the traffic environment I do hope that the inspiration can reach beyond the traffic islands.

Questions I wish to answer:

- What qualities make up the conditions of traffic environments? How do we experience these?
- What natural habitats (non designed plant communities) can we look to for inspiration when designing plant communities for the traffic environment?
- How can perennials and geophytes be used to add aesthetic* and ecological** values to traffic islands while lowering the need for repeated maintenance?
- In what way might perennials in the traffic environment impact people's health and wellbeing?

Due to the time limit of this work the following delimitations applies to the design proposal:

- The project will not look at the road systems and make any changes regarding the traffic.
- The project will not include full technical plans including superstructures.
- The project will not include quantities of substrate needed for the plantings. However the substrate will be specified.

* The word originates from the greek word aisthēta that means to perceive, and is commonly described as perception by the senses' (Lexico 2021). In this work the focus is on the perception of sight. The appreciation of the beauty found within the diversity of colour, shape and structure among plants and the value they bring to our lives.

** Benefits provided by nature to the environment, humans as well as nonhumans (Cordell et al. 2005).

METHOD AND MATERIALS

This work has been conducted through a literature study and a design process.

LITERATURE STUDY

To find literature I have borrowed books on the subject from the library in Alnarp. I have also used databases including Primo, Scopus, Google scholar and Epsilon. Query strings I have used are: Biodiversity and health and wellbeing, Vegetation in urban setting for mental health and wellbeing, Hälsa och välbefinnande i urban miljö, Traffic and roads as habitats for plants, Traffic landscape perennials as well as Traffic landscape. I have also received information and documents from Bromma stadsdelsförvaltning.

REFERENCES

This thesis focuses on herbaceous vegetation in the traffic environment a subject that has proven hard to find literature on. There are studies conducted about health in urban environment and the benefits of plants. However, they usually focus on vegetation on a whole or with a focus on woody plant material.

Although the focus in the literature is not necessarily the same as in the thesis some important sources contributing to the literature study are; *Role of Vegetation as a Mitigating Factor in the Urban Context* (Ferrini et al 2020) , *Psychological benefits of greenspace increase with biodiversity* (Fuller et al 2007) and *Does biodiversity improve mental health in urban settings?* (Dean et al 2011).

There are valuable information regarding plants, people and the stressful environment of our cities to be found in these texts. The information found in said texts can be interpreted to include herbaceous plants such as perennials and geophytes that are the focus of this thesis.

In regards to finding inspiration for the design and plant composing aspects of this work some of the most important sources are *Naturalistic Planting Design The Essential Guide* By Nigel Dunnet (2019) as well as *Planting in a Post-Wild World* written by Thomas Rainer and Claudia West (2015). Both these books have a focus on nature as a source of inspiration something that has been a central part of this work. To gain more information about plant strategies as well as prairie and steppe habitats the books *Plant strategies, vegetation processes, and ecosystem properties* (Grime 2001), *Sowing beauty: designing flowering meadows from seed* (Hitchmough 2017a) *Gardening With Prairie Plants: How To Create Beautiful Native Landscapes* (Wasowski 2001) have been the key sources.

Although not published sources the conversations with Marc Brent from Oxford Botanical Gardens and Arboretum as well as Malena Christoffersson from Lund municipality contributed with awareness of the current view among professionals within the field of maintenance something that I value highly. Same goes for the correspondance with Sonja Forward regarding road safety.

DESIGNPROCESS

Nigel Cross (2008) describes a simple four-step model of the general design process seen below in *figure 1*. However the process in itself isn't necessarily experienced as being linear as the model suggests. In the book *Design process och metod* (Wikberg et al 2015) the authors write that all design processes will be different. There is a dynamic within designing that will change depending on the project and the people involved. For instance they write that a planned process where one follows a specific method can be limiting for some. Nigel Cross also writes in the book *Design Thinking* (2011) that a lot of designers find it hard to describe their process since it is partly intuitive or instinctive. This is something I explored in my Bachelor thesis where I categorized the steps of the design process into free/intuitive or intellectual/thought driven (Holmberg 2019).

With the design proposals presented in this thesis I did not set out to follow a specific method but instead let my intuition lead the process. In retrospect I can see how it, although not intentionally, follows the four-step model by Nigel Cross (2008). As a way to describe my process I have divided it into four steps correlating with the model mentioned above. In line with the result I could see in my Bachelor thesis a lot of the problem solving of designing has taken place unconsciously. On the following page a description of the stages are presented combining the four-step model with the categories from my previous thesis.

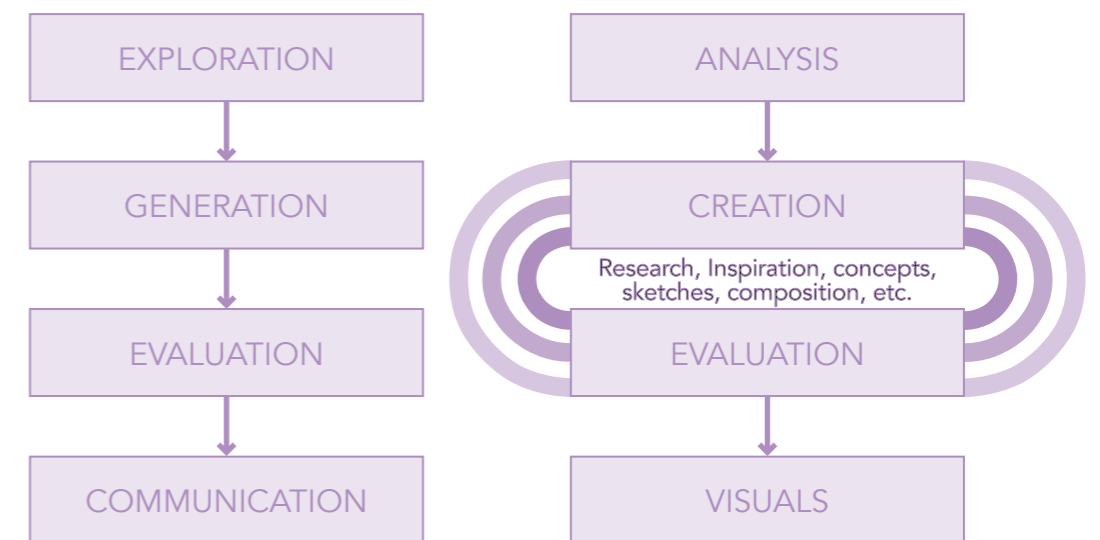
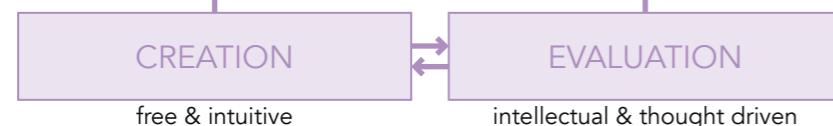


Figure 1: To the left is the four-step model over the design process by Nigel Cross(2008). On the right is a rendition by the author showcasing the design process in this work. In the rendition one can see the circuit created between the creation and evaluation. A cycle within which a majority of the time is spent during the process.



Site visits both in winter and summer, photographs being the primary medium to document the sites. Maps and documents provided by Bromma Stadsdelsförvaltning have also been part of the analysis. It is also important to point to the fact that I have seen these places throughout my whole life and therefor have experiences that might have affected the result of the analysis.



During this stage the process becomes somewhat diffuse. This is where the intuition has been let to take the lead. The creation is constantly evaluated. These two processes seem to happen parallel to each other. There isn't much clarity until finally things fall into place resulting in a design and planting scheme.

Inspiration and Concept

Apart from finding inspiration through the literature study I have been influenced by pictures of both natural habitats and designed plantings. I also carry experiences from travels, internships and my time at SLU. Inspiration from both external and internal sources has contributed to the concepts for the sites and character traits for each site were selected. These then acted as a framework for the design.

Composition and Design

Perhaps the most instinctive of all stages has been the design and plant composition part. Through rough sketches, trial and error the concepts were brought to life. With the layout drawn the focus was to create plantmixes. This included researching plants that would fit the conditions and combining them into mixes. This process was made easier thanks to the knowledge gained from studies at SLU which has resulted in a library of plants suitable for different sites. Once mixes were created the final planting plan was drawn.



An important part of the design proposals has been to showcase the character of the designs and the diversity within the plant mixes. Illustrations have been made using a combination of hand drawn sketches and digital tools such as Affinity Designer and Affinity Photo. Visuals were also made for showing the result from the analysis using the same softwares.

STRUCTURE AND READING GUIDE LINES

The work is divided into five parts, not including list of references. At the end of part one and two a short conclusion on the subjects covered in the chapter is presented.

The parts are as follows:

I - Literature study, People and Plants in Urban Cities

This initial part of the literature study has a starting point in the research questions and focuses on the struggles people and plants face in the urban environment.

II - Literature study, Design and Nature

The second part of the literature study has a focus on nature as a source for inspiration for designing plant communities.

III - Design Proposal

First follows an overall analysis that applies to all three of the sites. Further on the sites Alviksplan and Ulvsundaplan are presented with site details, concept, plans and illustrations. The presentation of Brommaplan, which is the last of the three sites, varies from the two prior. This site has received a conceptual moodboard and suggestions for plants. However there are no plans for this site due to infrastructural challenges that will in time lead to a redesign of the area. Finally a short description of the maintenance required for the sites is presented.

IV - Discussion

The discussion is divided into four sections where the results from the literature study and design proposals are reflected upon.

V - Conclusion and final reflection

A summary over the answers found for the research questions.

VI - References

All references are listed at the end of the thesis. All photographs and illustrations throughout the thesis are presented with a figure number, the name of the creator and if available a CC-license. More detailed descriptions of the figures are found in the list of figures following the literature references at the end of the thesis. Unless anything else is stated all figures such as photographs and illustrations are works by the author, and are not to be used without their consent. Theses are also included in the list at the end.

Qualities of the urban environment from a human perspective

According to the UN 55,3% of the world's population live in urban areas. In Sweden this number is even higher coming in at 87,4% (United Nations 2019). In the urban setting people are constantly surrounded by different stressors such as pollution, noise, economic stress and dense living situations. To be constantly stimulated often results in feeling overwhelmed which can affect a person's overall wellbeing (Taylor et al. 2018). That these circumstances affect people is not surprising. Looking at the history and the evolution of mankind we have only been exposed to these stressors during a very short period of time. This means that the urban environment can be seen as an unnatural environment for humans (Peschardt 2014).

During the last decade we can see a rise in stress related illnesses. In Sweden the amount of psychiatric diagnoses increased with 59% in 2010-2015 and among these 66% were due to stress (Lindwall & Olsson-Bohlin 2016). It's hard to tell whether the rise in stress related illness is due to our lives in urban environments. However a lot of research show that nature can have a positive effect on people's wellbeing in comparison to the built environment (Ulrich 1984). Something that aligns with research from Norway stating that green cities with a lot of parks and green elements are preferred over grey cities (Nordh 2010).

One of the most extreme environments in our cities are our streets. These grey infrastructural elements waving through our cities play an important role in our everyday life as they help us get from A to B. We spend a lot of time in or in close proximity to the traffic environment. In Stockholm 41% of travel is made by car (Region Stockholm 2019). Looking at the daily commute between 40-50% use their car. This percentage is lower than for the regions of Göteborg and Malmö perhaps because of the well designed public transportation system offered in Stockholm but also due to the congestion in the traffic system (Smidfelt Rosqvist et al. 2011). Queues are no longer exclusive to rush hour resulting in frustration and higher levels of everyday stress. In the magazine *Teknikens Värld* (Åhlander 2017) one can read about a survey conducted by SIFO that shows how 75% of drivers in Sweden experience that the stress levels have increased during the last 10 years. A high number of participants also tell of increased road rage among other drivers.

The traffic environment is not only a stressful environment for our mental health but it is also full of risks. In Sweden Trafikverket work with Vision Zero, a project with the goal that no humans will be killed or injured in the traffic (Trafikverket 2020b). The biggest reason for accidents is the human factor. There are a number of things that influence the way we act in the traffic. The car as a status symbol, the fact that people feel a sense of anonymity when in the car, self-assertion, driving skills and the amount of cars that if high can lead to frustration. Stress or overall wellbeing is something that plays a role in how people react in relation to these circumstances. One common reaction is overspeed or reckless driving (Forward 1999). The speed has a big impact on the severity of an accident. Overspeed is the reason for around 100 lives lost each year in the traffic in Sweden (Trafikverket 2020a). The Stockholm municipality has a programme for the development of a safer and more attractive city. In this they report that the most important goal is to make sure that speeds are adjusted according to specific traffic situations and that they are being followed. In the rapport one can see pictures how they for example include plants and adjust design of streets to create a more attractive and safer environment (Hartzell et al. 2010)

Qualities of the urban & traffic environment from a plant's perspective

Plants can sometimes be complicated to understand. We find them growing in the most hostile of environments and yet it can be hard to keep them alive in our gardens. However when it comes down to it they all need the same things; water, light, nutrients and air, only in varying amounts. This said it is important to understand the environment in which we wish to introduce plants. The urban environment might be as unnatural for plants as stated earlier regarding humans (Peschardt 2014). However one can with the right analysis pick plants that are well suited for this environment, something that has been addressed by a number of plantsmen and women such as Thomas Rainer, Claudia West, and Beth Chatto among others (Rainer & West 2015; Chatto 2021).

Urban cities and the traffic environment in particular are highly contaminated both above and below ground. Air pollution of varying sorts and sizes make for tough growing conditions for all plants (Spirn 1984). One problematic factor is the salt that is used during winter to clear streets from snow and ice. The airborne salt that lands on the parts above-ground is highly concentrated and can cause physical damage to the plants (Huisman 2000).

In order to provide healthy growing conditions for plants the soil is of high importance. It is from the soil that the plants through the roots get a majority of their nutrients, water and oxygen needed to grow. It is important to have pores of different sizes within the soil (Gustavsson 2020). The compacted soil we often find in the urban setting is therefore another problem making life challenging for the urban plant. Besides the lack of water and air in a soil suffering from compaction the life of microorganisms that help provide nutrients for the plants is also affected. On top of this the root growth is hindered in a densely packed soil, with limited root growth nutrition uptake is minimized, affecting the condition and life span of the plants. The soil in close proximity of streets suffers not only from compaction but from contamination just like the air (Spirn 1984). Although the airborne salt and other particles are stated as the most problematic for plants, the contaminated soil will also affect the plants through absorption through the roots (Huisman 2000).

As described initially plants have a few essential necessities in order to survive and thrive. All the conditions described above contribute to challenging growing conditions affecting the lifespan of plants. According to *The Granite Garden* (Spirn 1984) the lifespan of a tree living under these conditions is only around 10 years. 10 years might be on the lower end of the lifespan of trees even in the urban environment. In an article by Lara Roman (2014) the lifespan of trees are expected to be somewhere between 19-29 years. In the article the annual mortality rate is estimated to be between 3,5-5,1% resulting in a half-life among street trees to land between 13-19 years. This means that around 50% of all trees planted in the street environments do not make it past 13-19 years. Although this is far longer than the 10 years mentioned above it is still to be considered a short lifespan for trees. Spirn (1984) suggests that perennials thanks to their smaller root systems may be better suited for the harsh environment that is found in our urban cities.

Values of vegetation, with a focus on perennials, in the urban environment

BIOMASS

In the section above, contamination of the traffic environment was presented as well as the challenges that face plants living in this environment. However, plants can play an important role in the urban environment by helping to remove pollutants. In a review on the role of vegetation in urban environments Ferrini et al. (2020) conclude that higher biomass gives higher values. A larger biomass should therefore be desirable. Although the review focuses on the importance of trees one can imagine that a lush and rich herbaceous layer also contributes to the mitigation of pollutants. By introducing a diverse perennial planting one could improve not only the aesthetic aspects but also the quality of the air.

DIVERSITY FOR ECOLOGY AND HEALTH

Diversity within planting communities is naturally important from an ecological aspect since it is providing living habitats, food and shelter for insects and other animals (Dunnett 2019). A diverse planting can in other words increase the biodiversity regarding both flora and fauna. In a study by Johansson et al (2014) the result showed that people are concerned about biodiversity and the decrease seen in species. The authors write that this might be due to a rise in peoples 'pro-environmental behavior'. Although that study was not conducted within an urban environment it gives us a deeper knowledge about peoples feelings toward biodiversity and the conservation of natural environments which can be relevant even in an urban setting. According to Dean et al. (2011) biodiversity can also have a positive effect on humans. This due to the critical role it plays in the health of our ecosystems. Healthy ecosystems have the potential to provide humans with important services, *ecosystem services*. The concept of ecosystem services aims to shine light on how human welfare is connected to the services provided by ecosystems (Naturvårdsverket n.d.). They are commonly divided into four categories: provisioning, regulating, supporting and cultural (Boverket 2021). The services provided by plantings with higher biodiversity can help in recovery from stress related illness such as fatigue, benefits that fall in the cultural category (Dean et al. 2011). Since the traffic environment is proven to be highly stressful as noted earlier in this work (Åhlander 2017) these studies talk in the favor of adding plantings with higher levels of diversity in our roadside environments. The study by Johansson et al (2014) showed that people experience a high appraisal towards an intermediate to high level of biodiversity. Areas with the lowest biodiversity received the lowest grades regarding appraisal. They also found that people seemed to think that all biotopes* were important to conserve, proving that people care for natural environments. The importance to conserve biotopes could point towards that the public prefers or finds native species to be of higher importance. However a study in Sheffield recently showed that the perceived biodiversity and natural structure of a planting had a bigger impact on restorative effect than the number of native species (Hoyle et al. 2017).

In the book "The Biophilia Hypothesis" (Kellert & Wilson 1993) the authors bring up four statements for why biodiversity is so important. These statements rise from evolution and point us towards the future. These can be seen on the next page.

*biotope, a region with a particular flora and fauna (Hine, 2008)

- *"Biodiversity is the Creation - the importance of the incredible amount of living organisms in constant development"*
- *"Other species are our kin - evolution, humans arose from the single cell eukaryotic organisms of the planet and therefore we are all connected"*
- *"The biodiversity of a country is part of its national heritage - Not one country has the same set of biodiversity as another one, it is unique and therefore of high value"*
- *"Biodiversity is the frontier of the future - the future is here on earth and it will continue to develop but we need to take good care of it if we want to be a part of it"*

(Kellert & Wilson 1993)

SEASONAL AESTHETICS: COLOR AND AND STRUCTURE

In the book *Planting a new perspective* (Oudolf & Kingsbury 2013) the authors present the qualities that perennials can bring for all seasons. By working with multiple layers in a planting it is possible for a planting to deliver all year round. They are by no means alone with this approach. Tomas Rainer, Claudia West and Nigel Dunnett (Rainer & West 2015; Dunnett 2019) among others also create plantings focusing on perennials with long seasonal interest. A year in a herbaceous planting starts with the first growth of perennials paired with geophytes that go dormant in summer. In *figure 5* the color of early spring bulbs are shown. As summer approaches perennials and grasses tend to grow taller offering both color and structure to the borders. As summer turns to fall and later on winter the color focus fades and structure becomes the main event in the border as the vegetation period is over and a majority of the herbaceous plants go dormant. Come next year the cycle will start again with the first burst of color offered from the plants (Oudolf & Kingsbury 2013). In *figure 1-4* below the seasonal change of *Hylotelephium* 'Herbstfreude' are shown.



Figure 1. Early spring growth *Hylotelephium* (Garcy 2021)



Figure 2. Summer *Hylotelephium* (Wahl 2007)



Figure 3. *Hylotelephium* summer flower

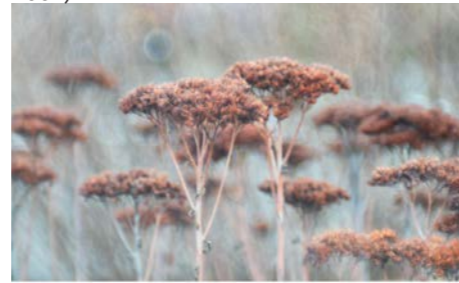


Figure 4. Winter *Hylotelephium* (Roos 2018)

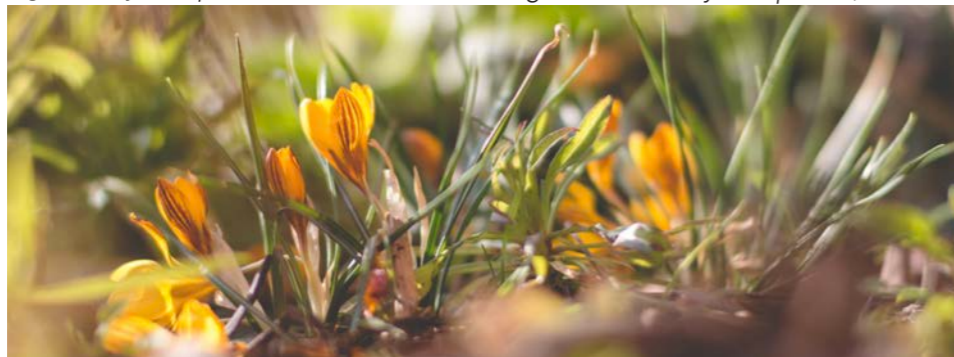


Figure 5: *Crocus* ad a splash of color in the early spring (Andrews 2018)

Plants in the traffic environment

The Urban forestry/Urban Greening research at the University of Washington (Wolf 2010) points out that drivers in areas with more greenery along roads show lower levels of stress as well as frustration. By adding trees and other vegetation along roads in urban areas one might be able to prevent road rage that has been increasing according to Swedish drivers (Åhlander 2017). Traffic researcher Sonja Forward (2021) agrees with this and recalls one study that showed that the speed decreased when people were driving through areas with more greenery. She is also confident that vegetation has the capacity to affect drivers although more research is needed on the subject.

Forward (2021) mentions that the removal of trees in the roadside vegetation is common in Sweden due to the increased risk in the case of accidents. However she also writes that lately it has shown that the lack of trees can lead to higher speeds due to drivers experiencing a lower risk where there are no fixed objects along the roads. These trends can be seen as problematic since speed is one of the most crucial factors when it comes to road safety (Trafikverket 2020a). The positive effects on people mentioned above regarding vegetation including lowering stress levels as well as the improved perception among drivers seem to result in safer driving styles (Wolf 2010). This could indicate that trees and other vegetation might actually be a mitigation measure in the traffic environment.

"Planning and design for livable cities should include roadside vegetation and trees that are placed appropriately..." (Wolf 2010)

How people are affected by plants

In the book *Interaction by design: bringing people and plants together for health and well-being: an international symposium* (Shoemaker 2002) we can read that people seem to receive healing effects from nature through two main ways. One is through the senses and the other through activity. The first one happens on an unconscious level by simply being surrounded by nature. The author believes that this is a good argument for incorporating nature in our public spaces. Wolf (2010) indicates that even the roadside vegetation can have a positive impact on people's health and well-being.

In a review regarding the evidence on the health benefits of urban green spaces we can read about both physical and mental health benefits. On the physical plane people can experience a higher motivation for exercise such as walking in a greener environment. The connection between physical activities and health is well known but the connection between it and nature is still a bit vague (Lee & Maheswaran 2011). Looking at the mental benefits gained through urban greenery the benefits seems to be even better. People living in greener areas reported higher quality of life and lower stress levels. Taylor, Haas & Hochuli (2018) writes that even though natural elements can not be seen as a solution to the high levels of stress in the city, nature has the ability to support wellbeing and balance among city people. For it to have a significant effect it is important that the green elements are located in proximity to peoples homes and/or working places.

Fuller et al (2007) bring up the importance of the quality of greenspace. The health benefits for people can vary dramatically depending on the provided greenery. Their study proves that reflection and distinct identity improved with the richness of plants and a variety of habitats. Environments with varied habitats and plant richness not only provide benefits for people but also the planet. By planning for green areas we can contribute with shelter and food for animals in our urban environments.

Regarding the scale of green space one has to take more of a helicopter view. Large parks are of great value due to the fact that they can include a lot of different activities and therefore be of importance to different user groups. However smaller parks often have the advantage of accessibility. They are usually located closer to peoples home and therefore valued high especially among elderly people and children who might experience difficulties accessing a larger park usually located in the outer areas of cities. In the same way the roadside vegetation might be of high importance for people commuting and thereby spending a lot of time in the car (Wolf 2010). A small park or roadside vegetation can not be seen as an alternative to or a replacement of a larger park but as a good compliment. On the whole a greener city with a variety of large parks, smaller parks and green corridors will have a positive effect on both ecology and human health (Nordh 2010).

CONCLUSION PART I

Looking at the literature one can conclude that the urban environment in general and the traffic environment in particular is tough on both humans and plants (Spirn 1984; Peschardt 2014; Huisman 2000). Stress related illnesses have increased and in line with the research presented above one can assume that the lack of nature and greenery can have a negative effect on our wellbeing. Plants do have a positive effect on wellbeing and stress levels and can therefore be used in the urban environment to improve life for humans (Lee & Maheswaran 2011). Even though parks and larger green spaces are to be preferred it seems that smaller green elements also have a positive effect on people as presented in the research by Helena Nordh(2010). Scientists are also positive that plants can play a role in the traffic environment to reduce road rage and improve safety if planned well (Wolf 2010; Forward 2021).

Design starts with a site

In *Site Matters* (Kahn & Burns 2005) the authors describe the importance of a site in the process of designing. The site is where it all begins. Landscape architects need to understand the physical qualities and limitations of a site in order to create a design that can stand the test of time. Carola Wingren (2009) writes about the fact that we in design often strive for and focus on beauty, something she believes can hinder us from reaching the best possible solution for a site. She puts it beautiful when describing that the ambition of a design instead should be an ideal landscape 'ideallandskap'. This ideal landscape will change depending on a number of aspects, the site being one of them and the usage and its users another. This does not mean that the end result won't be described as beautiful but merely that the aim is something bigger. When designing one needs to take all the technical aspects in consideration. This is especially true in the urban environment as stated in part 1 of this work.

Landscape architects work with natural, living material but the process is not about replicating nature. The work is however often inspired by natural environments. Not only because of their aesthetics but because of their construction. The landscape architect finds the essence and translates it to a concept and/or a design that is adopted to a site, something that can be called the art of landscape architecture (Kahn & Burns 2005).

Nature as a source of information and inspiration

In order to design a sustainable planting in an urban environment a lot of Landscape architects look to nature for inspiration. Sprin (1984) writes that plant communities in nature are inseparable to their environment and it is therefore crucial to find the perfect match between plants and site when designing. When looking for inspiration or searching for plants for a specific site there are a few things one need to keep in mind. James Hitchmough (2017a) writes about the importance of understanding the complete conditions in which a specific plant grows in order to pair it with the right site. He divides these conditions into climate, soil, competition between plants and palatability to herbivores.

CLIMATE

When it comes to climate the factors worth focusing on are temperature during summer as well as winter and precipitation both in regards to when it rains/snows and the quantity. The Köppen climate classification system developed by Vladimir Köppen divides the world in five main categories corresponding to the five vegetation types and is the most commonly used system for climate (Arnfield 2020). By finding the right classification of a site one can search for

plants originating from areas with the same classifications. It is also important to understand how latitude and altitude influence climate conditions. This means that it can be possible to find plants on a high altitude set in a warmer climate that would be well suited for a location on a lower altitude in a cooler climate. So even though the classification system gives a great overview of the world's climatic zones and is a great starting point one has to look at the microclimate to be able to make well informed decisions (Hitchmough 2017a).

SOIL

Soil has been mentioned in part I of this work as an important source for plants (Gustavsson 2020). There are different factors that combined, create the characteristics that will determine what plants will thrive and what type of plant community is best suited for a soil. The characteristics of the soil are determined and affected by sources below as well as above ground. The bedrock on which the soil sits as well as organic materials added from plants and animals are responsible for the distribution of particle and pore sizes within a soil as well as the pH (Råman & Rundquist 2016). As mentioned earlier water, oxygen and nutrient availability are the key factors affecting the plants. A soil consisting of fine materials like clay will have a high water holding capacity but might lack in oxygen. The opposite is true for a soil consisting of coarser material such as sand or gravel (Hitchmough 2017a). The pH level will determine what nutrients are available for the plants. Very acidic or alkaline soils, below pH3 or above pH8, are practically not habitable for plants. This is due to the fact that all nutrients are strongly tied to the soil. This leaves a pH range for plants that can be described as fairly small. A lot of plants prefer a productive soil with a pH between 5,5-7,5 and with an optimal level at around 6-6,5 (Råman & Rundquist 2016). There are plants to be found on both ends of the spectrum however herbaceous plants are more commonly found in the neutral to alkaline part of the scale and on acidic soils it is more common to find woody plant materials (Hitchmough 2017a). The alkaline soils will be less productive than the once described as the optimal, still we find some of the most diverse plant communities on these alkaline soils. Hitchmough describes in the book *Sowing Beauty Designing Flowering Meadows from Seed* (Hitchmough 2017a) that since the plants will not produce as much biomass on a less productive soil they leave room for other plants to join in the community. This subject will be explored and described further in the paragraph about plant strategies found below. The soil can as this paragraph describes be very different and therefore the understanding of it and what the desired plants need are highly important. Magnus Svensson (Svensson 2020) talks about the importance to be specific in the prescription of substrate when working in urban environments where one often does not have a natural terrass or soil to plant in. In order to do so one has to be clear about what type of plant community one wishes to create as well as making sure that all conditions of the site are well matched to create a unity.

PLANT STRATEGIES

Plants are complex. They may all have the same goal of surviving as individuals and as species but they have different strategies to reaching these goals. In order to combine plants and design stable plant communities landscape architects need understanding for the different plant strategies that occur in nature. Professor Phil Grime at the University of Sheffield presented an approach to looking at surviving strategies among plants in the 1970s that has been widely used. He divided plants in three main categories: competitors, stress-tolerators and ruderals. These can be combined creating secondary categories: competitive stress-tolerators, competitive ruderals and stress-tolerating ruderals (Grime 2001). The theory is based on the level of productivity and stability a site offers. The relationship between the types of strategies are shown in *figure 6*. Productivity of a soil is determined on the nutrient availability for plants which was covered in the paragraph above. Sunlight is also something that will affect productivity as well as water. A site in a sunny position with high nutrient availability and well balanced water levels will have the highest productivity. Change in any of these qualities, lower nutrient, shade, drought or water excess will have a negative effect on productivity. Stability will be affected by external influences such as grazing, floods, droughts, trampling etc. What plants are capable of competing at a site is determined by what surviving strategies they have adopted. Hitchmough (2017) mentions that this approach is useful since one can quite easily categorize plants by merely looking at them. Competitors usually have lush green foliage, big root systems and you can find them growing in large patches. Stress-tolerators have assets such as hairy stems and leaves, silvery or succulent leaves, taproot and are usually clump forming. Ruderals can have a varying physiognomy but they are short lived, usually annuals or biennials and they are mostly spreading by seed. On the opposite page an overview of the characteristics of the main categories are listed.

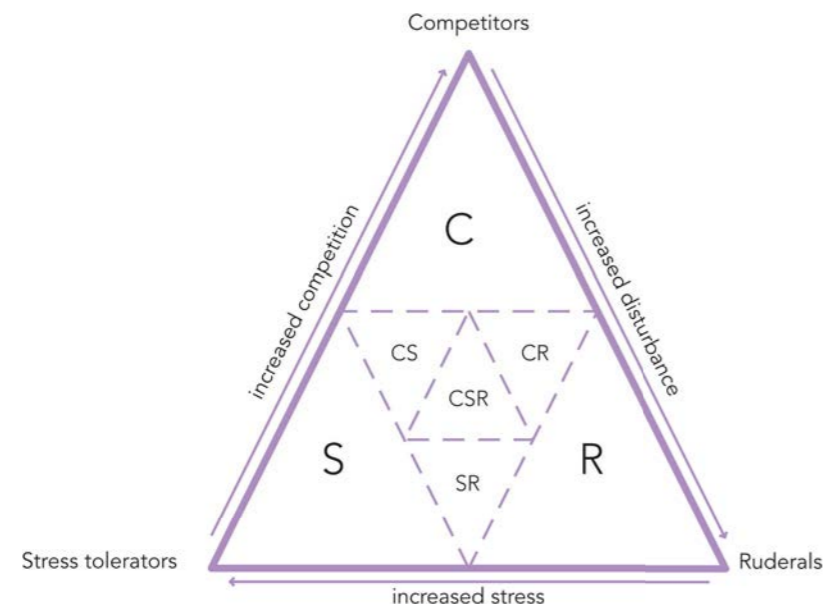


Figure 6: The relationship between plant strategies. Based on the model made by Grime in the 1970s (Grime 2001)

Competitors

- Fast growing
- Large biomass
- Lush green
- Grows in large patches, can create monocultures
- Spreading is mainly vegetative
- Highly competitive on productive soils with good light conditions.

Stress-tolerators

- Slow growing
- Small biomass
- Clump forming
- Spread vegetatively or by seed
- Morphological traits such as, silvery, hairy, succulent small leaves etc to cope with stressors such as sun, salt, drought

Ruderals

- Fast growing with short lifespan, annuals/biennials
- Spreading is mainly by seed
- Biomass is varying

HABITATS

As earlier stated, plants in the traffic environment will be faced with stressful growing conditions. By pairing the site with a suitable natural habitat one can find plants that are capable of coping with the conditions of the site. One way is to look at a habitat diagram shown in *figure 7* where habitats are categories based on the water availability Y-axis and pH X-axis (Wahlsteen 2018). This system combined with the plant strategies described on page 30 are great tools to find both plants and inspiration for design concepts. Since one in an urban environment usually works with sites lacking in natural soils one can manipulate the site and to some extent create conditions better suited for a plant community one wishes to design. However there is still a lot to take in consideration such as air pollution, precipitation and disturbance. On the following pages two natural habitats are presented, the steppe and the prairie. From these two habitats one can draw inspiration and find plants that have adapted to more stressful living conditions.

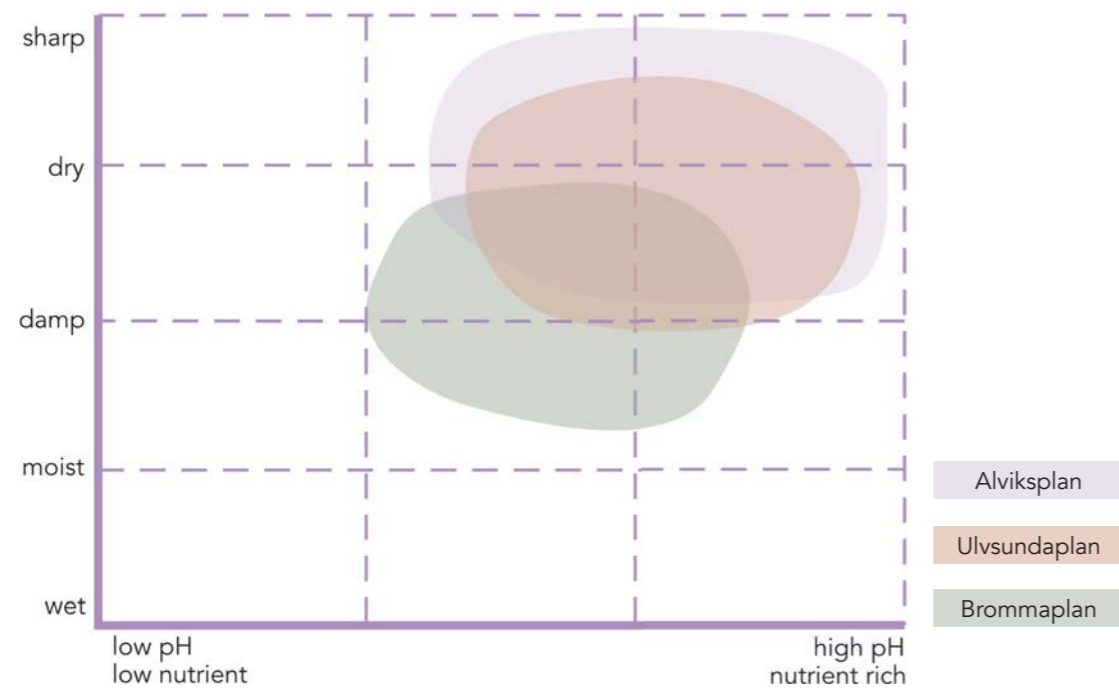


Figure 7: Habitat diagram based on model in *Utökad växt- och ståndortskänedom* (Wahlsteen 2018). Sites from the design proposal in part III are placed according to their conditions.

STEPPE

The steppe is a grassland first and foremost but not exclusively found in Eurasia from Hungary in the west to Manchuria in the east (McNeill 2021). A continental climate with hot summer and very cold winters as well as little rainfall results in a stressful environment and hence a lot of the species found here are deciduous and capable of coping with periods of drought. Due to these conditions the steppe in general grows quite short shown in *figure 9*. Greater biomass does occur where soils manage to provide more moisture, *figure 8*. On the more unproductive sites the vegetation is relatively open and bare patches of soil can be seen between the plants. The main flowering occurs in spring to midsummer, there are however a few species that bring seasonal interest during the later summer and autumn months. Due to the stress-tolerating characteristics as well as the aesthetically appealing flowers of many of the plants found on the steppe it is a great source of inspiration for designs on low fertility soils in the urban environment with low rainfall (Hitchmough 2017).



Figure 8: Drifts of *Salvia nemorosa* in Austria (Reiser 2015) (CC BY-NC-ND 2.0)

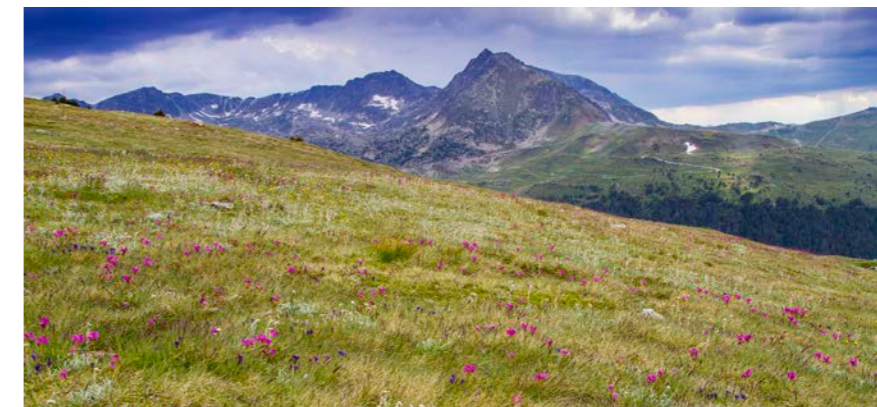


Figure 9: Low meadow with interesting mix of plants growing in drifts and patches (Hunt 2015) (CC BY-NC 2.0)

PRAIRIE

In the book *Gardening With Prairie Plants: How To Create Beautiful Native Landscapes* (Wasowski 2001) the prairie is described as an overview of a diversity of grasslands. Lowland prairie, Mesic prairie, Upland prairie, Sand prairie and Savannas are all types of grassland communities found in North America. The prairie is however commonly divided in short- and tall-grass prairie. In general the prairies are found in areas with higher rainfall and on more productive soils than the steppe. But as addressed there is a diversity within the prairie category. Shortgrass prairies are found on less productive sites that in some cases can resemble the steppe. On more productive soils the tall-grass prairie is more common (Hitchmough 2017). These communities are dominated by grasses, figure 11. Although grasses dominate, the prairies are also incredibly rich in diversity something that can be seen in figure 10. It is possible to find up to 160 flowering forbs, excluding grasses, over the course of a season (Wasowski 2001). One can therefore understand that Hitchmough (2017) describes the prairie as a valuable resource for naturalistic plantings in the urban environment since they provide such a broad variety of plants for diverse conditions.



Figure 10: Prairie with drift of Echinacea and Rudbeckia dotted within a green matrix (wdterp 2021) © wdterp

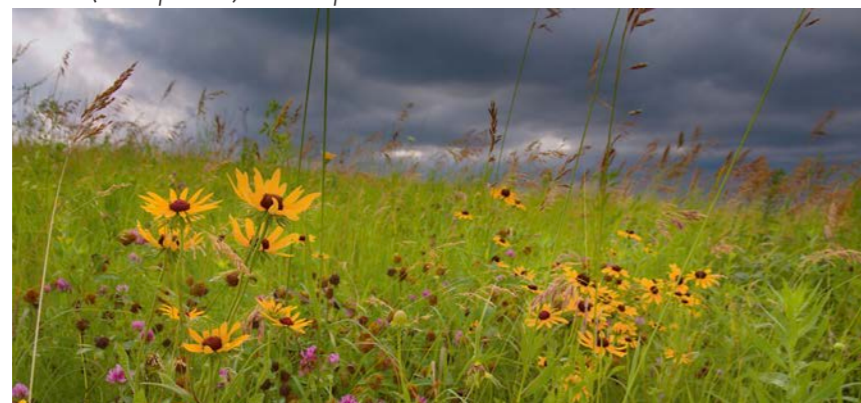


Figure 11: Prairie dominated by grasses (wdterp 2021) © wdterp

Maintenance

All plantings, especially newly planted, require maintenance. However when the plants are chosen to match the habitat conditions of a site the planting will need less coddling and the maintenance will therefore be more economical (Spirn 1984). Maintenance in the traffic environment is full of risks. To lower the need for maintenance is therefore not only a question of money but also safety. Today we see a lot of grass communities in close proximity to streets. In order to keep a lawn in good condition one needs to cut it often. Depending on the usage and location grass is kept at varying heights and therefore cut with different intervals. Maintenance of grass in the traffic environment can be classified as 'medium maintenance' and cutting is required approximately six times a year (Boorman 2004).

A perennial planting if designed well and cared for during the establishment years can require less frequent maintenance. Looking at Oxford botanic garden & arboretum perennial borders are maintained in different ways. The classic 'English' plantings are very intense with mulching, feeding, plant support and watering. A relatively new addition to the garden are the 'Merton' borders which are developed together with James Hitchmough in a more naturalistic manner based on studies of natural plant communities. In these borders the garden has a much more radical approach to maintenance. They are cut down once a year, cuttings removed and no watering or feeding is needed. Interventions are required a few times per season in order to keep weeds from establishing and to keep the plant composition balanced. Mark Brent, garden curator and head of horticulture states that a reasonable level of skill is required in order to care for these plantings especially initially (Brent 2021). By using sand or gravel as mulch one can reduce but not eliminate weed invasion lowering the need for frequent weeding (Fieldhouse, Hitchmough 2004).

In 2011 a steppe planting was established in Trollebergströndellen, a central roundabout in Lund. This planting has a maintenance level equivalent to the Merton borders in Oxford only requiring one cutting per year. According to Malena Christoffersson, landscape engineer at Lund municipality, the most important thing to keep in mind regarding the maintenance of vegetation within the traffic environment is the safety of their staff. A lot of planning goes into every session. To lower the number of inputs needed throughout the year is therefore positive and plantings like the steppe in Lund that is cut down once a year can for that reason be preferred over cut grass. Christoffersson also mentioned that the reaction among the public has been mainly positive (Christoffersson 2021). In Oxford, Brent (2021) mentions that there is a need to acclimatize the visitors to this "new" aesthetic in naturalistic plantings. However, he also shares that the public is warming up to it and appreciate the aim to increase biodiversity and create more sustainable plant communities.

In any planting the management required will, as described in this section, need to be adapted to the conditions of the site and the type of perennial planting. By paying attention to the site and working with the conditions Fieldhouse and Hitchmough (2004) writes that it is possible to work on a budget and with limited skills among maintenance staff and still create plantings that offer aesthetical and ecological values appreciated by both maintenance staff and public.

CONCLUSION PART II

The literature suggests that in order to create sustainable plantings one needs to have a deep understanding for the conditions of the site, how and by who it is to be used as well as the level of maintenance the planting will receive. Climate, soil and competition between plants are as stated above of the highest importance. Plant communities are to be found in all types of environments and nature can therefore be a great source of inspiration regardless of the site if one is capable of pairing the site with a natural habitat. Plant strategies described by Grime (2001) and the habitat diagram described on page 32 are great tools when designing with plants. Maintenance is also a reason for drawing knowledge from nature. Professionals believe that it is possible to lower the intensity of maintenance when plants and composition is adopted to a site (Fieldhouse, Hitchmough 2004; Brent 2021).

Design proposal - Introduction

As mentioned in the literature study Stockholm municipality has a program where one of the goals is making the city more attractive (Hartzell et al. 2010). Since the traffic environment is a central part of our urban environment and many times lacking in greenery with the exception of mowed lawns, trees or shrubs as well as other aesthetic elements. These are areas where one with relatively small changes could make a big difference. When working within the traffic environment the safety should always come first but as the quote on page 19 describes plants should have a role in designing the livable city (Wolf 2010). Stockholm is the capital and the largest city of Sweden with many districts and suburbs surrounding the center. The sites in this work are all located in one of these suburbs called Bromma. The idea is to evolve already green traffic islands in this district by adding a more diverse herbaceous vegetation. As stated in the literature study, perennials might be better suited for the tuff environment in close proximity to streets compared to trees (Spirn 1984). The literature also suggests that perennials can deliver big seasonal values (Oudolf & Kingsbury 2013). The benefits and diversity within the herbaceous vegetation as well as the fact that this type of vegetation can be seen as somewhat neglected within public areas are reasons for the focus on perennials in the proposals on the following pages.

Before continuing to the analysis and designs of the sites a short description of plant mixes is provided on page 41.

Plantmixes

In two of the proposals the designs are inspired by the steppe and prairie vegetation. To achieve a naturalistic feeling in the plantings plant mixes have been composed. Traditionally in a horticultural context perennials are planted in blocks creating a patchwork of different species. Whereas in a mix species with different qualities and functions are combined creating a plant community. There is not one way to achieve this and this description is mainly an explanation for the thought process used in this work. It is based on the knowledge gained during studies at SLU as well as principles described by plant designers such as Nigel Dunnet (2019) and Piet Oudolf (Oudolf & Kingsbury 2013).

When combining plants the goal has been to create mixes that are stable in the long term as well as offering a level of dynamic to the plantings. Earlier in this work plant strategies were explained and these play an important role. On page 30 characteristics are described for the different strategies. In the plantmixes presented on the following pages all plant strategies (Grime 2001) are represented although a majority of the plants chosen can be categorized as stress-tolerators or somewhat so. A lot of them are clump forming and stable resulting in a planting that can have a long lifespan. However a few species have more of the ruderal characteristics and will self seed within the planting filling in gaps between other plants. There are also plants that are carpet-forming and spreading vegetatively providing a groundcover helping suppress weeds and hence lowering the need for weeding.

Besides plant strategies, aesthetic qualities among the plants have been important. Seasonal qualities described on page 22 being one of the qualities. Color and structure in the plants as well as patterns within the planting are also qualities that have been top of mind while designing. This is something that Nigel Dunnet describes as important aspects to consider when designing (Dunnett 2019).

Climate

In the section about using nature as a source of inspiration starting on page 28 it is stated that understanding the climate has an important role in the analysis of a site. This information will be crucial in order to pick the right species to the project.

Stockholm falls under the Köppen classification Dfb (Warm Summer Continental Climate) (Weatherbase n.d.)

However the climate in an urban environment including the traffic environment can differ from the general classification of a geographical area. For example with higher temperatures (Bulut et al. 2008). One can therefore assume that although the sites falls within the classification Dfb, areas with the classification Dfa could also be good sources for finding suitable plants. The geographical distribution of the Dfb and Dfa can be seen in figure 22 and 24 respectively. They both fall under the Continental climate with even precipitation through the year and the main difference between the two being the temperature that is higher in Dfa areas (Arnfield 2020). On the opposite page an overview of the climate in Stockholm is provided.

Places with classification Dfa and Dfb that will be used for inspiration:

Central Europe and Eurasia including Caucasus

North America: North Eastern USA and southern Canada

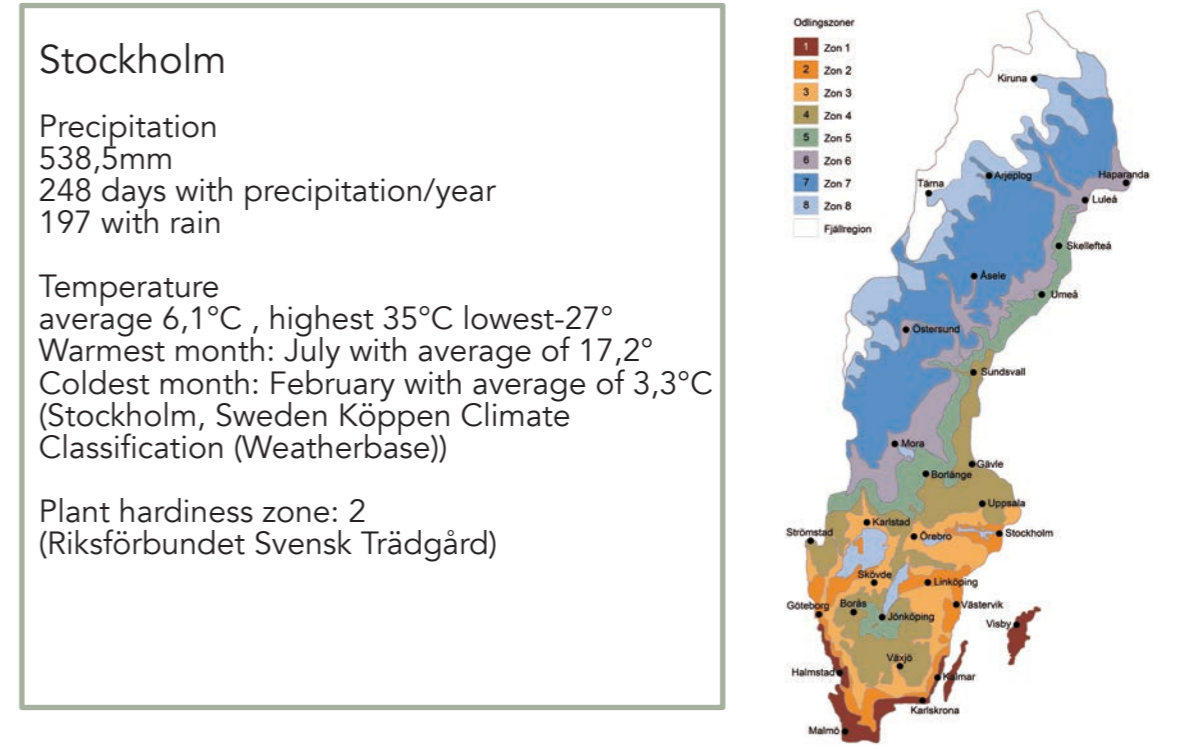
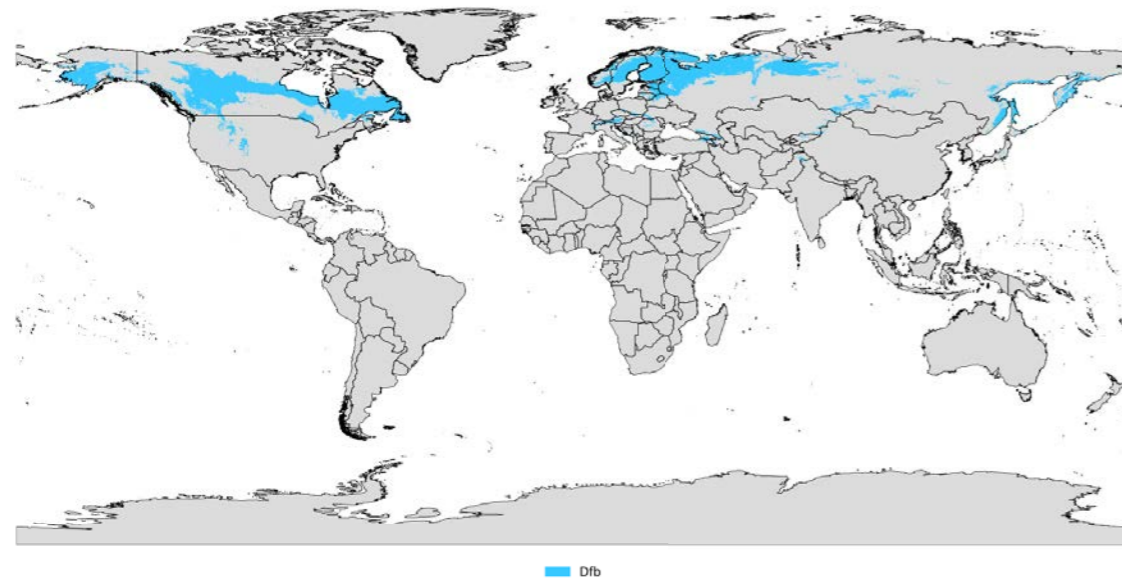


Figure 23: Map over hardiness zones © Riksförbundet Svensk Trädgård

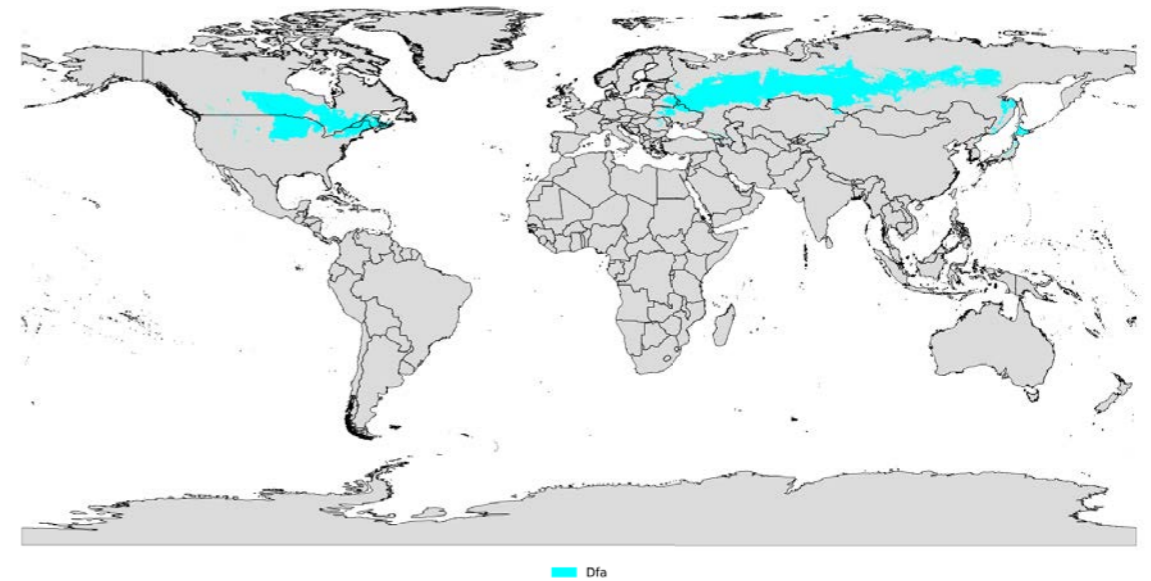
Cold, no dry season, warm summer (Dfb) (2071–2100)



Source: Beck et al.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018)

Figure 22: Map over the distribution of Köppen–Geiger climate classification Dfb (Beck et al. 2018) (CC BY 4.0)

Cold, no dry season, hot summer (Dfa) (2071–2100)



Source: Beck et al.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, Scientific Data 5:180214, doi:10.1038/sdata.2018.214 (2018)

Figure 24: Map over the distribution of Köppen–Geiger climate classification Dfa (Beck et al. 2018) (CC BY 4.0)

A garden city

Bromma is a suburb located west of Stockholm. Looking back it has been inhabited since the Viking age. During the 1600s the area was divided between a couple of larger estates. These were during the 1700-1800s cut off as wealthy families from the city center wanted crofts and land to escape the city during the summers. In the beginning of the 1900s the city of Stockholm bought the land and started to establish a garden city, "trädgårdsstad". In figure 13-17 photographs of the neighborhoods are presented. The road network was carefully adapted to the landscape. Forest edges and natural parks were saved making the neighborhoods rich with greenery (SWECO 2008).



Figure 13: Neighborhood environment



Figure 14: garden at Myrmarksvägen



Figure 15: Neighborhood



Figure 16: Mälaren



Figure 17: Tram rail

The road

Drottningholmsvägen was opened in 1787 and was commissioned by King Gustav III. It was built as a faster connection between the Royal Palace of Stockholm and Drottningholm Palace. The original route can be seen in figure 18. The road got its current route after a few changes were made during the 1930s stretching to the roundabout Brommaplan (SWECO 2008). This can be seen in figure 19.



Figure 18: Map over old rute of Drottningholmsvägen (Lundgren 1829) (CC-BY)



Figure 19: Map over new(solid) and old(dotted) rute of Drottningholmsvägen (Stockholm stad 2021)

Usage

Drottningholmsvägen connects the western parts of Stockholm to the city center and is used for daily commuting shown in figure 20-21. According to Stockholms Stad close to 60 000 cars drive though Alvik and over Tranebergsbron on a weekday. To this number can be added 6 800 bikers and 1 300 pedestrians (Tjärnberg 2020).



Figure 20: Drottningholmsvägen, Ulvsundaplan



Figure 21: Bikelane, Drottningholmsvägen, Ulvsundaplan

Locations

Brommaplan: An important traffic junction however there are a lot of traffic disturbances contributing to the ongoing yet ever changing plans for change. The area consists of 1950's architecture which contributes to the cultural values for this part of Bromma (Landskapslaget AB 2008).

Ulvsundaplan: A junction of roads and bike lanes. A few smaller grass patches and solitary trees.

Alviksplan: First/last traffic intersection when entering/leaving the district of Bromma. An elevated grass area with corten edges designed by Hans Peterson and Jonas Berglund in 1997(Alton 1997).



Figure 12: Map showing the three locations Alviksplan, Ulvsundaplan and Brommaplan. To the right is Tranebergbron which leads into the city center of Stockholm.



Figure 25:
preserved nature

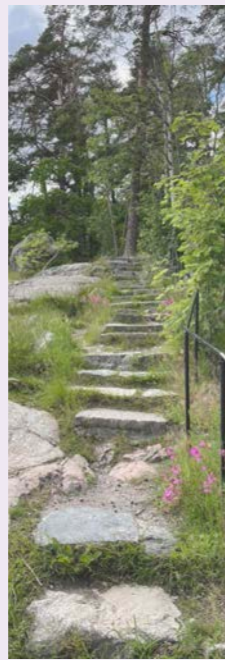


Figure 26:
walking path

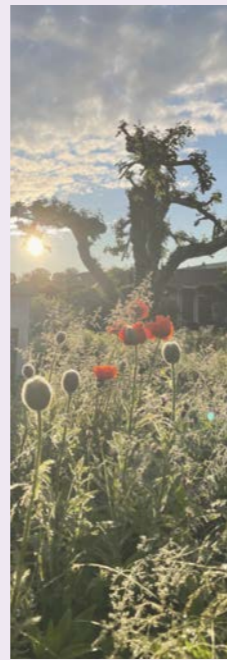


Figure 27:
allotment garden

CONCEPT - GARDEN CITY 2.0



In the Park Plan for the district of Bromma one can read that the scenic location next to the lake Mälaren and the connected parks and nature areas of the district are important parts of the identity of its people and something they take great pride in (SWECO 2008). The intersections are the gateways to the district and should reflect this while welcoming both residents and visitors. The overall concept "Garden City 2.0" is modern and naturalistic. Inspiration from both nature and cultural values within the district of Bromma.

Alviksplan - site specifics

vegetation



Cut lawn in a elevated art piece with corten edges.

Surrounding vegetation consists of both natural woods and private gardens as well as street trees/ grass communities.

-  Private gardens & street trees/vegetation
-  Natural areas

roads

The last intersection before Tranebergsbron that leads to the city center. Bike lanes run alongside the main road and an additional bike lane is planned to run alongside the elevated planting. Construction is scheduled for 2022 (Stockholm stad 2021).

-  roads
-  metro

site

Drottningholmsvägen

Metrostation: Alvik

Garden city neighborhood Äppelviken

-  site

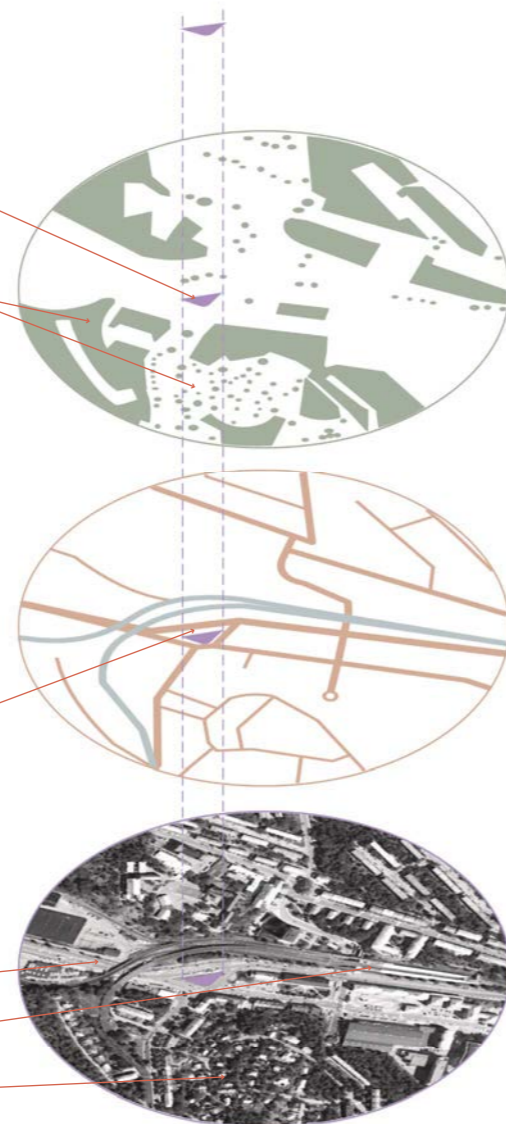


Figure 28: Layered analysis showing the vegetation, road system and surrounding area of Alviksplan.

On the opposite page pictures from the location are presented.

Figure 29-31, 33: intersection. One can see that the grass-covered intersection is invaded by weeds and that the vegetation is spilling over into the hardscape surrounding the corten construction.

Figure 32: Road leading to Tranebergsbron and the city center.

Figure 34: a newly renovated playground located close to Alviksplan.

Figure 35: winter decoration in the intersection.

Figure 36: Alvik, a small plaza where shops, cafes, subway, busses, tram, doctors office etc are located.



Figure 29: corten structure



Figure 30: Grass and weeds



Figure 31: view over landscape art-piece

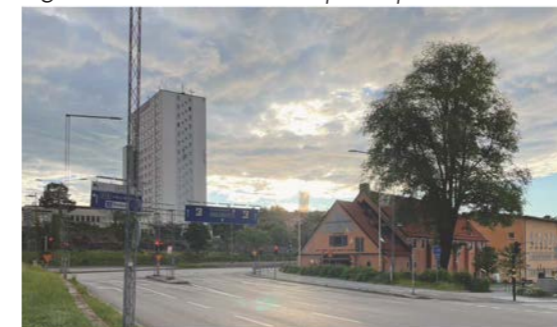


Figure 32: Traffic lanes to Stockholm city



Figure 33: weeds



Figure 34: Playground



Figure 35: Winter decorations



Figure 36: Alviks Torg

Inspiration ALVIKSPLAN - a hillside steppe

The inspiration for this intersection is drawn from the steppe, a natural habitat described on page 33. Through studying pictures of said habitat characteristics and patterns could be found. This is something that Nigel Dunnett writes about in his essential guide to naturalistic planting design. He writes about movement, rhythm and structure as important qualities when one is opting for a naturalistic feeling within a planting (Dunnett 2019).

As a way to visualize the patterns found in the photographs, digital sketches were made that showcase three characters that has been used as conceptual pillars in the planting design for Alviskplan. These characters are Drifts, Patches and Solitaires.

On the opposite page the conceptual sketches are shown in figure 41-43 with the figure descriptions connecting them to the natural habitats shown below in figure 37-40. These are a representative sampling of the pictures studied.



Figure 37: Beautiful drifts of Salvia nemorosa in Austria (Reiser 2008) (CC BY-NC-ND 2.0)



Figure 38: Wildflowers at Mount Rainier (Mount Rainier National Park, 2009) (CC BY 2.0)



Figure 39: Mix of Melica and Galium (Falkner 2008) (CC BY-NC 2.0)



Figure 40: Diverse wildflowers Meadow (Mount Rainier National Park, 2005) (CC BY 2.0)

Conceptual sketches ALVIKSPLAN - a hillside steppe



Figure 41: Movement in the planting. This is something that can be seen especially in fig.37 and 38. With one species creating a sweeping drift through the landscape a soft flow within the planting is created.



Figure 42: Groupings of plants. Nigel describes it as centers of gravity where species or plants gravitate towards each other creating a rhythm (Dunnett 2019). This can be seen within the drifts of Salvia in fig 37 as well as in fig 40. In fig 39 the yellow Galium, although discreet, also creates patches within a sea of Melica.

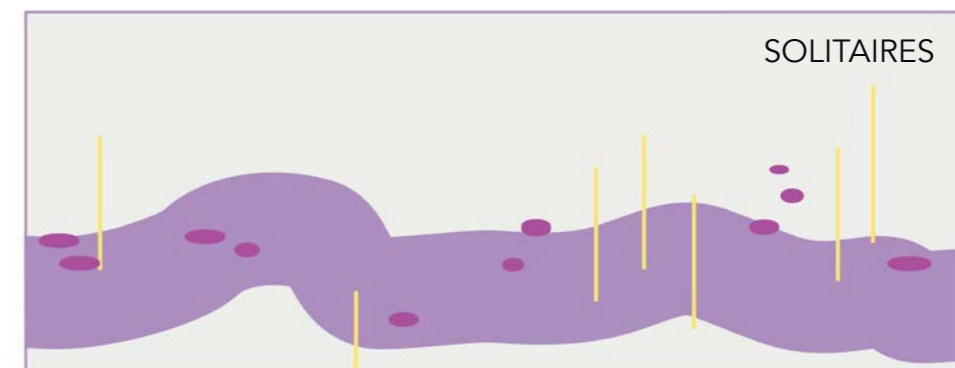


Figure 43: Proud solitaires. If one looks closely in all the figures on the opposite page but especially in fig.38 and 40 one can see plants that stand out in regards of color and/or form. These plants create interest as well as contribute to the rhythm within the plantings.

Concept and Design ALVIKSPLAN - a hillside steppe

"Här har Peterson och Berglund helt enkelt lyft upp landskapet ur asfalten som en historisk vålnad och sedan låtit det genomkorsas av det breddade trafikinätet." (Alton 1997). (Translation: Here Peterson and Berglund simply elevated the landscape from the asphalt like a phantom from the past and then let the roads criss-cross through it.) A quote from an article about the then newly installed landscape-art piece. One can not help but wonder; if nature where to find its way back up and into our grey world filled with infrastructure, would it stop with a lawn?

In this design proposal the goal is to keep with the idea of letting nature break through, only elevating it even higher. The strict minimalistic form of the art-piece will be kept intact and the intention to "clarify the flow of the roads in relation to society" (Alton 1997) will therefore not be broken. The small hill will be planted with a steppe inspired planting well suited for the sunny and dry conditions of the site. Large drifts make a visual effect that can be seen from afar where both colors and structural elements contribute to the seasonal interests. A visualization can be seen below in figure 44. A more detailed view of the plants can be seen in figures 45-47 where plantmixes are presented. Further on a plantingplan in presented in figure 49 on page 58-59.



Plant combinations

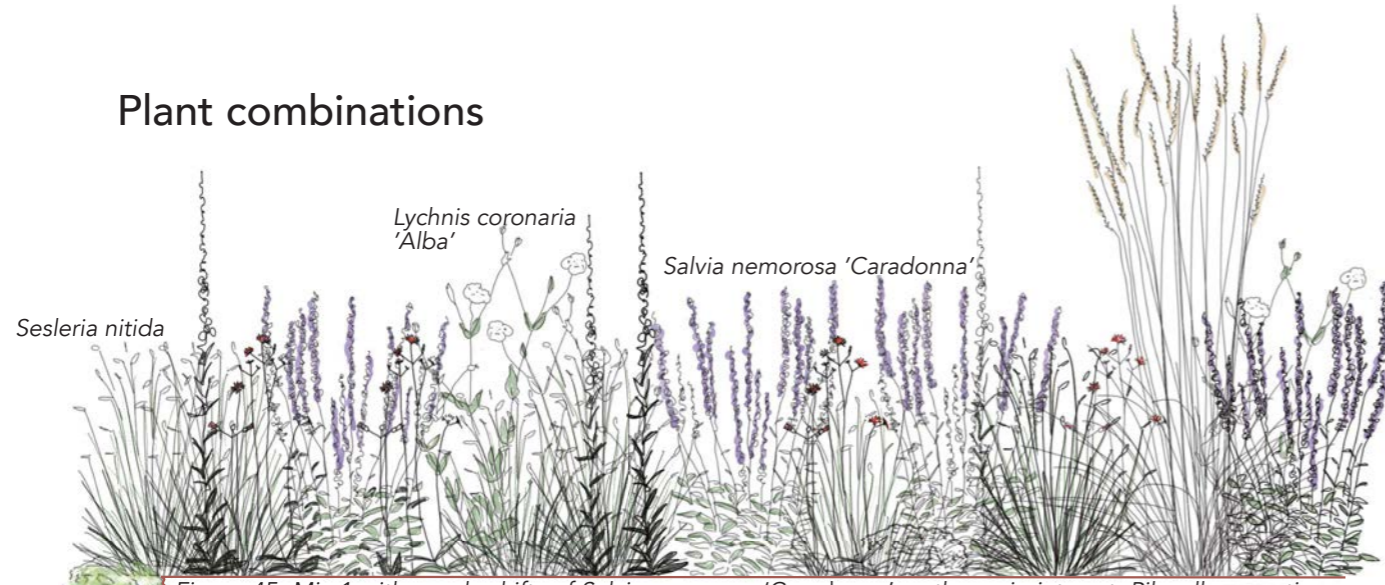


Figure 45: Mix 1 with purple drifts of *Salvia nemorosa* 'Caradonna' as the main interest. *Pilosella aurantiaca* and *Lychnis coronaria* 'Alba' will be self seeding in the planting filling in gaps. Included in the sketch is also *Digitalis ferruginea* and *Calamagrostis auctiflora* 'Karl Foerster' that stand tall creating a structure throughout all the mixes in the planting.

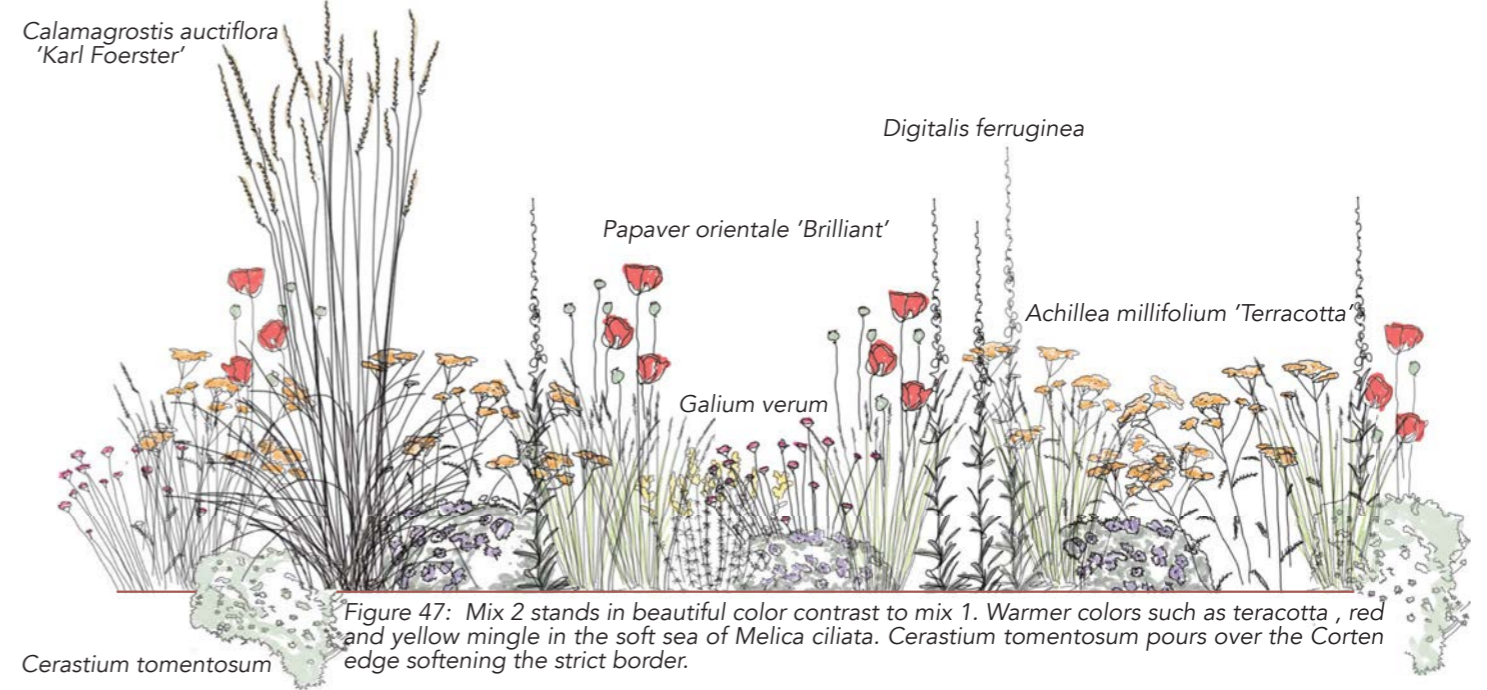


Figure 47: Mix 2 stands in beautiful color contrast to mix 1. Warmer colors such as terracotta, red and yellow mingle in the soft sea of *Melica ciliata*. *Cerastium tomentosum* pours over the Corten edge softening the strict border.

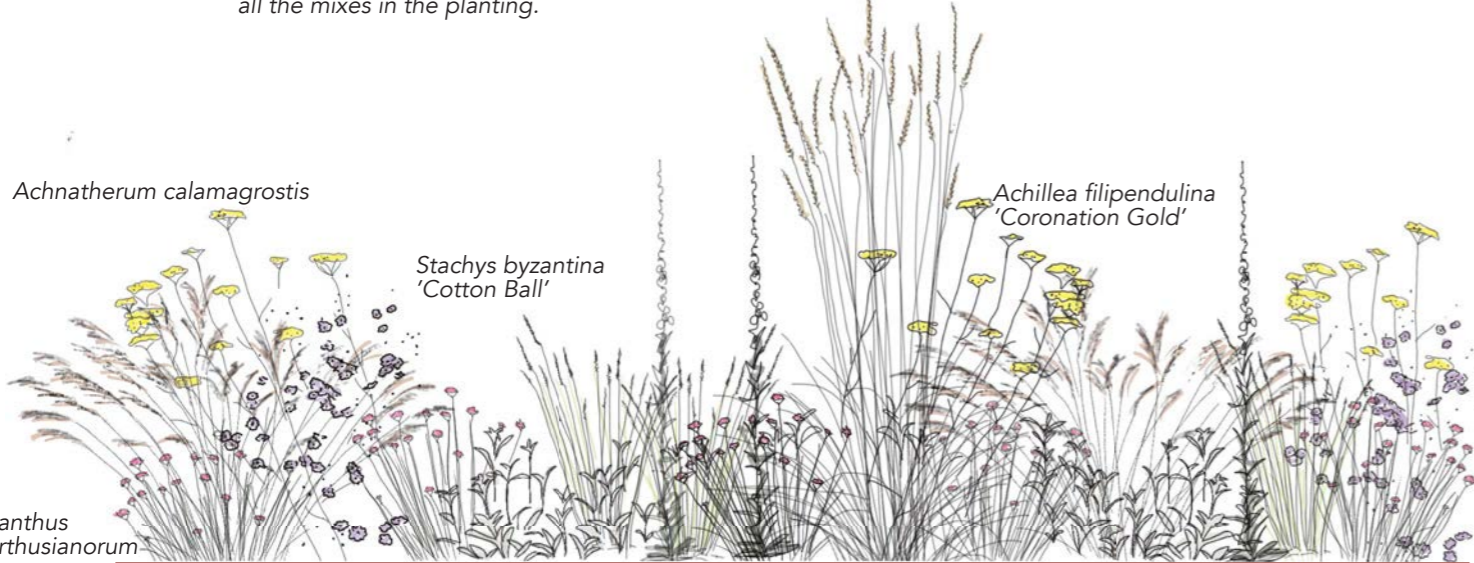


Figure 46: Mix 3 flows between the two other mixes with grasses and tall *Achilleas* floating above. *Dianthus carthusianorum* and *Melica ciliata* connects this mixture to Mix 2 creating a soft bridge between the mixes.

Table 1: Overview of plantmixes. Colors correlate to the simplified visualization over the site shown in figure 48.

MIX1	MIX2	MIX3	BULBS/SOLITAIRES
<i>Euphorbia cyparissias</i> 'Fens Ruby'	<i>Melica ciliata</i>	<i>Achnatherum calamagrostis</i>	<i>Crocus chrysanthus</i> Blue Pearl
<i>Lychnis coronaria</i> 'Alba'	<i>Achillea millifolium</i> 'Terracotta'	<i>Melica ciliata</i>	<i>Crocus chrysanthus</i> var. <i>fuscotinctus</i>
<i>Pilosella aurantiaca</i>	<i>Cerastium tomentosum</i>	<i>Achillea filipendulina</i> 'Coronation Gold'	<i>Crocus tommasinianus</i> 'Ruby Giant'
<i>Pulsatilla vulgaris</i>	<i>Dianthus carthusianorum</i>	<i>Achillea filipendulina</i> 'Parkers Variety'	<i>Tulipa pratans</i> 'Fusilier'
<i>Salvia nemorosa</i> 'Caradonna'	<i>Galium verum</i>	<i>Dianthus carthusianorum</i>	● <i>Calamagrostis auctiflora</i> 'Karl Foerster'
<i>Sesleria nitida</i>	<i>Papaver orientale</i> 'Brilliant'	<i>Pulsatilla vulgaris</i>	○ <i>Digitalis ferruginea</i>
	<i>Pulsatilla vulgaris</i>	<i>Stachys byzantina</i> 'Cotton Ball'	
	<i>Symphyotrichum dumosus</i> 'Augenweide'	<i>Symphyotrichum</i> 'Treffpunkt'	

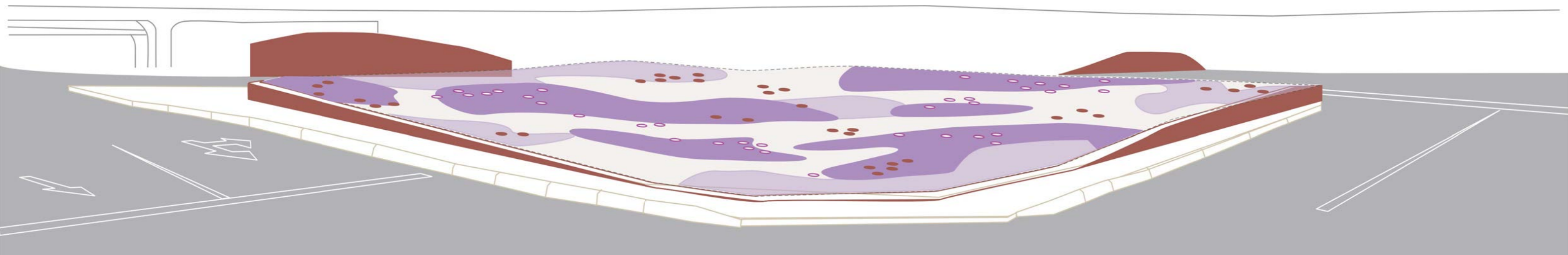
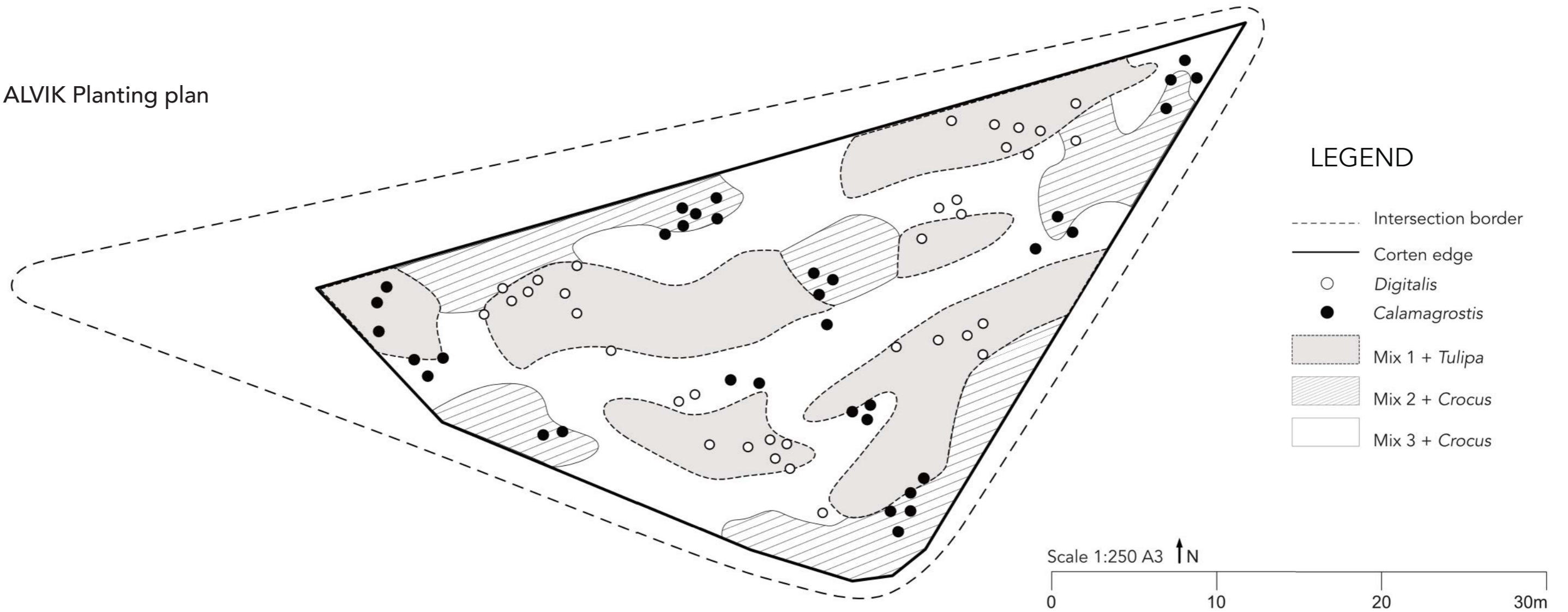


Figure 48: Conceptual visualization over plant mix distribution.

ALVIK Planting plan



LEGEND

- Intersection border
- Corten edge
- *Digitalis*
- *Calamagrostis*
- Mix 1 + *Tulipa*
- ▨ Mix 2 + *Crocus*
- Mix 3 + *Crocus*

Scale 1:250 A3 ↑ N



Table 2: Plantlists for mixes including percentage distribution and grouping of species when planting.

Figure 49: Plantingplan Alviksplan

MIX1		MIX2		MIX3	
<i>Euphorbia cyparissias</i> 'Fens Ruby'	5% solitary	<i>Melica ciliata</i>	15% groups of 3-7	<i>Achnatherum calamagrostis</i>	10% groups of 3
<i>Lychnis coronaria</i> 'Alba'	10% groups of 2-4	<i>Achillea millifolium</i> 'Terracotta'	15% groups of 3-5	<i>Melica ciliata</i>	10% groups of 3-9
<i>Pilosella aurantiaca</i>	10% groups of 3-7	<i>Cerastium tomentosum</i>	5% groups of 2-5	<i>Achillea filipendulina</i> 'Coronation Gold'	12% groups of 2-7
<i>Pulsatilla vulgaris</i>	15% groups of 3-5	<i>Dianthus carthusianorum</i>	15% groups of 3-7	<i>Achillea filipendulina</i> 'Parkers Variety'	8% groups of 2-5
<i>Salvia nemorosa</i> 'Caradonna'	25% groups of 3-9	<i>Galium verum</i>	15% groups of 2-5	<i>Dianthus carthusianorum</i>	20% groups of 2-7
<i>Sesleria nitida</i>	20% groups of 2-5	<i>Papaver orientale</i> 'Brilliant'	10% groups of 2-5	<i>Pulsatilla vulgaris</i>	15% groups of 3-5
		<i>Pulsatilla vulgaris</i>	10% groups of 3-5	<i>Stachys byzantina</i> 'Cotton Ball'	10% groups of 2-5
		<i>Symphotrichum dumosus</i> 'Augenweide'	15% groups of 2-5	<i>Symphotrichum</i> 'Treffpunkt'	15% groups of 2-5

Planting description

1. Solitary plants are spaced accordingly to the planting plan and the information provided in table 2.
2. Plant-mixes are planted across the area according to the planting plan shown in figure 49. Species within the mixes are distributed according to the % in table 2.
3. Plants are spaced in groups or drifts according to the number following the % in the table. The goal is to get a naturalistic flow in the planting.
4. Bulbs are to be planted in fall according to the planting plan and table 2. If all planting is done in fall one can choose to either spread bulbs before or after perennials.

BULBS/SOLITAIRES	
<i>Crocus chrysanthus</i> Blue Pearl	All <i>Crocus</i> varieties are to be calculated 30/m ² All <i>Crocus</i> bulbs are mixes before spread in drifts within borders for perennial mixes 1 and 2
<i>Crocus chrysanthus</i> var. <i>fuscotinctus</i>	
<i>Crocus tommasinianus</i> 'Ruby Giant'	
<i>Tulipa pratensis</i> 'Fusilier'	Planted in groups/drifts 3-10 within the borders of perennial mix 3
<i>Calamagrostis auctiflora</i> 'Karl Foerster'	● Planted in groups of 1-3 in locations marked on planting plan with a black dot
<i>Digitalis ferruginea</i>	○ Planted in groups of 3-5 in location marked on planting plan with a black and white dot

Soil: Hasselfors Citykross 4-8

Equivalent to the substrate used by Stockholms Stad. This substrate from Hasselfors Garden has good qualities for plants in the urban environment providing variation of pore sizes. It is fortified with compost and biochar that can help with the waterholding capacity and nutrient availability as well as working as a filter for contaminated water Hasselfors Garden (2020).



To increase the pH and suppress weeds a mulch layer of 50 mm limestone chippings is added

Ulvsundaplan - site specifics

vegetation

Cut lawn with a few solitary trees. The younger trees have severe damages to their trunks and low vigor.

Surrounding vegetation consists of both natural woods and private gardens as well as street trees/grass communities.

-  Private gardens & street trees/vegetation
-  Natural areas

roads

Intricate intersection that cut through the green elements.

Critical crossing for cars where sight needs to be taken in consideration.

-  roads
-  metro

site

Drottningholmsvägen

Metrostation: Stora Mossen

Garden city, neighborhood Stora Mossen built during the first half of the 1900.

-  site

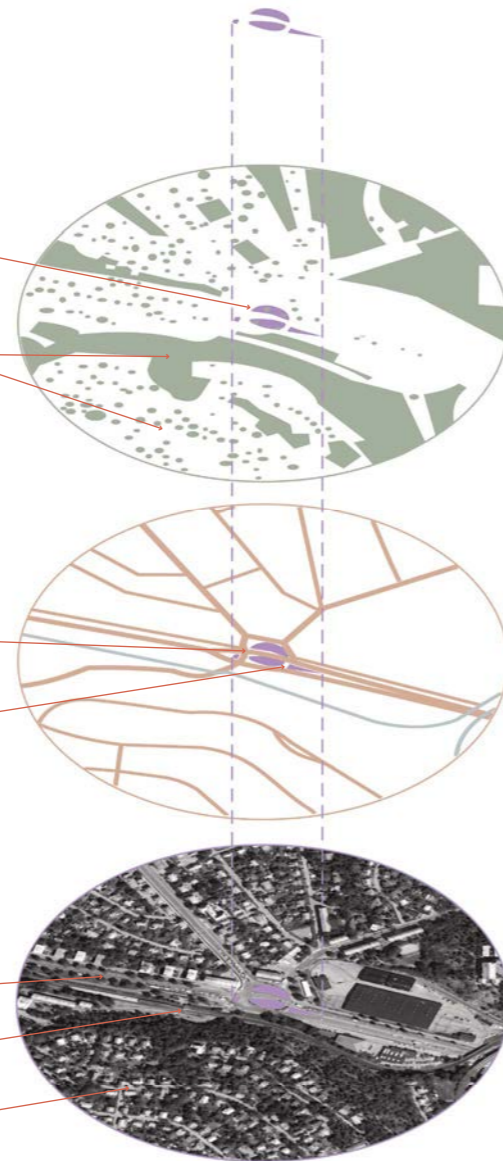


Figure 50: Layered analysis showing the vegetation, road system and surrounding area of Ulvsundaplan.

In figure 51-58 on the opposite side pictures from the location are presented.

Most pictures show the intersection and the vegetation. At the time of the site visit the grass had recently been cut. In figure 54, 56 we also see the subway, pathways for cyclists and pedestrians as well as the damages one of the tree trunks growing in the intersection figure 57.



Figure 51: view over intersection

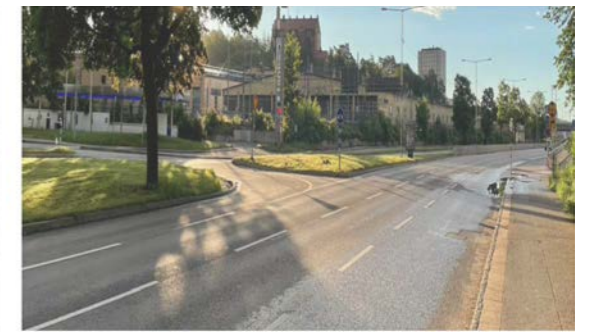


Figure 52: view problematic crossing



Figure 53: View over intersection.



Figure 54: Subway



Figure 55: Mowed grass



Figure 56: walk path to subway



Figure 57: injuries on tree trunk



Figure 58: view from walkway to subway

Inspiration ULVSUNDAPLAN - a prairie passage

Inspiration for this intersection is drawn from the prairie, a habitat described on page 34. In line with the work described for Alviksplan on page 52 pictures of the prairie were studied to find characteristics and patterns to use in the design.

The same approach for visualization was used and digital sketches were made that showcase three characters that has been used as conceptual pillars in the planting design for Ulvsundaplan. These characters are Drifts, Mixing and Solitaires.

On the opposite page the conceptual sketches are shown in figure 63-65 with the figure descriptions connecting them to the natural habitats shown below in figure 59-62. These are a representative sampling of the pictures studied.



Figure 59: Colorful drifts in California (Stowe 2008) (CC BY 2.0)



Figure 60: Blooming prairie with rich diversity (wdterp 2016) © wdterp



Figure 61: Andropogon in a tall grass prairie (Taeger 2013) (CC BY-NC 2.0)

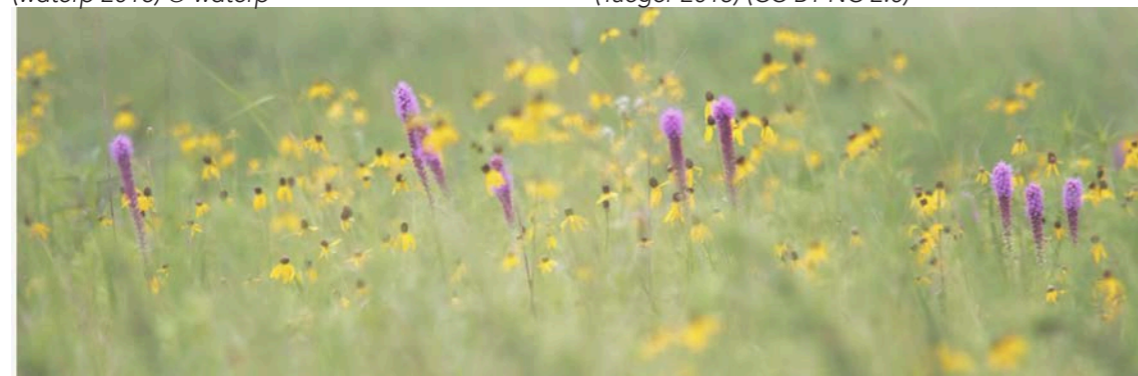


Figure 62: Prairie Wildflowers with beautiful structure and color (wdterp 2018) © wdterp

Conceptual sketches ULVSUNDAPLAN - a prairie passage

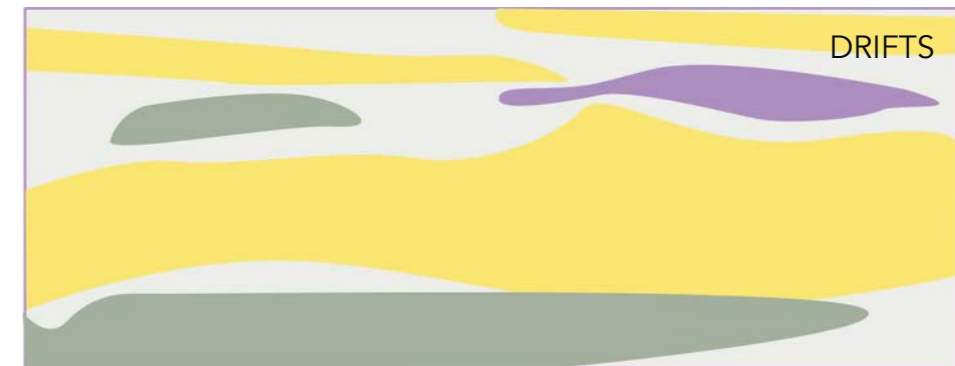


Figure 63: Sweeping drifts. The drift are the base, the movement and the flow of the planting. Fig 59 shows a large area with its drifts sweeping through the landscape that inspired this character.



Figure 64: In the prairie the plants seem to mingle in a intricate way. Many species can be found within a small area as shown in fig. 60. This creates an interesting planting to experience both from a far and up close.



Figure 65: Solitaires for structure and rhythm. This theme is the same as the one for Alviskplan. It is an important character to create interest and structure. It is portrayed beautifully in fig. 62 where the Liatris spikes appear among the grasses and rudbeckias.

Concept and Design ULVSUNDAPLAN - a prairie passage

Different from Alviksplan this intersection has not been created as a landscape art piece. It is mainly an infrastructural intersection with a combination of traffic islands of varying sizes with both roads, bike lanes and paths for pedestrians finding their way through the area. Since both pedestrians, cyclists and drivers come relatively close to the planting it has been inspired by the species rich prairie. In *figure 66* the idea of the planting as a prairie inspired mixed planting is shown.

This planting can be enjoyed up close as well as from the road. A colorful mix of perennials mingle in a sea of grass. Structural plants are an important part of this composition giving it visual qualities during the winter. A more detailed view of the plants can be seen on *figures 67-70* where the plant mixes are presented. Further on a planting plan can be seen in *figure 72* on page 68-69.



Figure 66: Visualization of the character of the prairie planting 64

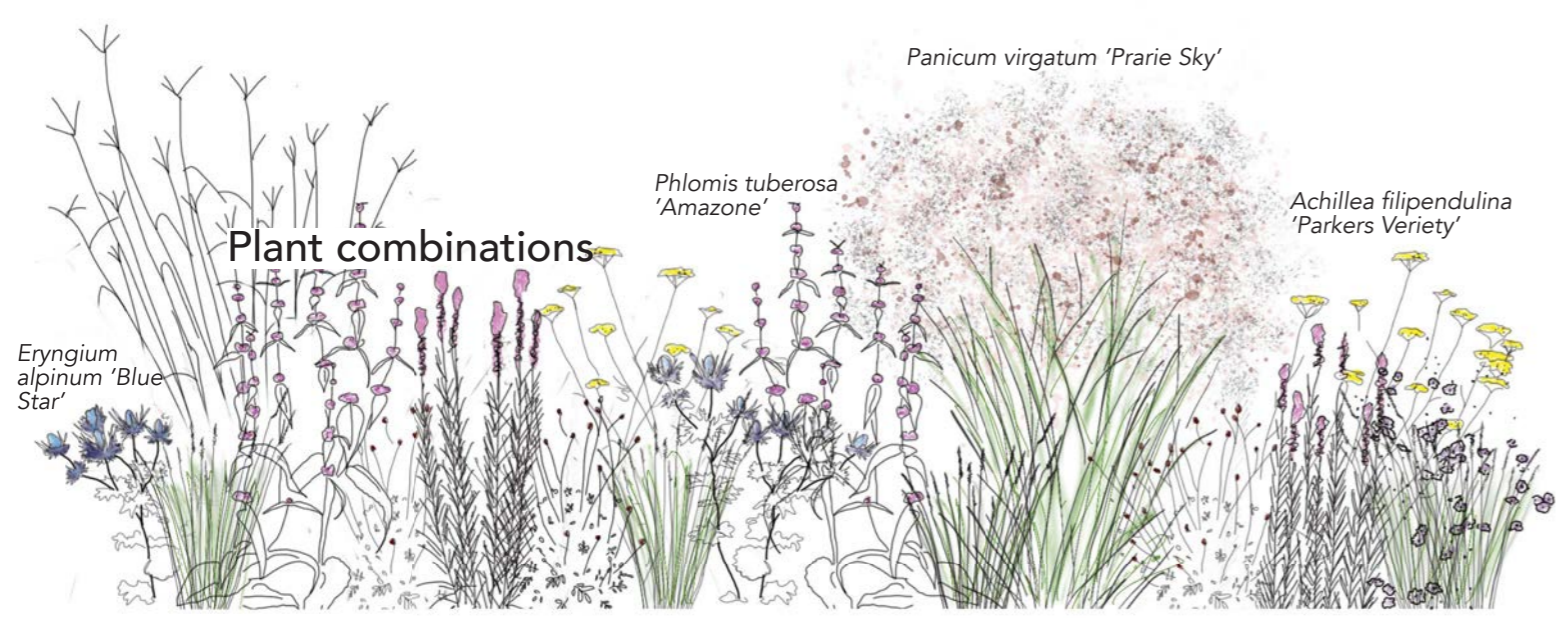


Figure 67: Mix 1 with strong characters both regarding form and color creates interesting meetings between plants that are fun to experience up-close. Even though one drives through the intersection the planting offer a beautiful scenery.

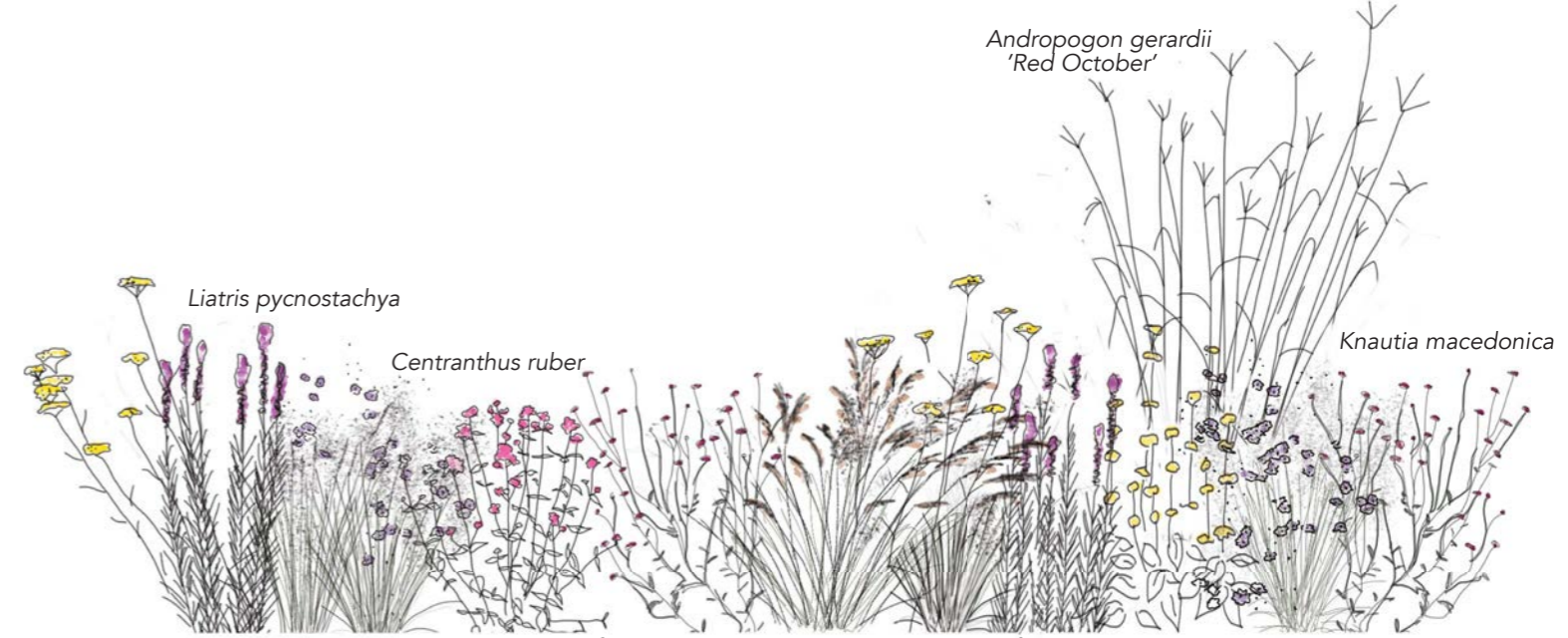


Figure 68: Mix 3 is more coherent with a focus on grasses with pink and yellow flowers emerging. The mix also bring winter interests with seed heads. The knautia will seed and fill in gaps together with the Centranthus.

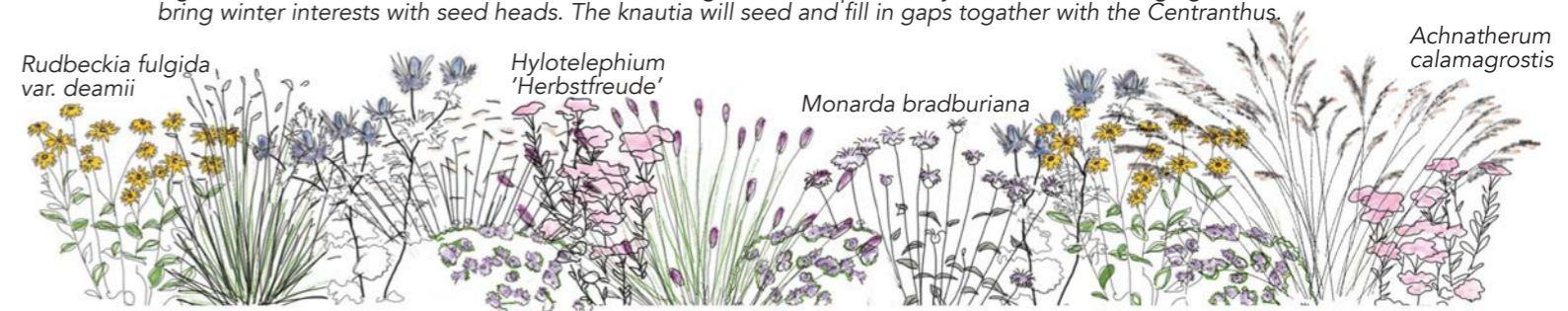


Figure 69: Mix 2 is a mix that with the help of Hylotelephium and Symphyotrichum help create a structure. Feathery grasses and Rudbeckias are two other important elements of this mix.

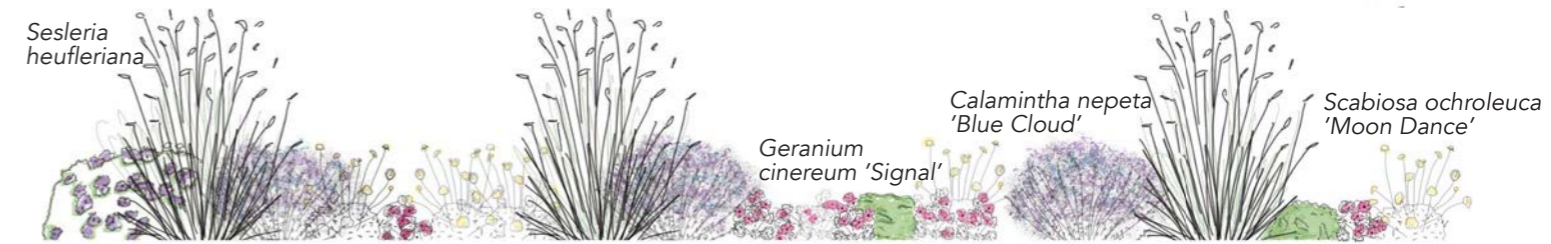


Figure 70: Mix 4
The traffic cuts through these traffic island in a way that the height of the plantings can have a critical affect on the safety. Therefore a lower-growing mix is placed in areas where visibility is of great importance for the safety. Geraniums ad color and Scabiosa a fun element with its flowers floating above. Sesleria heufleriana is a bit higher but thanks to the transparency of the taller straws it will not be a problem for the visibility.

Table 3: Overview of plantmixes. Colors correlate to the simplified visualization over the site shown in figure 71.

MIX 1	MIX2	MIX3	MIX4	BULBS/SOLITAIRES
Melica ciliata	Achnatherum calamagrostis	Achnatherum calamagrostis	Sesleria heufleriana	Tulipa praestans 'Shogun'
Panicum virgatum 'Prairie Sky'	Bouteloua gracilis 'Blond Ambition'	Sesleria autumnalis	Euphorbia cyparissias 'Fens Ruby'	Muscari armeniacum
Achillea filipendulina 'Coronation Gold'	Sesleria heufleriana	Sporobolus heterolepis 'Cloud'	Geranium cinereum 'Signal'	Muscari aucheri 'White Magic'
Achillea filipendulina 'Parkers Variety'	Dalea candida	Achillea filipendulina 'Coronation Gold'	Scabiosa ochroleuca 'Moon Dance'	Muscari armeniacum 'Peppermint'
Eryngium alpinum 'Blue Star'	Eryngium alpinum 'Blue Star'	Achillea filipendulina 'Parkers Variety'	Calamintha nepeta 'Blue Cloud'	Crocus chrysanthus 'Blue Pearl'
Liatris pycnostachya	Hylotelephium 'Herbstfreude'	Centranthus ruber	Symphyotrichum dumosus 'Augenweide'	Crocus chrysanthus 'Goldilocks'
Liatris spicata	Monarda bradburiana	Centranthus ruber 'Alba'		● Andropogon gerardii 'Red October'
Phlomis tuberosa 'Amazone'	Rudbeckia fulgida var. deamii	Knautia macedonica		○ Symphyotrichum ericoides 'Pink Star'
Sanguisorba officinalis 'Tanna'	Symphyotrichum dumosus Gr. 'Mittelmeer'	Liatris pycnostachya		
		Liatris spicata		
		Phlomis russeliana		

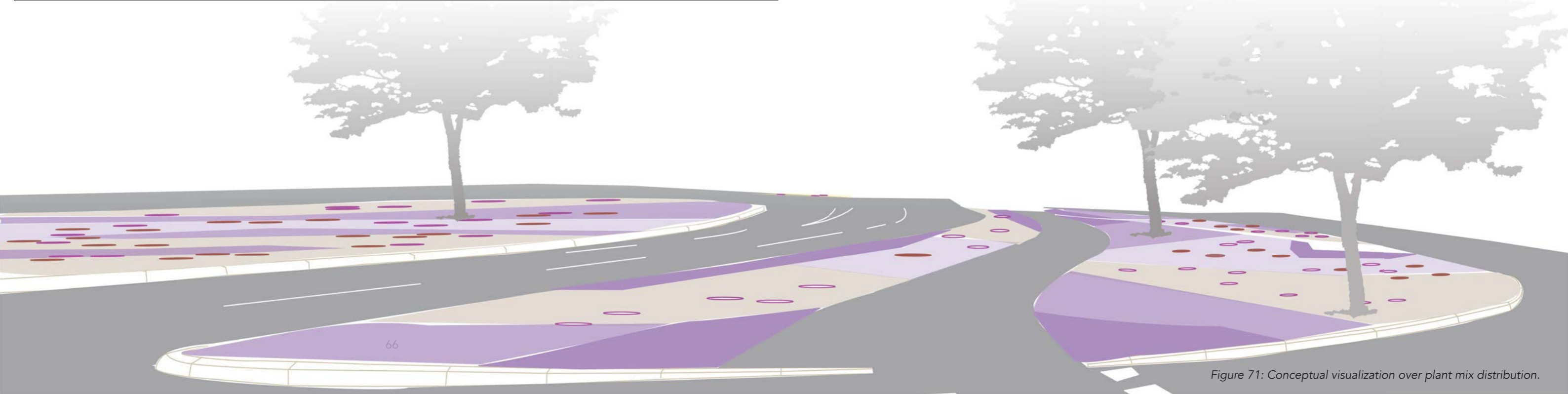
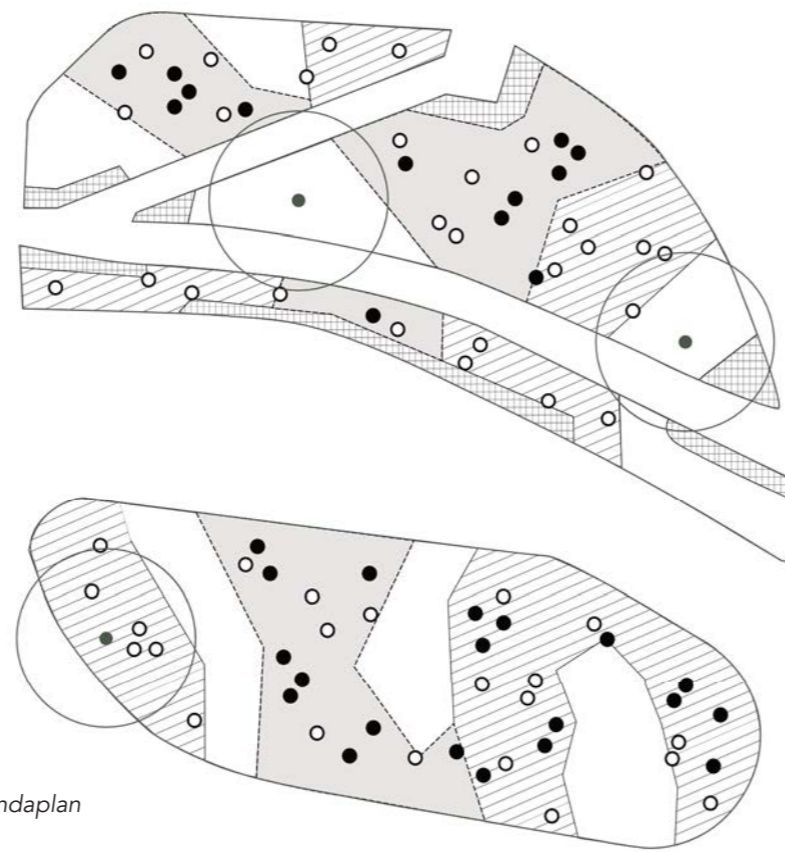


Figure 71: Conceptual visualization over plant mix distribution.

ULVSUNDAPLAN Planting plan



Scale 1:500 A3 **↑N** Figure 72: planting plan Ulvsundaplan

LEGEND

- Tree
- Symphyotrichum ericoides* 'Pink Star'
- Andropogon gerardii* 'Red October'
- Mix 1 + Crocus
- Mix 2 + Tulipa and Muscari
- Mix 3 + Muscari
- Mix 4 + Crocus
- Tree to be cut down
- Lower mix to ensure good visibility for drivers.

Tree cutting plan

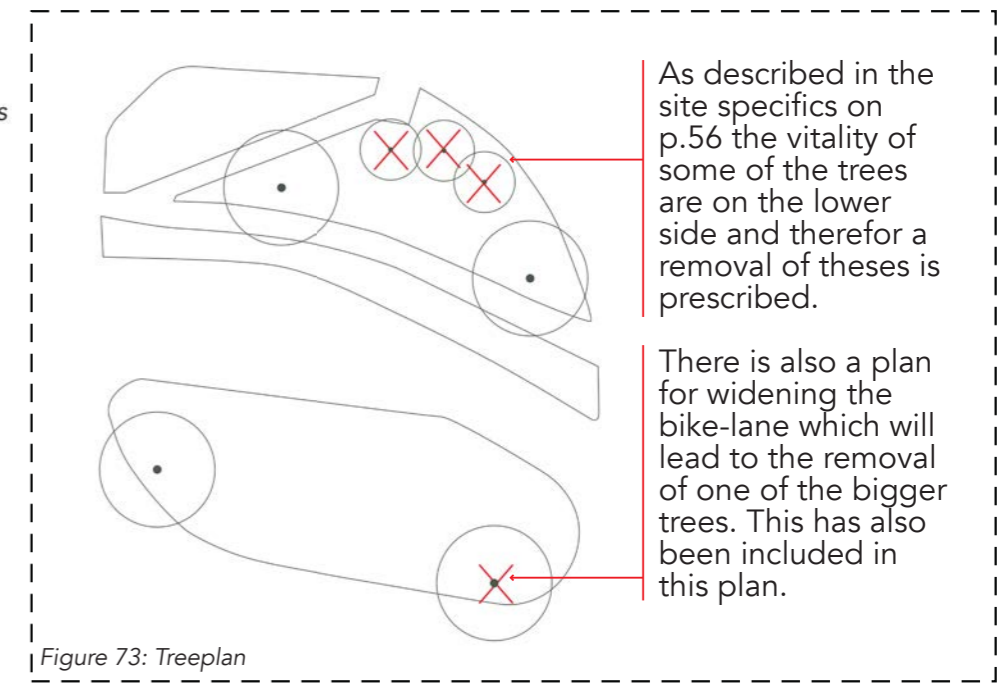


Figure 73: Treeplan

Table 4: Plantlists for mixes including percentage distribution and grouping of species when planing.

MIX 1		MIX 2	
<i>Melica ciliata</i>	15% groups of 3-7	<i>Achnatherum calamagrostis</i>	10% groups of 1-2
<i>Panicum virgatum</i> 'Prarie Sky'	10% groups of 3	<i>Bouteloua gracilis</i> 'Blond Ambition'	10% groups of 2-5
<i>Achillea filipendulina</i> 'Coronation Gold'	8% groups of 3-5	<i>Sesleria heufleriana</i>	10% groups of 2-5
<i>Achillea filipendulina</i> 'Parkers Variety'	12% groups of 3-7	<i>Dalea candida</i>	10% groups of 1-4
<i>Eryngium alpinum</i> 'Blue Star'	10% groups of 3-5	<i>Eryngium alpinum</i> 'Blue Star'	10% groups of 3-5
<i>Liatris pycnostachya</i>	10% groups of 2-5	<i>Hylotelephium</i> 'Herbstfreude'	10% groups of 3-7
<i>Liatris spicata</i>	5% groups of 2-5	<i>Monarda bradburiana</i>	15% groups of 3-5
<i>Phlomis tuberosa</i> 'Amazone'	5% groups of 3-5	<i>Rudbeckia fulgida</i> var. <i>deamii</i>	15% groups of 3-7
<i>Sanguisorba officinalis</i> 'Tanna'	15% groups of 3-5	<i>Symphyotrichum dumosus</i> Gr. 'Mittelmeer'	10% groups of 3-5
MIX 3		MIX 4	
<i>Achnatherum calamagrostis</i>	5% groups of 1-2	<i>Sesleria heufleriana</i>	20% groups of 2-5
<i>Sesleria autumnalis</i>	15% groups of 2-5	<i>Euphorbia cyparissias</i> 'Fens Ruby'	10% singulary
<i>Sporobolus heterolepis</i> 'Cloud'	10% groups of 3-5	<i>Geranium cinereum</i> 'Signal'	20% groups of 2-7
<i>Achillea filipendulina</i> 'Coronation Gold'	8% groups of 3-5	<i>Scabiosa ochroleuca</i> 'Moon Dance'	15% groups of 3-5
<i>Achillea filipendulina</i> 'Parkers Variety'	12% groups of 3-5	<i>Calamintha nepeta</i> 'Blue Cloud'	15% groups of 2-5
<i>Centranthus ruber</i>	10% groups of 3-5	<i>Symphyotrichum dumosus</i> 'Augenweide'	20% groups of 2-4
<i>Centranthus ruber</i> 'Alba'	5% groups of 2-4		
<i>Knautia macedonica</i>	10% groups of 2-5		
<i>Liatris pycnostachya</i>	10% groups of 2-5		
<i>Liatris spicata</i>	10% groups of 2-5		
<i>Phlomis russeliana</i>	15% groups of 3-5		

Soil: Hasselfors Citykross 4-8

Equivalent to the substrate used by Stockholms Stad. This substrate from Hasselfors Garden has good qualities for plants in the urban environment providing good variation of pore sizes. It is fortified with compost and biochar that can help with the waterholding capacity and nutrient availability as well as working as a filter for contaminated water Hasselfors Garden (2020).

To increase the pH and supress weeds a mulch layer of 50 mm limestone chippings is added

Table 5: Plantlists over solitaires and bulbs including description for planing and number of plants.

BULBS/SOLITAIRES	
<i>Tulipa praestans</i> 'Shogun'	20/M2 planted in groups/drifts 3-10 within the borders of perennial mix 2
<i>Muscari armeniacum</i>	25/M2
<i>Muscari aucheri</i> 'White Magic'	10/M2 all Muscari bulbs are mixes before spread within the borders of perennial mix 2 and 3
<i>Muscari armeniacum</i> 'Peppermint'	15/M2
<i>Crocus chrysanthus</i> 'Blue Pearl'	30/M2 all crocus bulbs are mixes before spread within the borders of perennial mix 1 and 4
<i>Crocus chrysanthus</i> 'Goldilocks'	20/M2
<i>Andropogon gerardii</i> 'Red October'	● 33 planted in locations marked on planting plan with a black dot
<i>Symphyotrichum ericoides</i> 'Pink Star'	○ 120 planted in groups of 1-3 in location marked on planting plan with a white and black dot



Brommaplan - Site specifics

vegetation

The areas of the traffic intersection consists of cut lawn and solitary trees of varying species and sizes.



Two narrow borders with *Allium* and *Lilium*.

The surrounding neighborhood have both gardens, larger nature areas as well as allotments

-  Private gardens & street trees/vegetation
-  Natural areas

roads

A roundabout that has received a lot of critique over the years

-  roads
-  metro

site

Drottningholmsvägen

Large allotments are located above nature area.

Center for public transport, busses and metro.

Grocery stores, systembolaget, dentist office etc.

-  site

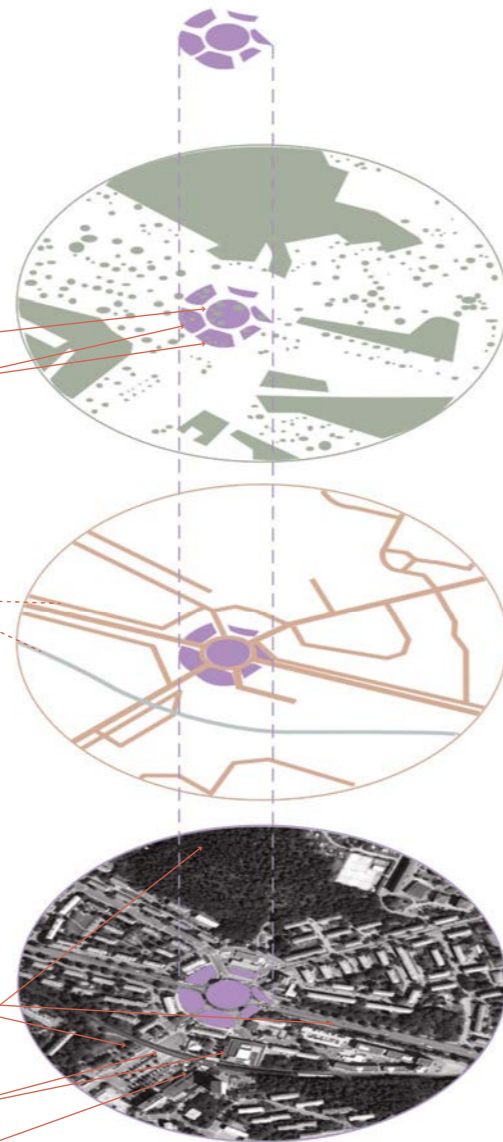


Figure 74: Layered analysis showing the vegetation, road system and surrounding area of Brommaplan.

On the opposite page pictures from the location are presented. Brommaplan is an important center for public transportation with both busses and subway shown in figure 76. Shops including Systembolaget, groceries, a small outside market for vegetables and flowers, doctors- and Bank offices makes Brommaplan a vibrant square. One of the cultural values described by Landskapslaget AB (2008) is the 1950's architecture shown in figure 79, 81 82. There are a few benches places facing the roundabout figure 83. The vegetation in the intersection is mainly cut grass trees and a few shrubs pictured in figure 76,78, 80, 84. Alongside the benches are narrow perennial borders with mostly Alliums and Liliums that seem to be somewhat neglected as shown in figure 82.



Figure 75: subway station



Figure 76: roundabout



Figure 77: market place



Figure 78: roundabout vegetation



Figure 79: offices in 1950's building



Figure 80: mowed lawn and trees



Figure 81: 1950's architecture.



Figure 82: perennial boarder



Figure 83: benches placed along the perennial boarder.



Figure 84: bike lane

Infrastructure and change

This area has been the subject of a lot of discussions. Changes to this roundabout seem to be inevitable. The questions are only when and how changes will be made. The responsibility for the vegetation in this area is divided and the district of Bromma only cares for the outer areas and not the center of the roundabout. Due to the changes needed in the infrastructure of this area the proposal will focus on a concept and plant suggestions. However no specific design nor planting plan will be provided.



Figure 85: Illustrative map over Brommaplan and the vegetation surrounding the site.

Concept

The idea for the concept for a future planting design of this area is sprung from the architectural values mentioned earlier in this work. Brommaplan was developed during the 1950's and therefore the inspiration for the concept is drawn from patterns created during the decade. A lush garden wallpaper shown in figure 86 and an abstract color block wallpaper shown in figure 88 represent a type of the main sources of inspiration. These can be translated into a block-planting like the one shown in figure 87. The idea is that this type of planting could connect the vegetation to the architecture and enhance the characteristics as well as pay a tribute to the historical values. These ideas can be adoptable to whatever the future may hold for Brommaplan providing the characteristics from the 1950's are preserved. This concept is created with a focus on the green areas surrounding the roundabout. This due to the fact that they are cared for by the district of Bromma whereas the center is maintained by Vägverket.



Figure 86: Lush green pattern: Kjejsarkrona (Jacobsen 1982)



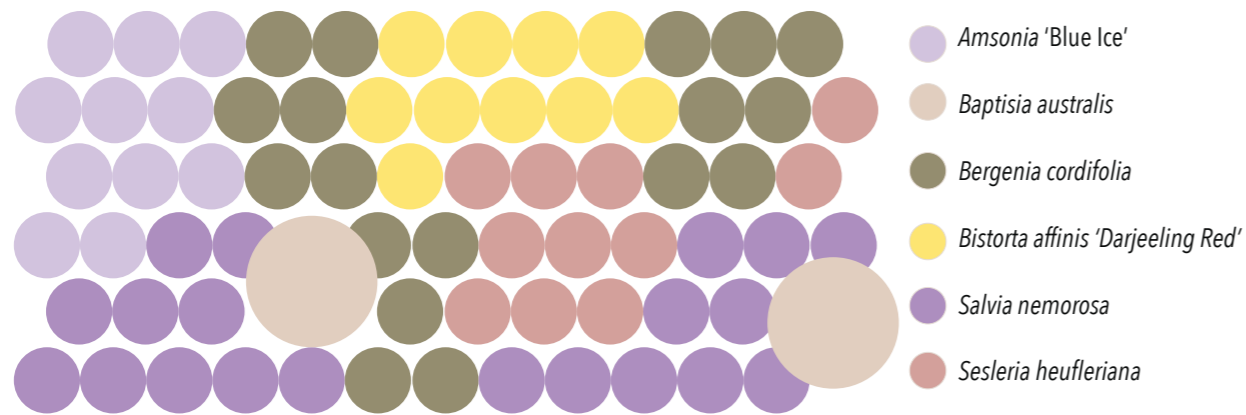
Figure 87: Vlinderhof planting plan (Oudolf 2014)



Figure 88: 1950's pattern (Kalmar tapetfabrik 195X)

Brommaplan Plants

As mentioned no master plan is provided for Brommaplan. However, a small plan demonstrating how the planting could be composed in a block/drift planting can be seen in figure 89. In figure 90 on the opposite page a moodboard is presented. The goal is to inspire a new approach to the vegetation surrounding the roundabout in Brommaplan. When it comes to plants a few perennials are listed below in table 6. It is important to remember that more specific planning is needed and plant choices has to be adopted to the different areas of the site depending on the microclimate described earlier in this work starting on page 28. The Plant strategies also need to be taken in consideration to create a balance between the blocks. Characteristics to look for are plants that are somewhat competitive yet not dominating and that can cope with the stressors plants face in the traffic environment mentioned earlier in this work. It can also be a good idea to mix in a few ruderals to fill in the gaps especially initially before the plantings have found their balance. A perennial block-planting surrounding the roundabout could create a landmark for this central part of Bromma. Reflecting the cultural values and the joy for plants in a Garden City. Plants with architectural qualities and long seasonal interest would make this site beautiful all year around.



Scale 1:50 A3 Figure 89: Conceptual planting plan for Brommaplan with the aim to inspire.

Table 6: Plant suggestions for Brommaplan

grass	perennials	bulbs
<i>Melica ciliata</i>	<i>Amsonia 'Blue Ice'</i>	<i>Crocus vernus</i>
<i>Chasmanthium latifolium</i>	<i>Baptisia australis</i>	<i>Tulipa 'Ballerina'</i>
<i>Chalamagrostis auctiflora 'Karl Foerster'</i>	<i>Bergenia cordifolia</i>	<i>Narcissus poaeticus 'Actaea'</i>
<i>Sesleria autumnalis</i>	<i>Bistorta affinis</i>	<i>Muscari armaniacum</i>
<i>Sesleria heufleriana</i>	<i>Chleone oblida</i>	<i>Fritillaria imperialis</i>
	<i>Geranium sanguineum</i>	
	<i>Helleborus foetidus</i>	
	<i>Hemerocallis 'Happy Returns'</i>	
	<i>Heuchera villosa 'Autumn Bride'</i>	
	<i>Hosta spp. cvs.</i>	
	<i>Symphyotrichum novi-belgii 'Early Blue'</i>	
	<i>Rudbeckia fulgida</i>	

Moodboard



Figure 90: Moodboard for Brommaplan.

Maintenance

The subject of maintenance has been explored earlier in this work. As stated maintenance is an important part of any planting but maybe even more so in public areas especially in close proximity to streets due to the safety risk for the maintenance staff. The goal with these plantings has been to design plantings that won't require as frequent inputs as lawn cutting once the plantings are established.

The naturalistic mixed plantings designed for Alviksplan and Ulvsundaplan are to be cut back early in spring, cuttings being removed. Weeding will be required especially initially before the plants fill their space. Once the plantings are established the balance within the plan community should be checked once a year and necessary actions taken to keep the plantings in line with the vision. Dynamic changes are welcome but no species should take over, some plants may disappear after a few years and in some cases new species may need to be introduced to keep a dynamic and interesting planting.

The concept and plants suggested for Brommaplan will need a different approach. These plantings will also be cut back early in spring. Cuttings can be cut in smaller pieces and used as mulch to add nutrients to the plantings. A layer of 5 -10cm of green compost is to be added once every other year at the time of the cutback. Since a block/drift planting is suggested for this site one will need to make sure that no species are interfering and pushing others out of their space. It is important that the plants cover the ground in order to keep weed invasion to a minimum. If species are not delivering said quality they should be removed and replaced by another that provides better ground cover.

Life in the city, road safety and vegetation

Today our cities are to a high percentage covered by hardscape, something that according to the literature has a negative effect on our wellbeing (Nordh 2010). Life in the city is often stressful as one is exposed to stressors such as pollution, noise, economic stress etc. resulting in a feeling of exhaustion (Taylor et al. 2018). Although more research is needed, evidence points towards that vegetation can play a positive role in regards to peoples health and wellbeing by lowering stress and frustration levels. According to the research people prefer green cities (Nordh 2010) and as described in the result in the literature study one can benefit by just being surrounded by greenery (Shoemaker 2002). So if a city can offer a combination of larger and smaller parks connected with green corridors people regardless of location would be exposed to the positive effects offered by greenery. In this work the focus is on green elements we find within close proximity to streets. As stated in the result section a lot of urban citizens commute and hence tend to spend a considerable amount of time each day in this environment. The increase of stress and road rage reported (Åhlander 2017) can have a negative effect on our driving and lead to accidents and in the worst case scenario the loss of lives (Forward 1999). By adding more greenery and designing lush plantings in these environments Vision Zero won't be miraculously reached but we may be able to gain some of the benefits addressed in part one regarding lowering the levels of stress and frustration (Wolf 2010).

Planting design and maintenance

When it comes to vegetation and green elements in the urban environment diversity is as the literature used in this work suggests an important factor (Fuller et al. 2007; Nordh 2010). Lawns can be a great element in public parks since it encourages activities and social interactions. However the vegetation in all three of the traffic intersections in the design proposal are used mainly for visual effects, as they are not suited for activities due to their locations within the road system. When the possibility for activity is removed it can therefore be hard to motivate the usage of lawn. So just like Wingren (2009) acknowledged it is of the highest importance to take all factors in consideration when designing. Among the questions one needs to ask oneself are; what type of vegetation will bring the most value to this site? how will this site be used? and what level of maintenance is best suited for this location? According to the park plan for Stockholms Stad most of the grass in the intersections addressed in the design proposal are classified as "Bruksgräsytor". Areas with this classification shall be cut every two weeks and a minimum of nine times per season according to the technical requirements description from Stockholm Stad (Otteklint 2017). Professionals within the field of maintenance in urban environments believe that maintenance inputs with lower frequencies is to be preferred in close proximity to streets (Christoffersson 2021). The answer to the questions above could therefore indicate that perennial plantings with low maintenance needs, like the ones described in this work, is a good alternative to grass within the traffic environment. Apart from the lower frequency of maintenance needed perennial

planting will also have a larger biomass that contributes to improved air quality (Ferrini et al. 2020) as well contributing with aesthetic values over the year with more diversity in color and structure (Oudolf & Kingsbury 2013).

It is important to remember that low maintenance does not equal no maintenance. With one main input a year cutting back perennials and no feeding or watering needed naturalistic plantings, like the Merton borders in Oxford Botanic Garden & Arboretum, tend to save resources and be more sustainable. However in order to keep the planting balanced and in good condition selective weeding is important, something that requires a higher level of knowledge compared to the care of lawns (Brent 2021). When asking Mark Brent (2021) about using this approach in urban environments he says that it is crucial to have good establishment and maintenance in the initial phase otherwise he fears that municipalities will go back to lawns. Malena Christoffersson (2021) at Lund municipality believes that perennial plantings can create engagement among the maintenance staff. The positive reactions from the public also work as a great motivator. However it is important that the staff feels confident that they have the right knowledge and skills to care for diverse and mixed plantings. Initial training can therefore be an investment worth considering as well as engaging the designer in the first phases of management (Rainer & West 2015; Hitchmough 2017b). By doing so the vision of the designer is passed on to the staff caring for the planting, hopefully resulting in even higher confidence and motivation.

Design proposal

The design proposals in this work have focused on plant composition since the sites are already set and well integrated within the infrastructure of the district of Bromma. The proposals for Alviksplan and Ulvsundaplan have been given a naturalistic aesthetic and inspiration was drawn from nature as recommended in the literature used in this work. Plant choices were made with Grimes (2001) plant strategies in mind. Most of the plants possess characteristics that make them well suited for the stressful environment. The concept created for Brommaplan has a different approach in regards to design aesthetic and a block and drift planting was suggested to honor the architectural values of this part of Bromma. One might feel that this goes against the recommendations presented in this work, both in regards to nature as a source of inspiration as well as the intention to lower the need for maintenance. However the plants suggested for that concept have also been chosen with plant strategies in mind, only with a different focus. So even though we won't find blockplantings in nature we find plants that have a tendency to grow in large patches and monocultures. These plants might not be suitable for horticultural plantings since they are a bit too competitive, and in order to maintain the desired design would require a lot of maintenance. However, there are plants that have a combination of characteristics that make them suitable for these types of plantings. Among these characters are plants that produce a considerable amount of biomass covering the ground making it hard for weeds to establish. Plants that have no or slow vegetative spread so that they can coexist with other plants. The plants also need to have characteristics that make them cope with the stressors found

in the traffic environment. By combining these plants I believe that a block or drift planting can be maintained with less frequency than a lawn. And although the design is mainly inspired by architecture the understanding of plant strategies are a central part of the process and hence nature is in a way part of the inspiration.

As opposed to what Wingren (2009) suggests, one of the main goals has been to create beautiful combinations and bring aesthetic values to these places. Although this has not been the only focus nor has the technical aspects been ignored in favor of beauty. But I do believe that striving to create something beautiful can be at the core of our work without overshadowing the importance of the site or its users. Nature is a great source for beauty and if a site is paired with a natural habitat as suggested by Sprin (1984) beauty can be a central part of a design.

Plant suggestions

It is crucial to remember that one can never fully predict how a planting will turn out. Rainer and West (2015) write that some species might disappear during the establishment years even when great analysis and thought were put into the design. The vision might then be in need of alteration.

The plant choices made for the design proposals have been carefully chosen and the goal is to have plantings that can stand the test of time. However the steppe and prairie inspired plantings in particular will have a dynamic to them.

In Alviksplan one example of a plant that might disappear after a few years is *Pulsatilla vulgaris*. This will add beautiful values in spring during the first seasons but will probably not cope with the competition once the other perennials grow into their place. Another perennial that might not be as long lived is *Achillea millifolium* 'Terracotta'. This is chosen for its beautiful color and structure. The *Achillea filipendulina* varieties are added as a backup although they do not provide the same color.

In Ulvsundaplan the plants will face root competition from the existing trees as well as partial shade. This would need to be taken in consideration at the time of the planting since some plants cope better with these stressors. However, it is hard to predict exactly how the plants will react at a site. Thanks to the plants being composed as mixes a natural dynamic wont necessarily disturb the vision. The plants will be allowed to find their best placements. Following the evaluation, for both designs, over a few years will be necessary to see how the designs progress.

Finally I believe that a vision is great and even necessary but as the quote below states it is nothing without execution. When working with living material an important part of the work is learning to work with the plants. To stand back and watch as they bring the planting to life. The vision might need to shift as stated above and that is ok. To be humble and flexible can according to me be one of the greatest qualities as a designer or architect working with plants.

*"Having just a vision's no solution
everything depends on execution"*

Steven Sondheim (1983)

Method discussion

To truly reach a deeper level in this work, field studies of different natural habitats could have been a good compliment to the literature study. However, this was not possible within the timeframe nor was it the focus or aim to explore natural habitats in person. The focus was to, with help from literature, explore the urban environment and the relationship between ditto, plants and people. And see if it would be possible to pair the urban environment with natural habitats to find inspiration for planting designs.

When it comes to the design proposals I believe that it in retrospective would have been better to focus on two of the sites. Instead of creating two mixed naturalistic plantings and a concept that scratches the surface of the complexity that is blockplantings. It would have been more beneficial to make one mixed and one blockplanting. Then comparing the benefits and challenges between the two in relation to the urban environment. This is not to say that the two mixed plantings presented doesn't have different qualities that can inspire the use of perennials in line with the aim. It is merely a reflection on the depth that could have been reached with a different approach. However, given the circumstances regarding the uncertainty of the constructions of Brommaplan a detailed design for that site didn't feel right and neither did a blockplanting in Ulvsunda or Alvik feel like the right choice.

CONCLUSION AND REFLECTION ON RESEARCH QUESTIONS

- What qualities make up the conditions of traffic environments? How do we experience these?

The short answer would be that the urban environment including the traffic environment can be described as somewhat unnatural (Peschardt 2014). It is full of environmental stressors such as pollution as well as traffic related stressors including increasing queues. People seem to experience higher stress levels in the traffic (Åhlander 2017). And that is something that can have negative effects on our overall health.

- What natural habitats can we look to for inspiration when designing plant communities for the traffic environment?

It is unfortunately not possible to answer this question since it depends on the microclimate of a specific site. Therefore this is a question requiring a more specific wording. One can however to some extent generalize and recommend natural habitats that can be described as stressful. Plants within the group of stress tolerators described by Grime (2001) are in general better suited for the conditions we find in the traffic environment such as drought, salt, floods etc. However, it is not possible to give a short answer since many factors come into play in order to make the perfect match between site, natural habitat and plants. Field studies and test plantings within the traffic environment would be needed to truly understand how this environment affects herbaceous plants. Once that is determined, natural habitats best suited for inspiration could be established.

- How can perennials be used to add aesthetic and ecological values to traffic islands while lowering the need for repeated maintenance?

In conclusion perennial plantings will require more effort in terms of planning and skill than a lawn. But they do also provide bigger values, both aesthetic and ecological for people and the planet, as described in this work. Something that hopefully is reason enough to incorporate more perennial plantings within our urban cities including the traffic environment. However, maybe one big subject to consider for the future is how the quantity within maintenance can be turned into quality. Perhaps a question worth asking is how one can improve the motivation and skill among the staff caring for our public green areas?

- In what way might perennials in the traffic environment contribute to people's health and wellbeing?

Biodiversity and healthy ecosystems are believed to have positive effects on humans as they provide important services (Dean et al. 2011). Nature can also support wellbeing (Taylor et al. 2018) that is not to say that we solve all health problems by adding perennial plantings alongside roads. More research is needed but I can not help but believe that if we plan for more urban greenery, including roadside vegetation, with a high level of biodiversity and diverse habitats we could generate a more positive feeling among urban citizens. The effect of perennials in regards to the stress and safety in the traffic environment is a subject worth exploring more.

FINAL REFLECTION

In a lecture with Sarah Price on August 31st 2021 she stated that perennials or herbaceous vegetation often is neglected by landscape architects. This is something that I can only agree with. This is also reflected in the academic literature where perennials often are forgotten or overlooked in favor of woody plant material. Although the literature used in this work have given results useful for the design proposals presented in this work as well as for future planting designs. More in-depth research with a focus on the herbaceous vegetation is needed. Preferable in relation to people, health and the urban environment.

Maybe the biggest hope going into this work was to find evidence that point towards the positive effects of replacing mowed lawns with perennials. This is something I believe was achieved although, as stated above, more research is needed.

In conclusion I can say that over the course of the work with this thesis I have gained knowledge regarding not only plants but also the stressors we face living in the city. I am convinced that we with the help of herbaceous plants can, to some extent, lighten the negative effects of these stressors. When it comes to the future within the field of traffic island vegetation I can only hope we will see greater diversity. If we want to make our cities greener and more attractive we need to make the most of every green patch present. Perennials can have a place in our traffic environment and our cities. But in order to see a change within the green structure we need to build bridges between landscape architecture and horticulture and between the designer and the maintenance staff. Hopefully this work can bring inspiration to municipalities and other professionals that work with the development of our urban environment and public spaces.

/ Hanna Holmberg

List of references

Alton, P. (1997). *Snitt utan smicker. Gränsen mellan konst, landskapsarkitektur och trafikteknik suddas ut*. DN.SE. Stockholm. <https://www.dn.se/arkiv/kultur/snitt-utan-smicker-gransen-mellan-konst-landskapsarkitektur-och-trafikteknik-suddas-ut/> [2021-04-29]

Arnfield, A.J. (2020). *Koppen climate classification I Definition, System, & Map. Encyclopedia Britannica*. <https://www.britannica.com/science/Koppen-climate-classification> [2021-03-07]

Boorman, A. (2004). *The Management of Amenity Grasslands. Plant User Handbook A guid to effective specifying*.

Boverket (2021) *Typer av ekosystemtjänster* <https://www.boverket.se/sv/samhallsplanering/sa-planeras-sverige/planeringsfragor/ekosystemtjanster/olika-typer-av-ekosystemtjanster/> [2021-12-12]

Bulut, Y., Toy, S., Irmak, M.A., Yilmaz, H. & Yilmaz, S. (2008). *Urban-rural climatic differences over a 2-year period in the City of Erzurum, Turkey*. *Atmósfera*, 21 (2), 121–133

Chatto, B. (2021). Beth Chatto's Plants and Gardens *The story of Beth Chatto OBE* <https://www.bethchatto.co.uk/discover/story.htm> [2021-03-01]

Cordell, H.K., Murphy, D., Riitters, K.H. & Harvard, J.E. (2005). The natural ecological value of wilderness. In: The Multiple Values of Wilderness: 205-249,. <https://www.srs.fs.usda.gov/pubs/25131> [2022-01-16]

Cross, Nigel (2008). *Engineering design methods: strategies for product design*. 4. ed. Chichester: John Wiley

Cross, Nigel (2011). *Design thinking: understanding how designers think and work*. Oxford: Berg

Dean, J., van Dooren, K. & Weinstein, P. (2011). *Does biodiversity improve mental health in urban settings?* Medical Hypotheses, 4c[Bath]: Filbert Press.

Dunnett, N. (2019). *Naturalistic planting design : the essential guide* . Bath: Filbert Press.

Ferrini, F., Fini, A., Mori, J. & Gori, A. (2020). *Role of Vegetation as a Mitigating Factor in the Urban Context*. Sustainability (Basel, Switzerland), vol. 12 (10), p. 4247– BASEL: MDPI.

Fieldhouse, K. & Hitchmough, J. (2004). *Plant user handbook : a guide to effective specifying* / edited by James Hitchmough and Ken Fieldhouse. Oxford: Blackwell Pub.

Fuller, R.A., Irvine, K.N., Devine-Wright, P., Warren, P.H. & Gaston, K.J. (2007). *Psychological benefits of greenspace increase with biodiversity*. *Biol. Lett.*, 5

Grime, J.P. (2001). *Plant strategies, vegetation processes, and ecosystem properties*. 2. ed. New York,: Wiley.

Hasselfors Garden (2020).*Citykross 4-8*. Hasselforsgarden.se. <https://www.hasselforsgarden.se/produkter/citykross-4-8/> [2021-09-09]

Hartzell, H., Brundell-Frej, K. & Waara, N. (2010). *Trafiksakerhetsprogram för Stockholms stad*. Trafikkontoret Stockholms stad. <https://start.stockholm/globalassets/start/om-stockholms-stad/politik-och-demokrati/styrdokument/trafiksakerhetsprogram.pdf> [2021-02-25]

Hine, Robert & Martin, E. A. (red.) (2008). *A dictionary of biology* [Elektronisk resurs]. 6. ed. Oxford: Oxford University Press [2022-01-15]

Hitchmough, J. (2017a). *Sowing beauty : designing flowering meadows from seed*. Portland, Oregon: Timber Press.

Holmberg, H. (2019). Hotade skånska arter ett gestaltungsförslag till Botaniska trädgården vid Lunds Universitet. Alnarp: Sveriges lantbruksuniversitet. <http://urn.kb.se/resolve?urn=urn:nbn:se:slu:epsilon-s-10527> [2021-10-15]

Hoyle, H., Hitchmough, J. & Jorgensen, A. (2017). *All about the ‘wow factor’? The relationships between aesthetics, restorative effect and perceived biodiversity in designed urban planting*. *Landscape and Urban Planning*, 164, 109–123. <https://doi.org/10.1016/j.landurbplan.2017.03.011>

Huisman, M. (2000). *Örter och gräs i trafikmiljöer*. Utemiljö. 2000 (3). <https://www.movium.slu.se/system/files/news/7622/files/Fakta2000-3.pdf> [2020-12-09]

Johansson, M., Gyllin, M., Witzell, J. & Küller, M. (2014). *Does biological quality matter? Direct and reflected appraisal of biodiversity in temperate deciduous broad-leaf forest*. *Urban Forestry & Urban Greening*, vol. 13 (1), pp. 28–37. Jena: Elsevier GmbH. <https://doi.org/10.1016/j.ufug.2013.10.009>

Kahn, A. & Burns, C.J. (2005). *Site matters : design concepts, histories, and strategies*. New York: Routledge.

Kellert, S.R. & Wilson, E.O. (1993). *The Biophilia hypothesis*. Washington, D.C.: Island Press.

Lee, A.C.K. & Maheswaran, R. (2011). The health benefits of urban green spaces: a review of the evidence. *Journal of public health* (Oxford, England), vol. 33 (2), pp. 212–222 England. <https://doi.org/10.1093/pubmed/fdq068>

Lexio (2021) *Meaning of aesthetic in English* <https://www.lexico.com/definition/aesthetic> [2021-12-12]

Lindwall, U. & Olsson-Bohlin, C. (2016). *Sjukskrivning för reaktioner på svår stress ökar mest*. (2016:2). Stockholm: Försäkringskassan. https://www.forsakringskassan.se/wps/wcm/connect/41903408-e87d-4e5e-8f7f-90275dafa6ad/korta_analyser_2016_2.pdf?MOD=AJPERES&CVID= [2021-02-22]

Naturvårdsverket (n.d.) *Ekosystemtjänster* <https://www.naturvardsverket.se/ekosystemtjanster> [2021-12-12]

Nordh, H. (2010). *Restorative components of small urban parks - Restituerende komponenter i små urbana parker*. Diss. Ås: Norwegian University of Life Sciences, Department of Landscape Architecture and Spatial Planning. <http://hdl.handle.net/11250/2431920>

Otteklint, Å. (2017). *Upphandling avseende parkskötsel* Teknisk kravbeskrivning Handling 06.01 Diariennr: 624-16-2.2.2. Bromma stadsdelsförvaltning.

Oudolf, P. & Kingsbury, N. (2013). *Planting : a new perspective*. Portland, Or.: Timber Press.

Peschardt, K.K. (2014). *Health Promoting Pocket Parks in a Landscape Architectural Perspective*. Department of Geosciences and Natural Resource Management, Faculty of Science, University of Copenhagen. <https://soeg.kb.dk/permalink/45KBDK_KGL/fbp0ps/alma99122976022105763> [2021-02-23]

Rainer, T. & West, Claudia. (2015). *Planting in a post-wild world : designing plant communities for resilient landscapes*. Portland, Oregon: Timber Press.

Råman, T. & Rundquist, E.-M. (2016). *Gödsel : om trädgårdens näringsliv*. Stockholm: Bonnier Fakta.

Region Stockholm (2019). *Mobilitets- och trafikutvecklingsrapport 2019*. Stockholm. <http://rufs.se/globalassets/h.-publikationer/2020/mobilitets--och-trafikutvecklingsrapport-2019-region-stockholm.pdf> [2021-02-26]

Riksförbundet Svensk Trädgård Svensk Trädgård - *Zonkartan*. http://www.tradgard.org/svensk_tradgard/zonkarta/index.html [2021-03-31]

Roman, L.A. (2014). How Many Trees Are Enough? Tree Death And The Urban Canopy. *Scenario 04: Building the Urban Forest* Philadelphia. https://www.fs.fed.us/nrs/pubs/jrnl/2014/nrs_2014_roman_001.pdf

Shoemaker, C.A. (2002). *Interaction by design : bringing people and plants together for health and well-being : an international symposium*. Ames, Iowa : Iowa State Press.

Smidfelt Rosqvist, L., Adell, E., Indebetou, L., Manander, M. & Dickinson, J. (2011). *Arbetspendlingen i Sveriges storstadsområden - nuläge, brister och förtjänster*. (2011:37). Lund.

Spirn, A.W. (1984). *The granite garden : urban nature and human design*. New York: Basic Books.

Stockholm stad (2021-09-02). *Säkrare cykling förbi Alvik - Stockholm växer*. <https://vaxer.stockholm/projekt/sakrare-cykling-forbi-alvik/> [2021-09-07]

McNeill, W. H. (2021). *the Steppe. Encyclopedia Britannica*. <https://www.britannica.com/place/the-Steppe> [2021-07-20]

Sondheim, S. (1983). Putting it together *Sunday in the park with George*. London

SWECO (2008). *Parkplan Bromma Del 2*. Stockholm stad.

Taylor, L., Hahs, A.K. & Hochuli, D.F. (2018). Wellbeing and urban living: nurtured by nature. *Urban ecosystems*, vol. 21 (1), pp. 197–208 New York: Springer US. <https://doi.org/10.1007/s11252-017-0702-1>

Tjärnberg, P.-Å. (2020). *Cykel- och gångbanor, Drottningholmsvägen*. Inriktningsbeslut. 18. <http://insynsverige.se/documentHandler.ashx?did=1991525> [2021-03-30]

Trafikverket (2020a). *Hastighet och trygghet*. Trafikverket. [text]. <https://www.trafikverket.se/resa-och-trafik/trafiksakerhet/Din-sakerhet-pa-vagen/Hastighetsgranser-pa-vag/trygghet-och-hastighet/> [2021-03-02]

Trafikverket (2020b). *Vision Zero Academy*. Trafikverket. [text]. <https://www.trafikverket.se/en/startpage/operations/Operations-road/vision-zero-academy/> [2021-03-02]

Ulrich, R.S. (1984). View through a Window May Influence Recovery from Surgery. *Science (American Association for the Advancement of Science)*, vol. 224 (4647), pp. 420–421 Washington, DC: The American Association for the Advancement of Science.

United Nations, Department of Economic and Social Affairs, Population Division (2019). World Urbanization Prospects: The 2018 Revision (ST/ESA/SER.A/420). New York: United Nations

Wahlsteen, E. (2018). *Växt- och ståndortskänedom*. Alnarp. [Course literature Utökad växt- och ståndortskänedom, 2019]

Wasowski, S.W. (2001). *Gardening With Prairie Plants: How To Create Beautiful Native Landscapes*. Minneapolis: Univ Of Minnesota Press.

Weatherbase (n.d) Stockholm, Sweden Köppen Climate Classification *Weatherbase*. <http://www.weatherbase.com/weather/weather-summary.php3?s=6420&cityname=Stockholm,+Sweden> [2021-03-30]

Wikberg Nilsson, Å., Ericson, Å. & Törlind, P. (2015). *Design: process och metod*. 1. uppl. Lund: Studentlitteratur.

Wingren, C. (2009). *En landskapsarkitekts konstnärliga praktik*. [Doktorsavhandling]. <https://pub.epsilon.slu.se/1978/> [2020-12-08]

Wolf, K. (2010). *Safe Streets:: Green Cities: Good Health*. https://depts.washington.edu/hhwb/Thm_SafeStreets.html [2021-02-24]

Åhlander, J. (2017). *Mer stress och ilska i den svenska trafiken*. Teknikens Värld. <https://teknikensvarld.se/nyheter/bil-och-trafik/mer-stress-och-ilska-i-den-svenska-trafiken-460684/> [2021-02-23]

Personal contacts and lectures

Brent, M. (2021). *maintenance of the Merton borders*, Email correspondence [2021-04-27]

Christoffersson, M. (2021). *skötsel perenner/gräs* Email correspondence and phone call [2021-04-30]

Forward, S. (1999). *Aggressivitet på väg*. Väg- och transport-forskningsinstitutet. Memorandum for a lecture presented at a seminar on 21 April ,1999 in Borlänge. Provided by author via email [2021-02-24]

Forward, S. (2021). *Trafiksäkerhet, stress och växtlighet*, Email correspondence [2021-02-24]

Gustavsson, E.-L. (2020). *Soils for sustainable plantings: A place for plants*. Recorded lecture within the course Advanced Planting Design, SLU Alnarp. [2021-10-08]

Hitchmough, J. (2017b). *Urban Growth Conference* Lund [2017-09-08 to 2017-09-10]

Svensson, M. (2020). *Guided tour Cementparken* Malmö Stad. Within the Course Advanced Planting Design, SLU [2020-09-15]

List of figures

Figure 1: Garcy, D. (2021) *Hylotelephium 'Herbstfreude' AUTUMN JOY* [Photograph]. Available: <https://www.flickr.com/photos/94812913@N03/51135589534/in/photolist-2mgoH2r-2mgjwTg-2mgniPL-nyBomE-urW3Wf-uSGSq4-2kUFgeq-uHiHtZ-2meAayh> [2021-08-10] Used with permission by photographer © Debbie Garcy

Figure 2: Wahl, S. (2007) *Hylotelephium 'Herbstfreude' kärleksört* [Photograph]. Available: <https://www.flickr.com/photos/scottwahl/1259309072/in/faves-192779541@N02/> Used with permission by photographer © Scott Wahl

Figure 3: Holmberg, H. (2020) [Photograph]. © Hanna Holmberg

Figure 4: Roos, L. *Autumn joy in spring (Roos 2018)* [Photograph]. Available: https://www.flickr.com/photos/leo_roos/40756030871/in/faves-192779541@N02/ © Leo Roos [2021-09-02]

Figure 5: [Photograph]. Andrews, O. (2018) *Fuscotinctus Flowers* [Photograph]. Available: <https://www.flickr.com/photos/oandrews/40500124452/in/faves-192779541@N02/> [2021-09-02] Used with permission by photographer © Oliver Andrews

Figure 6: Holmberg, H. (2021) *Plant strategies*. [Illustration]. *Based on the model made by Grime in the 1970s (Grime 2001)* © Hanna Holmberg

Figure 7: Holmberg, H. (2021) *Habitat diagram* [Illustration]. *Based on model in Utökad växt- och ståndortskänedom (Whalsteen 2018)*. © Hanna Holmberg

Figure 8: Rieser, B. (2015) *Salvia nemorosa near Gramatneusiedl Lower Austria* [Photograph]. Available: <https://www.flickr.com/photos/klasseimgarten/51413075553/in/album-72157719804120475/> [2021-08-24]

Figure 9: Hunt, P. (2015) *meadow* [Photograph]. Available: <https://www.flickr.com/photos/hunty66/19594907390/in/faves-192779541@N02/> [2021-08-10]

Figure 10: wdterp (2021) *Prairie Color* [Photograph]. Available: <https://www.flickr.com/photos/wdterp/51299498280/in/faves-192779541@N02/> [2021-09-06] Used with permission by photographer © wdterp

Figure 11: wdterp (2021) *Prairie Storm* [Photograph]. Available: <https://www.flickr.com/photos/wdterp/51334923905/in/faves-192779541@N02/> [2021-09-06] Used with permission by photographer © wdterp

Figure 12: Stockholm stad (2021) *Overview Drottningholmsvägen* [Cartographic material]. Available: <https://etjanst.stockholm.se/>

Byggochplantjansten/gallande-planer/sok-via-karta [2021-03-24]

Figure 13: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 14: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 15: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 16: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 17: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 18: Lundgren, C.G. (1829) *Karta över Bromma socken 1829* Object ID Stockholms stadsarkiv Stockholms stadsarkivs kartsamling NS 442, SE/SSA/0234/J 2 B:18 Karta öfver Bromma Socken 1829 [Cartographic material] Available: <https://stockholmskallan.stockholm.se/post/16035> [2021-04-07]

Figure 19: Stockholm stad (2021) *Drottningholmsvägen* [Cartographic material] Available: <https://etjanst.stockholm.se/Byggochplantjansten/gallande-planer/sok-via-karta> [2021-03-24]

Figure 20: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 21: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 22: Beck, H. E. , Zimmermann, N. E. , McVicar, T. R. , Vergopolan, N. , Berg, A. , & Wood, E. (2018) *Köppen–Geiger climate classification map for Cold, no dry season, warm summer (Dfb)* [Cartographic material]. Available: https://commons.wikimedia.org/wiki/File:Koppen-Geiger_Map_Dfb_future.svg [2021-06-12]

Figure 23: Riksförbundet Svensk Trädgård (no year available) *Map over hardiness zones* [Cartographic material] Available: http://www.tradgard.org/svensk_tradgard/zonkarta/index.html [2021-05-03] Used with permission by Riksförbundet Svensk Trädgård © Riksförbundet Svensk Trädgård

Figure 24: Beck, H. E. , Zimmermann, N. E. , McVicar, T. R. , Vergopolan, N. , Berg, A. , & Wood, E. (2018) *Köppen–Geiger climate classification map for Cold, no dry season, hot summer (Dfa)* [Cartographic material]. Available: https://commons.wikimedia.org/wiki/File:Koppen-Geiger_Map_Dfa_future.svg [2021-06-12]

Figure 25: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 26: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 27: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 28: Holmberg, H (2021) *Alviksplan site specifics*

[Illustration/Cartographic material]. The analysis is built on a aerial photo from Eniro using Affinity photo and Affinity designer.
Alviksplan. Areal photo [Cartographic material] <https://kartor.eniro.se/?c=59.332928,17.976334&z=15&l=aerial&q=%22alviksplan%22;geo> © Lantmäteriet/VISMA [2021-05-18]

Figure 29: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 30: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 31: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 32: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 33: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 34: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 35: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 36: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 37: Reiser, B. (2008) *Gramatneusiedl, unmengen steppensalbei (salvia nemorosa) 2008-07* [Photograph]. Available: <https://www.flickr.com/photos/klasseimgarten/2680924404/in/faves-192779541@N02/> [2021-08-10]

Figure 38: Mount Rainier National Park (2009) *Wildflowers at Mount Rainier* [Photograph]. Available: <https://www.flickr.com/photos/mountrainiernps/28944262524/in/faves-192779541@N02/> [2021-08-10]

Figure 39: Mount Rainier National Park (2005) *Wildflower Meadow* [Photograph]. Available: <https://www.flickr.com/photos/mountrainiernps/6997737191/in/faves-192779541@N02/> [2021-08-10]

Figure 40: Hermann Falkner (2008) *Melica transsilvanica subsp. transsilvanica (48°08' N 16°34' E)* [Photograph]. Available: <https://www.flickr.com/photos/hermannherbarium/3766898600/in/faves-192779541@N02/> [2021-08-10]

Figure 41: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 42: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 43: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 44: Holmberg, H. *Visualization Alviksplan* (2021) [Illustration]. The picture is made using illustrations, photos by

the author as well as stock imagery from pixabay. It is made digitally using Affinity designer and Affinity Photo. © Hanna Holmberg

Figure 45: Holmberg, H. *Plantmix* (2021) [Illustration]. Made using Affinity designer © Hanna Holmberg

Figure 46: Holmberg, H. *Plantmix* (2021) [Illustration]. Made using Affinity designer © Hanna Holmberg

Figure 47: Holmberg, H. *Plantmix* (2021) [Illustration]. Made using Affinity designer © Hanna Holmberg

Figure 48: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 49: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 50: Holmberg, H (2021) *Ulvundaplan site specifics* [Illustration/Cartographic material]. The analysis is built on a aerial photo from Eniro using Affinity photo and Affinity designer.
Ulvundaplan. Areal photo [Cartographic material] <https://kartor.eniro.se/?c=59.335127,17.967324&z=15&l=aerial&q=%22ulvundaplan%22;geo> © Lantmäteriet/VISMA [2021-05-18]

Figure 51: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 52: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 53: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 54: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 55: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 56: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 57: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 58: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 59: Stowe, R. (2008) *California Wildflowers* [Photograph]. Available: <https://www.flickr.com/photos/tomsaint/3361844880/in/faves-192779541@N02/> [2021-08-10]

Figure 60: wdterp (2016) *Blooming prairie* [Photograph]. Available: <https://www.flickr.com/photos/wdterp/27818911913/in/faves-192779541@N02/> [2021-09-06] Used with permission by photographer © wdterp

Figure 61: Taeger, O. (2013) *02 tall grass prairie in August (Blue*

Mounds, MN) [Photograph]. Available: <https://www.flickr.com/photos/40853856@N03/9592998938/in/faves-192779541@N02/> [2021-08-10]

Figure 62: wdterp (2018) *Prairie Wildflowers* [Photograph]. Available: <https://www.flickr.com/photos/wdterp/29764139548/in/faves-192779541@N02/> [2021-09-06] Used with permission by photographer © wdterp

Figure 63: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 64: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 65: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 66: Holmberg, H. *Visualization Ulvundaplan* (2021) [Illustration]. The picture is made using illustrations, photos by the author as well as stock imagery from Pixabay. It is made digitally using Affinity designer and Affinity Photo. © Hanna Holmberg

Figure 67: Holmberg, H. *Plantmix* (2021) [Illustration]. Made using Affinity designer © Hanna Holmberg

Figure 68: Holmberg, H. *Plantmix* (2021) [Illustration]. Made using Affinity designer © Hanna Holmberg

Figure 69: Holmberg, H. *Plantmix* (2021) [Illustration]. Made using Affinity designer © Hanna Holmberg

Figure 70: *Plantmix* (2021) [Illustration]. Made using Affinity designer © Hanna Holmberg

Figure 71: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 72: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 73: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 74: Holmberg, H (2021) *Brommaplan site specifics* [Illustration/Cartographic material]. The analysis is built on a aerial photo from Eniro using Affinity photo and Affinity designer.
Brommaplan. Areal photo [Cartographic material] Available: <https://kartor.eniro.se/?c=59.338628,17.937670&z=15&l=aerial&q=%22Brommaplan,%20BROMMA%22;207713246;geo> © Lantmäteriet/VISMA [2021-05-18]

Figure 75: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 76: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 77: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 78: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 79: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 80: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 81: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 82: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 83: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 84: Holmberg, H. (2021) [Photograph]. © Hanna Holmberg

Figure 85: Holmberg, H (2021) *Brommaplan overview* [Illustration/Cartographic material]. The illustration is built on a aerial photo from Eniro using Affinity photo and Affinity designer.
Brommaplan. Areal photo [Cartographic material] Available: <https://kartor.eniro.se/?c=59.338628,17.937670&z=15&l=aerial&q=%22Brommaplan,%20BROMMA%22;207713246;geo> © Lantmäteriet/VISMA [2021-05-18]

Figure 86: Jacobsen, A. (1982) *Kjesarkrona* [Wallpaper]. Available: <https://www.borastapeter.com/tapeter/arne-jacobsen-kejsarkrona-1982> [2021-08-05] Used with permission by Boråstapeter © Boråstapeter

Figure 87: Oudolf, P. (2014) *Vlinderhof Planting Plan* [Illustration]. Available: <https://en.vlinderhof.com/> [2021-08-05] Used with permission by Marc Kikkert at Vlinderhof © Piet Oudolf

Figure 88: Kalmar tapetfabrik (195X) *VINTAGETAPET W-5791* [Wallpaper]. Available: <https://www.tapetorama.se/vintagetapeter/kalmar-nya-tapetfabrik/1950-talstapeter/1761-106-w-5791> [2021-08-05] Used with permission by Tapetorama © Tapetorama

Figure 89: Holmberg, H. (2021) [Illustration]. © Hanna Holmberg

Figure 90: Holmberg, H. *Moodboard* (2021) [Illustration]. The moodboard is created with a mix of illustrations, pictures see figure 86 and figure 87, stock imagery from Pixabay and Pexels in Affinity Publisher. © Hanna Holmberg

Publishing and archiving

Approved students' theses at SLU are published electronically. As a student, you have the copyright to your own work and need to approve the electronic publishing. If you check the box for YES, the full text (pdf file) and metadata will be visible and searchable online. If you check the box for NO, only the metadata and the abstract will be visible and searchable online. Nevertheless, when the document is uploaded it will still be archived as a digital file. If you are more than one author you all need to agree on a decision. Read about SLU's publishing agreement here: <https://www.slu.se/en/subweb/library/publish-and-analyse/register-and-publish/agreement-for-publishing/>.

YES, I/we hereby give permission to publish the present thesis in accordance with the SLU agreement regarding the transfer of the right to publish a work.

NO, I/we do not give permission to publish the present work. The work will still be archived and its metadata and abstract will be visible and searchable.