

YGGDRASIL

THE LIVING NORDIC CITY

**Implementing nature-based
solutions through the
3+30+300 principle**



Contents

Foreword	5
Summaries	7
1. Introduction	9
Introduction to Yggdrasil – The Living Nordic City	9
Goals and objectives	11
Challenges	13
Participating cities	13
Approach and methodology	15
2. The 3+30+300 principle – from concept to Nordic implementation	23
Introduction of the ‘t(h)rees principle’	23
Use of the 3+30+300 principle to date	26
Urban Forest Strategies and Master Plans – creating a strategy to reach the 3+30+300 principle	29
Focus on the quality of green spaces and trees	31
Opportunities and challenges with implementing 3+30+300	32
3+30+300 implementation in a Nordic setting – policies, practices, and opportunities	36
Making the health connection	39
Tree species diversity and 3+30+300 implementation	46
3. GIS-analysis of 3+30+300 status in Nordic cities	53
Methodology	53
Nordic Cities current adherence to the 3+30+300 principle	55
Gap analysis to pinpoint areas with less than 30% canopy cover	56
Socioeconomic perspectives on urban trees	77
Nordic dimensions of socioeconomic vulnerability and access to green space and trees	94
Comparison of tree cover data with climate-related parameters	97
Trees under future climate change scenarios – an analysis	104

4. Mapping of tree species diversity in Nordic cities	116
Species diversity in Nordic cities	116
Tree species distribution in the partnering cities	116
Distribution of tree species planted in Sweden in 2023	120
Exploration of impacts on climate adaptation, including biodiversity	124
5. Conclusions and recommendations	133
Overall project results	133
Recommendations	134
Key messages	139
Executive summary	141
Sammanfattning på svenska	147
Sammendrag på norsk	153
Yhteenveto suomeksi	159
Samantekt á íslensku	165
References	172
Appendix	185
A1. Method for GIS-analysis	185
A2. Workshop series – aims and key findings	190
About this publication	196

This publication is also available online in a web-accessible version at:
<https://pub.norden.org/temanord2025-520>



Photo 1. Treelined walk in Malmö, Sweden (photo by Clara Lind).

Foreword

Yggdrasil – The Living Nordic City (the Yggdrasil project in short), launched under the Nordic Council of Ministers' Vision 2030 initiative, set out to contribute toward making the Nordic Region the most sustainable and integrated region in the world. As part of the broader Nordic Cities Nature-Based Solutions Programme, Yggdrasil has aimed to strengthen the role of urban trees and green spaces in creating healthier, more climate-resilient cities. It emphasises the unique Nordic perspective, building upon our region's strong tradition of environmental stewardship and community-focused urban planning.

The current growing interest in urban trees and green spaces reflects a broader recognition of their vital role in addressing critical challenges such as public health, climate adaptation, and biodiversity loss. Cities and municipalities across the Nordic region are increasingly embracing nature-based solutions which harness the power of natural ecosystems to tackle urban challenges. The Yggdrasil project contributes to this movement by establishing a collaborative network of Nordic cities, where municipalities can share ideas, experiences, and strategies for incorporating trees and green spaces into urban environments.

At the heart of the project has been the evaluation and implementation of the 3+30+300 rule, a greening principle that has gained prominence since its introduction in early 2021. This guideline promotes a healthier urban environment by advocating that every resident should be able to see at least three mature trees from their home, live in a neighbourhood with no less than 30% tree canopy cover, and have access to a green space within 300 metres. For the first time, a Nordic assessment has been undertaken to see how well Nordic cities are fulfilling this principle and how it can be adapted to the distinct local contexts across the region and adapted more widely.

The project highlights the importance of evidence-based guidelines to support governance, planning, design and monitoring. Through its evaluation of the 3+30+300 principle Yggdrasil offers a nuanced approach that respects local conditions and needs. By integrating research with practical applications, the project provides Nordic cities with the tools they need to make strategic decisions about urban greening, climate adaptation, and public health. Obviously, the involvement of municipalities in this work is therefore crucial and we are very grateful to the participating Nordic cities, Bergen and Stavanger in Norway, Tampere and Turku in Finland, Malmö and Umeå in Sweden, Kolding and Holbæk in Denmark, and Reykjavik in Iceland, for their active contributions during the workshops, sharing of data and other information, and other contributions throughout the project.

We also would like to thank the members of our advisory board for their support and important advice: Ulrika Åkerlund (formerly Boverket, now Movium, Sweden), Matthew Browning (Clemson University, United States), Pernilla Johansson (Trädkontoret, formerly, e.g., chair of Sveriges Stadsträdgårdsmästare, Sweden), Kjell Nilsson (owner of Nilsson Landscape, formerly among other Director of Nordregio, Sweden), Ben Somers (professor, Catholic University of Leuven, Belgium), Jessica Svännel (Region of Gotland, Sweden). These members represent a wealth of experience in Nordic and international green space policy, practice, and research and they have given us valuable insights that have strengthened the whole project. We are also grateful to Karin Sandberg, County Board (Länsstyrelsen) of Västmanland for her review of tree biodiversity aspects of this project.

As we move forward, the lessons learned from Yggdrasil will serve as a foundation for future projects and initiatives, fostering greater cooperation among Nordic cities and reinforcing the region's leadership in sustainable urban development. Through the collective efforts of policymakers, researchers, practitioners, and local communities, the Yggdrasil project will help create greener, healthier, and more resilient cities across the Nordic region.

The Yggdrasil project team



[Summary in English](#)

[Sammanfattning på svenska](#)

[Sammendrag på norsk](#)

[Yhteenveto suomeksi](#)

[Samantekt á íslensku](#)

Photo 20. Autumn colours in the tree canopy (photo by Jenny Hansen).



Photo 2. Winter river landscape in Tampere, Finland (photo by Eva Bronzini, Pexels).

1. Introduction

Introduction to Yggdrasil – The Living Nordic City

This report presents findings from the project 'Yggdrasil – The Living Nordic City', part of the larger Nordic Cities Nature-Based Solutions Programme which aims to contribute to achieving Vision 2030 – making the Nordic Region the most sustainable and integrated region in the world. Focused on promoting nature-based solutions in cities and municipalities across the Nordic region, the project centres on the 3+30+300 principle, which is a rule of thumb for urban trees and greening, emphasising biodiversity, climate adaptation, and public health. The 3+30+300 principle provides clear criteria for the minimum provision of urban trees in our urban communities: all citizens shall be able to see 3 large trees from their home; there should be at least 30 percent tree canopy cover in every neighbourhood; and nobody should live more than 300 metres from the nearest high-quality, publicly accessible park or other green space (Konijnendijk, 2022; 330300rule.com, 2024).

This project aims to evaluate the 3+30+300 principle's effectiveness in enhancing biological diversity, climate resilience, and public health in the Nordic Region, with a specific focus on native tree species. A key objective has been to establish a collaborative network among Nordic cities, fostering and supporting 3+30+300 implementation and the preservation and expansion of local tree populations. This collaboration is integral to achieving the overarching goals of Vision 2030, contributing to the region's sustainability and resilience.

The report is a collaborative effort financed by the Nordic Council of Ministers involving a team of partners and experts shown in Table 1. The partnership involves key 3+30+300 expertise (including the organisation that launched this principle) as well as leading experience related to urban forestry, nature-based solutions, urban ecology, and the health benefits of urban green space. The project period spanned from April 2024 through January 2025.

Table 1. *The Yggdrasil project team.*

Country	Company/Institution	People
Sweden	Trädkontoret (The Tree Office)	Clara Lind Johan Östberg Gustav Nässlander Gustaf Viita Adamsson Kalle Ågren
	Ekologigruppen AB	Hélène Littke Emanuel Vogel Wösel Thoresen Anna Maria Larson Ellinor Scharin
	County Administrative Board of Västmanlands län	Karin Sandberg
	Lund University	Anna Oudin
Global/Sweden and The Netherlands	The Nature Based Solution Institute (NBSI)	Cecil Konijnendijk
Denmark	Copenhagen University	Oliver Bühler
Norway	Trekontoret AS (The Tree Office)	Hanne Johnsrud
The Netherlands	Cobra Groeninzicht	Dirk Voets Petra Schoon

Brief overview of the report

This report first presents the project's objectives and scope, network, methodology, and activities. Next, it discusses the 3+30+300 principle, its background, and promising ways of implementing it - for example through specific policies and plans. The report then introduces a comprehensive GIS-analysis of the entire region and selected Nordic cities, with a specific focus on the 3+30+300 principle (current status and gap analysis), as well as post-analysis illustrating the potential transformation of these cities if the 3+30+300 principle were fully implemented. This work is also linked to socioeconomic and health aspects (central premises for use of the 3+30+300 principle), highlighting the impacts of for example climate change on vulnerable communities. The report also includes a mapping of tree species analysing the proportion of native and exotic species, coordinated with the NordGen's work on crop-wild relatives. An analysis is provided of the impact of climate change on the suitability of different tree species, both native and exotic,

for continued use in Nordic municipalities. The final part of the report presents conclusions and introduces recommendations and key messages for enhancing nature-based solutions and urban forestry in Nordic municipalities by means of the 3+30+300 principle.

As an appendix to the report there is the method for the GIS-analysis (see [Appendix A1](#)) and the agenda and summary of the workshop series (see [Appendix A2](#)) that was conducted as part of the project to bring the municipalities together to discuss implementations and challenges with the 3+30+300 principle.

It should be noted that some of the project's results and outputs are not (fully) covered in this report, including the 3+30+300 handbook and various communication materials. These will all be based on project findings presented in the report, however. Moreover, one of the three project workshops was to be held after project conclusion.

Goals and objectives

The Yggdrasil project has intended to promote and support nature-based solutions in Nordic cities, by means of a specific tool: the 3+30+300 principle. It set out to contribute to making the case for more resilient and healthy cities with more nature-based solutions that promote biodiversity, climate action, and public health in ways that serve all Nordic residents, and not in the least vulnerable populations.

The project aims are to:

- Evaluate the 3+30+300 principle's effectiveness in enhancing public health, climate change, and biological diversity, with a specific focus on native tree species.
- Guide the Nordic countries in their implementation of the Kunming-Montreal Global Biodiversity Framework Target 12 on green cities (Target 12 (cbd.int)) and support their work on Targets 8 and 11 on climate change, nature-based solutions and ecosystem services.
- Establish a collaborative network among Nordic cities, fostering the preservation and expansion of local tree populations.
- In countries where the 3+30+300 principle might not be relevant to implement (e.g. Faroe Islands, Iceland, and Greenland) due to lack of native tree species and the difficulty to reach high tree canopy levels, the aim is to assess realistic steps towards 3+30+300 and recommend alternative ways of urban greening based e.g., on native vegetation.

Project deliverables and outputs were designed to enhance and drive the implementation of the 3+30+300 principle across the Nordic Region, aiming for sustainable and greener cities. Key products include 3+30+300 maps and analyses for Nordic municipalities; a practical guide for implementation (a 'handbook'); communication materials to support 3+30+300 implementation for achieving health, climate, and biodiversity benefits; mapping of tree species for biodiversity preservation; collaboration forums for knowledge exchange and networking; and policy and other recommendations. Multilingual reports and materials will facilitate widespread dissemination, engaging policymakers and the public alike. Ultimately, these efforts seek to involve the entire Nordic region in the green transition, bridging societal gaps and fostering environmental cooperation.

Yggdrasil will form a Nordic base on which further analysis can be built and through that work high level strategic and management decisions can be made, tailored to the individual cities (Figure 1). For cities to succeed in this goal a key aspect has been to include the participating cities in the analysis, interpretation, and the recommendations that have been formulated within the project. This is done through the workshop series (see [Appendix A2](#)).

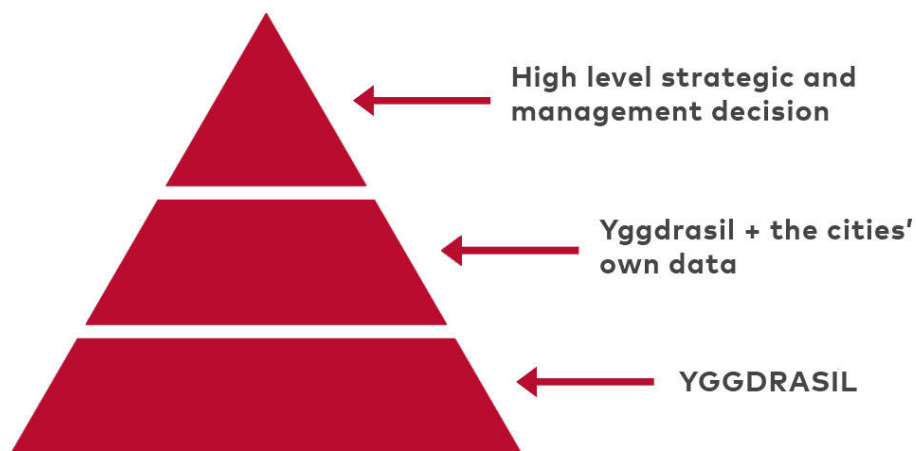


Figure 1. *Yggdrasil as a Nordic base on which further analysis and high-level decisions can be built.*

Project findings have been used to make recommendations on how Nordic cities can create greener and healthier cities with focus on several different aspects, e.g. biodiversity, and the physical, psychological, and social health of the inhabitants. Additionally, the project strives to connect the 3+30+300 principle to the wider urban greening and nature-based solution implementation in Nordic cities, in order to contribute to public health promotion (a key focus of this project), climate adaptation, and biodiversity conservation.

Challenges

Since its launch in February 2021, the 3+30+300 principle has been implemented by many municipalities in the Nordic Region and across the world. Based on previous work and experience so far, it is clear that the principle is powerful and widely applicable. With its emphasis on bringing trees and greenspace, and their benefits to every resident, the principle also adheres to important Nordic values, such as closeness to nature and focus on social equity. There is however a major risk of falling into the 'one-method-fits-none' trap, meaning that a single method or approach risks losing important information that already exists within the city and that it also will lose the depth needed to create a flexible framework that is adapted to local conditions and challenges. This project is therefore an important opportunity for a nuanced implementation of the principle, jointly with other guidance and tools, and building on the cities' needs and data, thereby lifting the decision higher.

Important questions to be answered include:

- How can the 3+30+300 principle be used for the implementation of key policy aims, from the Global Sustainable Development Goals to city-specific climate, health, biodiversity, and other targets?
- What is the best use of the principle in combination with other guidance and tools, for the implementation of different types of nature-based solutions related to biodiversity, climate adaptation, and health?
- What are some of the challenges and pitfalls that need to be addressed?

Participating cities

The partnering cities within the Yggdrasil municipalities network have included Malmö (Sweden), Umeå (Sweden), Stavanger (Norway), Bergen (Norway), Kolding (Denmark), Holbæk (Denmark), Turku (Finland), Tampere (Finland), and Reykjavik (Iceland), as listed in Table 2. To create a balance between countries up to two cities per country were engaged in the project. The decision was taken to exclude the capitals of the Nordic countries, mostly due to the fact that capitals often are not representable for the population of cities in a country, as they e.g. often have more data, different strategic levels and are larger. We have however included one exemption, Reykjavik, due to the fact that this city alone houses about 60% of Iceland's population.

All participating cities were, as a minimum, willing to work with the 3+30+300 principle and to participate in two half-day digital workshops and one optional

full-day, in-person event. For the workshops, the participating cities were encouraged to have both green space and planning expertise represented.

Table 2. Participating cities and why they were chosen to be a part of the project.

Participating cities	Country	Motives for selection
Holbæk	Denmark	Long standing work with urban trees and green spaces. Ongoing use of 3+30+300 in architectural and biodiversity strategies.
Kolding	Denmark	Has recently presented the 3+30+300 principle to politicians who are eager to get more information to thereby be able to formulate policies.
Turku/Åbo	Finland	Access to a full inventory of park and street trees. 3+30+300 could be a good planning tool, e.g., when redeveloping former industrial areas into residential ones.
Tampere/ Tammerfors	Finland	Access to a full inventory of park and street trees. Long-standing urban tree management tradition. Importance of seasonal use of green space.
Reykjavik	Iceland	Access to inventory of street trees and also a more challenging city due to the local climate. Issue of both native and non-native tree species, of particular importance in Iceland because of the limited range of native trees and specific growing conditions.
Stavanger	Norway	Have started to use 3+30+300 in green space planning and area analysis and redevelopment in particular. Stavanger has a partial tree inventory and tree canopy assessment.
Bergen	Norway	Access to a full inventory of park and street trees. The colder climate poses specific challenges.
Malmö	Sweden	Has a political decision to work with the 3+30+300 principle and has gained several years of experience with implementing the principle, including assessments of the current state and potential. Malmö is also part of the 3+30+300 analysis for Skåne. Long-standing work with urban green spaces and access to a full inventory of park and street trees. Malmö is a southern city with a high focus on non-native species.
Umeå	Sweden	Long-standing work with urban green spaces. Access to a full inventory of park and street trees. Represents a northern city with both native and non-native species. Has shown interest in the 3+30+300 principle.

Approach and methodology

Project activities and implementation

The Yggdrasil project was structured into nine specific tasks that all contributed to the different objectives of the project. Below is an overview of all the tasks with their respective methodology, and contributions to the project objectives.

Task 1 – Project management

The task: Managing the project from start to delivery, which included coordinating with the working group, cities, and the Nordic Council of Ministers.

Summary of method: Regular project meetings were held and an agreed Gantt chart used as a critical project management tool, ensuring that the project stayed on track, and when deviations occurred their impact on the project was assessed. The project management team also welcomed input from the Nordic Council of Ministers, the participating cities, and an external reference group, ensuring these important partners received the information they needed at the correct time. Relevant and structured meetings were held between the different partners and stakeholders involved in the project, including monthly steering group meetings. To address the challenges of meeting an ever-changing climate and at the same time promote biodiversity a think tank was conducted where participants and experts from Trädkontoret and Ekologigruppen got together to discuss.

Contribution to the objectives: Providing the conditions for overall project success, by coordinating and monitoring project progress and fostering collaboration between project partners, the participating cities, and the external advisory board.

Task 2 – Create a network

The task: Establish a broad network of tree-focused cities, across Nordic countries, willing to experiment with the 3+30+300 principle and to collaborate to preserve and increase the proportion of local native trees and share knowledge, which was essential for the whole project. The participating cities had to be prepared to work with the Yggdrasil project through network meetings and workshops. An important part of establishing the city network was to obtain their feedback on the work that the project group conducted and ensure that the recommendations presented were relevant to their specific challenges.

Summary of method: The network was put together mostly through the project group's existing network, as members of the project team have a large network of municipal experts and have already been working with over 70 cities in the Nordic region. The knowledge and participation from the partnering cities was collected through workshops, as well as by regular communication. Two 4-hour digital workshops and one voluntary full-day in-person workshop were set up for project duration (in September and November 2024, respectively February 2025 after

project completion). Material was sent to participants before the workshops, and they were tasked with helping the working group formulate recommendations and further analysis. See Appendix 2 for workshop agendas and summaries of key findings.

Contribution to the objectives: Creating a network of Nordic cities together will enhance and drive the implementation of the 3+30+300 principle across the Nordic region, as municipalities are key actors when it comes to urban forestry and implementation of nature-based solutions. To get input from representatives from actual cities working with trees ensured that the work did not end up in the 'one-method-fits-none' trap, meaning trying to apply a single, standardised method or solution to all situations, without considering the specific needs, contexts, or variables that may differ across different cases. Considerable focus was therefore placed on the workshops where the participants strengthened the project and made the result adaptable to local conditions and challenges.

Task 3 – GIS Analysis

The task: This task entailed conducting GIS analyses of multiple Nordic cities, focusing on the 3+30+300 principle. Initial steps involved mapping each city's adherence to the principle, followed by a gap analysis to identify areas lacking sufficient canopy cover.

Summary of method: A comprehensive methodology is detailed in [chapter 3](#) and [Appendix A1](#). Here, we provide a concise overview of the additional GIS analysis.

- **A socioeconomic and environmental analysis** focused on evaluating how vulnerable populations were affected by current green space distributions and exploring how the 3+30+300 principle could mitigate these disparities.
Method: The analysis was conducted by comparing 3+30+300 findings with available data on noise levels, air quality, and climate risks. The project aimed to understand the impact of green space on mitigating urban environmental issues and improving climate resilience. An environmental justice perspective was applied to ensure equitable access to green spaces. Vulnerable areas with socioeconomic challenges were identified in the nine participating cities and analysed in relation to the 3+30+300 principle. Results were presented in maps and text in the final report, with relevant research informing policy recommendations.
- **Comparison of tree cover data with climate-related parameters** focused on delivering data that illustrates the correlation between tree cover on the one hand, and climate change scenarios, heat stress, and noise pollution on the other.
Method: The methodology used was based on climate data and tree canopy data from participating cities, enabling two analyses: one on the correlation

between heatmap data and tree cover, and another on the relationship between noise pollution and tree cover. Malmö was selected for the noise pollution analysis due to its comprehensive data, providing a foundation for assessing how tree cover affects noise levels in urban environments.

- **Post analysis** focused on creating scenarios derived from IPCC climate predictions to evaluate the risks of heat stress and the suitability of tree habitats in participating cities.

Method: The methodology was based on climate change predictions from the IPCC, identifying urban areas at risk for heat stress both currently and projected for 2090. This analysis allows for the identification of "effective desert zones" within cities, which, while uncommon in the Nordic region, highlight potential vulnerabilities. Additionally, the methodology assesses areas that are currently too cold but are expected to become "tree-friendly" by 2090, facilitating targeted urban greening efforts.

Contribution to the objectives: The GIS analysis played a crucial role in achieving the project's objectives by providing spatial insights and data visualisation that helped in understanding and mapping the geographical distribution of key variables, such as tree cover, biodiversity, and ecosystem services. The approach ensured that the Yggdrasil project provided actionable insights and practical recommendations for creating more climate-adaptive and socially equitable urban environments across the Nordic region. Findings are intended to guide future urban planning and policy development.

Task 4 – Mapping of tree species

The task: Conduct detailed mapping of tree species in urban areas, focusing on identifying the proportion of native and exotic species in each city, incorporating an assessment of the proportion of native and exotic species. This aimed to better understand biodiversity and how urban forests contribute to climate resilience.

Summary of method: GIS technology was used to map the tree species distribution within five of the participating cities, collecting spatial data on both native and exotic species (native to the Nordic countries, not to the specific country). The cities that provided data were Malmö, Umeå, Stavanger, Bergen, and Kolding. This allowed for an in-depth analysis of tree diversity and its correlation with urban biodiversity goals. The task also looked at the number of trees surveyed per capita in the participating cities. To determine the population in the cities data from Wikipedia was collected choosing the number referred to under population "City" or "Urban" regarding what information was available.

Data was collected from four of the largest tree nurseries in Sweden to assess what is being planted in urban areas in Sweden, as a case study to inform the wider Nordic nursery situation. The data is however not publicly available due to the fact

that it contains sensitive and/or confidential information about the participating nursery businesses. All of the participating nurseries are wholesale nurseries, and most of their sold trees end up on public land or shared properties such as housing areas. The tree nurseries supplied the project with their turnover in terms of the amount of sold single stem trees of each species for 2023. No shrubs, young trees (also known as whips) or multi stem trees were incorporated in the data. The turnover also included trees sold to other nurseries, so a slight double-representation of some trees might occur. When interviewing nursery staff regarding this issue they informed that most trees sold to other nurseries were native trees, explaining why the amount of native trees being planted might be slightly lower than presented in the results. The project team considers these results and resulting recommendations as indicative for the wider Nordic nursery production situation.

Contribution to the objectives: Mapping tree species helped quantify biodiversity (and more specifically tree diversity) and identify gaps in native species presence. This data allowed for informed decisions on how to enhance urban greenery in line with the 3+30+300 principle and contributed to promoting native species in urban planning.

Task 5 – Coordination with NordGen

The task: Coordinate and collaborate with NordGen on their work related to crop-wild relatives in urban areas, part of Project 5 in the Nordic Nature-Based Solutions (NBS) program.

Summary of method: A meeting with the coordinator for NordGen was held early in the project to discuss possible areas for collaboration and information about the Yggdrasil project was circulated in the NordGen coordination group. Yggdrasil's focus is in urban areas and trees and NordGen's focus is more broadly geographically and connected food security, and as a result overlap between the projects is mostly connected to questions of a changing climate and its effects on climate zones as well as a general discussion on introduction of plants. Results and suggestions for recommendations for native and exotic tree species were available to NordGen for review and subsequent feedback on especially the recommendations was used during report revision.

Contribution to the objectives: The collaboration with NordGen enriched Yggdrasil policy recommendations connected to use of different tree species, native and exotic/introduced. Adding the expertise of genetics and connection to food security from NordGen creates an additional layer of completeness and contextualisation when prioritising species for improved ecosystem services and climate resilience.

Task 6 – Reporting

The task: Prepare a report that provides specific recommendations customised for urban nature-based solutions (NBS) and 3+30+300 principle in the Nordic region, with a particular emphasis on the use of native tree species within city environments. The task also included translating the report into two Nordic languages (Swedish and Norwegian) with additional summary in Finnish and Icelandic.

As an addition to the report the project group tasked themselves with creating a handbook answering common questions about the 3+30+300 principle and offering a step-by-step approach to implementing the principle. The target group for the handbook was those working for Nordic municipalities as well as other Nordic actors involved in the planning, design, and management of urban green spaces and city planning. The aim of the handbook was to equip them with the knowledge and tools needed to effectively implement the 3+30+300 principle, as well as helping them navigate frequently encountered challenges and ways to deal with these.

Summary of method: The report compiled data from the different project tasks, including review of literature and reports, policy analysis, city analyses, tree species mapping, and input from stakeholders. It was translated into Swedish and Norwegian, with additional summaries in Finnish and Icelandic to ensure wide accessibility within the Nordic region. The handbook was built upon previous experiences with implementing the 3+30+300 principle in different contexts as well as the findings from the workshop series with the participating cities. In the workshops, insights from practical experiences from the cities were discussed and compiled.

Contribution to the objectives: The report provides actionable recommendations for Nordic municipalities to integrate the 3+30+300 principle, particularly promoting native species in urban planning. By offering translations, the report enhanced its reach and applicability across the Nordic region. The handbook will serve as a practical tool for city administrations and other actors to navigate the complexities of the 3+30+300 principle and urban NBS implementation more broadly.

Task 7 – Policies

The task: Develop policies supporting the integration of nature-based solutions (NBS) through the 3+30+300 principle. Prepare communication material to support policy development and implementation.

Summary of method: Existing policies and initiatives across Nordic cities as well as from cities and countries in other parts of the world were reviewed to identify areas where NBS could be integrated by use of the 3+30+300 principle. Based on this compilation and analysis, guidance was offered through project recommendations and in a handbook on incorporating the 3+30+300 principle into urban and green space planning, design, and management. Communication materials were prepared to facilitate stakeholder engagement and policy adoption, including policy briefs and infographics.

Contribution to the objectives: The development of tailored policy and planning recommendations enables cities to systematically integrate NBS and more specifically, the 3+30+300 principle into their planning processes. These recommendations and their implementation can result in increased tree and green space cover, better accessibility of residents to trees and green, and in this way contributing directly to biodiversity, climate resilience, and public well-being.

Task 8 – Communication plan

The task: Develop communication materials to raise awareness and engage stakeholders in the project's objectives, including podcasts, posters, and a short video. Translate materials into English, Finnish, Icelandic, Swedish, and Norwegian.

Summary of method: A multimedia communication strategy was designed to ensure project visibility and engagement. Activities included a special podcast episode on Yggdrasil produced in Ekologigruppen's established podcast Artpodden, in collaboration with another well-established podcast series (Trädpodden), discussing the challenges and successes of implementing urban nature-based solutions, while posters visually communicate key data and findings. A short film was produced to highlight the importance of urban trees and the 3+30+300 principle, adding an easily accessible complement to the report and handbook. An after-work event was held in Stockholm (in conjunction with the 2nd workshop) for a group of regional urban greening stakeholders.

Contribution to the objectives: The communication plan broadened the project's outreach, ensuring stakeholders across various levels understood the project's aims. By offering translated materials, it further supported the dissemination of the 3+30+300 principle, promoting broader and more successful adoption across Nordic cities.

Task 9 – Reference group

The task: Establish a reference group to provide feedback on methodologies, results, and recommendations throughout the project.

Summary of method: An expert reference group was set up during the early stages of the project. This group was composed of representatives from Nordic cities, research institutions, and green space policy experts. Regular meetings and online discussions were held to review progress, with the group providing feedback on interim findings and final recommendations. Members of the reference group also participated in the project workshops. This ensured the project remained aligned with urban planning realities and could adapt to the specific needs of municipal administrations and other actors.

Members of the reference group were:

- Dr Ulrika Åkerlund, landscape architect at the Swedish National Board of Housing, Building and Planning and coordinator for children and youth issues at Movium, Sweden.
- Dr Matthew Browning, co-director of the Virtual Reality & Nature lab, Clemson University, South Carolina, United States.
- Pernilla Johansson, urban forest consultant and former Regional Gardener of Gotland, Sweden.
- Dr Kjell Nilsson, green space planning expert and former research director, as well as Director of Nordregio, Sweden/international.
- Professor Dr Ben Somers, Faculty of Bioscience Engineering, Catholic University Leuven, Belgium.
- Jessica Svännel, Regional Architect of Gotland, Sweden.

Contribution to the objectives: The reference group played a critical role in refining the project's direction and ensuring that recommendations were relevant, practical, and actionable. Their feedback contributed to the robustness of the final report, the value of the handbook, and the alignment of the project with the real-world challenges faced by Nordic and other municipalities in implementing the 3+30+300 principle.



Photo 3. City of Reykjavik (photo by Héloïse Delbos/Unsplash).

2. The 3+30+300 principle – from concept to Nordic implementation

Introduction of the 't(h)rees principle'

Urban forests, comprising all woodland, trees, and associated vegetation in urban areas, serve as critical components of cities globally, enriching the quality of life for inhabitants amidst contemporary challenges such as climate change and public health crises such as the recent COVID-19 pandemic (Konijnendijk, 2022).

Recognizing the growing importance of urban trees and green spaces, there is a pressing need for standardised, evidence-based guidelines to navigate the complexities of urban forestry and support urban governance, planning, design, and monitoring. Professionals engaged in advising municipalities, regional and national authorities, as well as international organisations on urban greening initiatives, including the members of the Yggdrasil project team, are often asked for advice on these matters and for proposing clear guidelines.

Historically, the diverse nature of urban landscapes has posed challenges in establishing universal benchmarks for urban green infrastructure and urban forests. However, the evolving landscape of research and practice, coupled with the increasing demand for guidance from policymakers, necessitates a reassessment of traditional approaches. The body of knowledge on the health, climate, and other benefits of urban forests and other green space has grown rapidly, which provides a strong foundation for evidence-based planning and design guidelines. Research has shown as well that to obtain the benefits of trees and other vegetation it is essential that all people have good access and are well exposed to trees and green space. Everybody needs to have trees and green space nearby so that benefits are easy to obtain. Based on this, Cecil Konijnendijk of NBSI, a member of the Yggdrasil project team, proposed a new guiding principle for developing greener and healthier cities during February 2021: the so-called 3+30+300 rule (Konijnendijk, 2022; 330300rule.com, 2024), sometimes referred to as the 'trees rule' or 'threes rule'.

The 3+30+300 rule or (as in this report) principle encapsulates the multifaceted considerations essential for developing a resilient and multifunctional urban forest while offering a practical framework that is both implementable and easily monitored. It combines the respective contributions of visual green, living area green, and recreational green. The rule has three components that reflect these.

In brief the principle stipulates that everybody should:

- See at least **3** large trees from where they live, work, learn, or are cared for.
- Live in a neighbourhood with at least **30%** tree canopy cover.
- Walk or bike no more than **300** metres to get to the nearest high-quality public green space of at least 0.5–1.0 ha.

Some more information about these three components is provided below and they are illustrated in Figs. 2, 3, and 4. For references and underlying research see Konijnendijk (2022). For a more in-depth discussion of the health benefits of urban forests see the dedicated section below.

Three Trees from Every Home: Especially more recent research underscores the importance of visible nearby greenery for mental health and well-being. Studies have shown that patients in hospitals recover faster when they have a 'green' view. Pupils and students at schools and universities demonstrate better study results when they are able to see green from their classrooms (see health-section for references). During the COVID19-pandemic, for example, many people locked down in their homes were dependent on trees and green around their home for a daily 'nature dose'. Trees in particular seem to be appreciated. Therefore, as a proxy for visible and diverse green, we should all be able to have a view of at least three mature, larger-sized trees from our residence, workplace, school, or place of care. Initiatives such as the tree policy in the Danish municipality of Frederiksberg (calling for all residents to see at least one tree from their home (Frederiksberg Kommune, 2018)) serve as examples to advocate for expansive approaches to ensure adequate green coverage in urban neighbourhoods.



Figure 2. The 3-component: three larger-sized trees from a residence, school, workplace, or place of care (illustration Ellinor Scharin, Ekologigruppen).

Thirty Percent Tree Canopy Cover in Every Neighbourhood: Urban tree canopy cover provides various benefits, including temperature regulation and a range of health benefits. In fact studies have consistently shown that people living in neighbourhoods with higher canopy covers are healthier and happier, even when controlling for confounding factors such as income and cultural background. There are indicators that a minimum canopy level of about 30% is required. Cities like Barcelona, Bristol, and Vancouver have set a 30% canopy cover. This target serves as a baseline, with cities encouraged to strive for higher canopy cover whenever feasible. It is important, however, to ensure that everybody in cities and towns lives in 30% canopy neighbourhoods, rather than just striving for a city average. Only in this way can environmental justice and tree equity considerations be met.



Figure 3. *The 30-component: thirty percent canopy cover in every neighbourhood (illustration Ellinor Scharin, Ekologigruppen).*

Three Hundred Metres from the Nearest Park or Green Space: Access to high-quality green spaces within close proximity is vital for promoting recreational activities and enhancing well-being. Organisations such as the World Health Organization have called for everyone to have a park or other public green space of at least 0.5–1 ha within 300 metres from their home (WHO Regional Office for Europe, 2017). Efforts must be directed towards ensuring equitable access to green spaces across different urban typologies. Innovative solutions, such as linear green spaces serving as cycle corridors, can effectively bridge the gap between urban dwellers and nature. In recognition of the importance of smaller green spaces and the realities of often dense urban areas, the 3+30+300 principle works with a minimum green space size of 0.5 ha, within a 300-metre walk or bike ride.



Figure 4. The 300-component: no more than three hundred metres to nearest, high-quality and publicly accessible green space (illustration Ellinor Scharin, Ekologigruppen).

Use of the 3+30+300 principle to date

Since its launch the principle has rapidly gained traction across the world, inspiring and being adopted by international organisations, city and regional governments, not-for-profits, researchers, and citizen groups. It has also seen considerable interest from 'non-green' professions, such as planning, architecture, engineering, and medicine. Its use to date has ranged from research studies to integration in green space strategies and even city master plans.

Research and assessment

Various researchers, students, and companies have made the principle 'measurable' and have assessed the current 3+30+300-situation in neighbourhoods, cities, and metropolitan areas around the globe (see for example, 330300rule.com/330300-in-the-media). Prior to the 3+30+300 assessments of Nordic municipalities by the Yggdrasil team, Nordic examples of assessments have included, among other, those for selected cities in Region Scania (Region Skåne, 2023) and the work done for Gothenburg (Daland, 2023).

A comprehensive study by Willems et al. at the Catholic University of Leuven, Belgium assessed the scientific support for the three components of the principle and concluded that there is sufficient evidence for recommending 3+30+300 as a green norm or principle (Willems et al., 2023). Studies by, among others, Nieuwenhuijsen et al. (2022) and Li et al. (2024) have provided further support to the (mental) health promoting impacts of implementing 3+30+300.

As there is no single, prescriptive way of assessing the three components, different approaches have been developed, as also summarised by Browning et al. (2024). The 30 and 300 components are relatively straightforward to assess using satellite imagery and GIS, although decisions and assumptions are required on how to define 'neighbourhood' for the 30-component and what a high-quality public green space entails for the 300-part. The 3-component is more challenging, as it will be difficult to find out how many larger trees are actually visible from individual homes, offices, schools, and places of care.

Expressing political ambition and political adoption of green norms

The rule and its 'stickiness' have led to interest from political parties and individual politicians. During local, regional, and national elections in countries like Belgium, France, Greece, Sweden, and The Netherlands, for example, several parties across the political spectrum included the principle in their national and local election programs. Political parties have also proposed the principle locally as an evidence-based, visionary way to green cities, adapt cities to climate change, and contribute to residents' health. In The Netherlands, the rule has featured in ongoing discussions about adopting a national 'green norm' which would set a minimum requirement for urban green space in municipalities (Sweco, 2024). In Flanders, Belgium, the principle has been adopted as a new regional green norm as well as a norm within the region's strategy for climate change and human health (Agentschap Natuur & Bos, 2024). Cities like Malmö have seen city councils formally adopt 3+30+300 (Malmö Stad, 2023).

Inclusion in green space and other strategies and policies

The principle has been integrated in policies and strategies focused on, among other, green space, green infrastructure, and/or urban forests and trees; climate action; public health; biodiversity and nature conservation; and building and architecture strategies. In countries like Sweden and The Netherlands, this has happened widely, while in other countries some cities have taken the lead. In the case of Swedish cities like Malmö and Kalmar, local political commitment has even resulted in inclusion of the rule in city comprehensive plans ('översiktsplaner'), driving an ambitious and balanced greening program. There are different ways of including the principle in policies, plans, and strategies, including as:

- Part of an overall vision.
- A policy objective or target, either for an entire municipality or for specific areas or land-use types.
- A key performance indicator for monitoring the implementation of the respective policy or strategy.

- A guideline and tool, offering a sense of direction.
- An analysis tool to e.g., assess a current situation, for the entire municipality, region, or country, or for specific neighbourhoods or areas.
- As a way of communicating the benefits of trees and green space.

The 330300rule.com (2024) website includes a special page with examples of national, regional, and local governments in the Nordic countries and elsewhere that have adopted the rule (330300rule.com/implementation). Links to specific strategies and plans are also provided here.

In some cases, local adaptations of the principle have been made, for example replacing 30% tree canopy cover with 30% green space. Sometimes this is a pragmatic choice, as 30% canopy cover is seen as unachievable. In other cases, a shift to combined trees and other vegetation cover is more grounded in the literature on e.g., health benefits (for example, Agentschap Natuur & Bos, 2024).

The use of urban forest strategies and master plans for implementing 3+30+300 will be discussed in one of the following sections.

Use for urban (re-)development

There has also been an interest in the rule from private developers and builders, for example in The Netherlands and Sweden. Being faced with a demand for developing more climate adapted, healthier, and greener neighbourhoods, they see the 3+30+300-rule as a promising and 'operationable' tool. Some of the developers have prepared plans for '3+30+300-neighbourhoods', such as the Cartesius district in the Dutch city of Utrecht (Cartesius, 2024) and the Jägersro district in Malmö (Jägersro, 2023). The three rule will not only be applicable to new developments but also urban renewal projects. In The Netherlands, a guidance document for nature-inclusive building for healthy residents includes the 3+30+300 principle as one of ten recommendations for development, building, and construction (KAN, 2023).

Use for awareness raising and activism

Not-for-profits and citizen groups have also started using the rule, often as a tool for advocacy. Local groups have assessed the 3+30+300 status of their city or neighbourhood, encouraging individual residents to e.g., share photos of their views or streets on social media. A citizen group in the Australian town of Mount Pleasant, for example, used the principle to advocate for a new local park. Environmental groups have also called upon political parties to integrate the principle in urban and new housing policies. The principle is easy to use and comprehend, also for non-experts, and it focuses on trees and nature in people's own streets and neighbourhoods, which helps with its popularity.



Photo 4. Street scene without much green from Copenhagen, Denmark (photo by Yadid Levy/norden.org).

Urban Forest Strategies and Master Plans – creating a strategy to reach the 3+30+300 principle

As mentioned, the 3+30+300 principle can be used in many different ways, including as part of strategies and policies at municipal and other levels. One promising way of using the principle is to include it in comprehensive urban forest master plans and strategies, as the examples from Belfast and Birmingham in the United Kingdom show (Belfast City Council, 2024; Birmingham Tree People, 2024).

Urban forest master plans are comprehensive documents that outline strategies and objectives for urban forestry within a city or municipality. These plans describe an 'ideal' state of a city's urban forests and the services it provides at some time in the future. These plans typically include goals and specific and measurable key performance indicators related to tree planting, maintenance, removal, and replacement, as well as strategies for addressing urban forestry challenges and opportunities. Urban tree master plans serve as guiding documents for city officials, arborists, urban planners, and community stakeholders involved in urban forest management. For a long-term, usually of several decades, they answer the key questions of 1) What do we have (inventory, assessment, policy analysis)?, 2)

What do we want (vision and objectives)?, 3) How do we get there (work plan with clear targets, indicators, resources, timeframes)?, and 4) When do we know we have arrived (monitoring)? For all of these questions, the 3+30+300 principle can play a role. Often urban forest master plans will include components or auxiliary documents such as tree planting guidelines, maintenance standards and protocols, community engagement plan, and a monitoring and evaluation plan.

Urban forest master plans have been widely adopted by cities around the world as a tool for enhancing urban forest management. And within them are clear goals towards achieving the 3+30+300 principle. Several cities around the world have integrated variations of the 3+30+300 rule into their urban forest master plans or similar strategies to enhance green space accessibility and canopy cover. The 3+30+300 website (330300rule.com, 2024, see 330300rule.com/implementation) lists examples of cities/regions that have used the rule in their planning. But the city in the world that has probably come the furthest in this respect is the city of Malmö, Sweden. Malmö, renowned for its commitment to sustainability and green urban planning, has taken a groundbreaking step in its journey towards creating a greener and more liveable city. In a landmark decision, the city has chosen to embrace the 3+30+300 principle as a cornerstone of its comprehensive plan (a strategic plan that governs future planning of the city, including buildings, roads, and parks), signalling a transformative shift in urban forest management and green space accessibility.

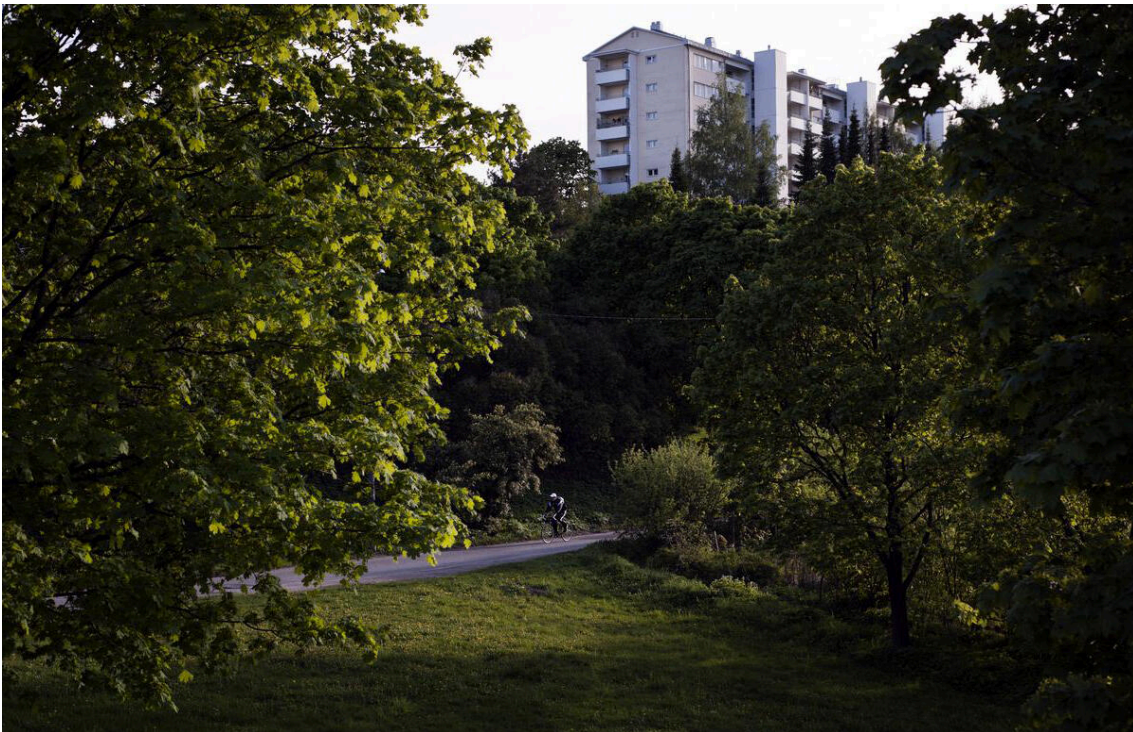


Photo 5. Cyclist in park in Finland (photo by Benjamin Suomela/norden.org).

Focus on the quality of green spaces and trees

The 3+30+300 principle focuses on more than quantitative aspects of urban green space, such as tree canopy cover. Strategies and master plans sometimes tend to focus heavily on quantitative measures such as canopy cover and minimum provision of a certain area of public green space per inhabitant or dwelling. However, in addition to this, the quality of green spaces is a crucial factor, for promoting health and well-being, biodiversity, and other benefits. High-quality green spaces provide opportunities for recreation, relaxation, and social interaction, contributing to physical and mental health outcomes for residents. Factors that influence the quality of green spaces include, among other, accessibility, biodiversity, variety, aesthetics, safety, and maintenance.

Cities should prioritise the creation and maintenance of high-quality green spaces that meet the diverse needs of urban populations, as also called for in the 300-component of the 3+30+300 principle. This includes designing parks, woodland, squares, and green corridors that are accessible to all residents, integrating native vegetation to support local biodiversity, incorporating amenities such as seating, lighting, and water features, and implementing strategies to ensure safety and security. High-quality urban green spaces will often afford a range of recreational activities, during different seasons. Additionally, ongoing maintenance and stewardship efforts are essential to preserve the integrity and functionality of green spaces over time.

Healthy trees are also fundamental to the success of urban forests, as they provide numerous ecological, social, and economic benefits. Trees contribute to air quality improvement, carbon sequestration, temperature regulation, stormwater management, and biodiversity conservation. However, maintaining tree health in urban environments can be challenging due to factors such as pollution, compacted soils, inadequate space for root growth, and pest and disease pressures.

To ensure the health and vitality of urban trees, cities must enhance tree diversity (see also later in this report) and prioritise proper tree selection, planting, and maintenance practices. Project leader Johan Östberg contributed to a recent article that highlights good practice in tree planting during pre-planting, installation, and post-planting stages, for example (Eisenman et al., 2024). Proper urban forestry practices include selecting tree species suited to local environmental conditions, providing adequate soil volume and quality, implementing regular watering and fertilisation regimes, and conducting routine inspections for signs of pests, diseases, and structural issues. Additionally, community engagement and education programs can empower residents to become stewards of urban trees, fostering a sense of ownership and responsibility for tree care.



Photo 6. High-quality parks as part of the 300-component are attractive, accessible, and diverse (photo by Cecil Konijnendijk).

Opportunities and challenges with implementing 3+30+300

Although the 3+30+300 principle is still novel, it has already gained substantial following, as mentioned above. It has also met criticism, not really challenging its evidence base but doubting its high ambition, especially for municipalities with dense built-up areas and low tree canopy cover. Other concerns raised relate to the rule's focus on trees rather than other vegetation. In a time of climate emergencies, public health challenges, and biodiversity loss, however, it is important to have ambitious greening programs that reflect the latest evidence on access and exposure to trees and other vegetation. Moreover, urban areas are far from static and often change quite rapidly. Substantial transformations can be expected also in terms of housing, mobility, and space reserved for private cars. Having clear ambitions and guidelines for green space will help with transforming cities into more resilient and liveable places, giving trees and green space planners and managers a seat at the table.

Vegetation other than trees should not be ignored but the research is very clear about the essential role that especially trees play in e.g., cooling and promotion of our health and wellbeing. While trees provide the framework, focus should be on

having multiple layers of vegetation and a diversity of green spaces across neighbourhoods and municipalities. It will also be important to focus on quality rather than just quantity, ensuring a sound mix of climate-adapted tree species and focusing on the development of high-quality public green space that cater for a wide range of recreational demands. Emphasis should also be on letting trees grow old and large, where possible, as large trees with large canopies provide more ecosystem services. The rule does not have to be met overnight but can drive longer-term urban development, decades into the future.

The contexts in which the rule is to be used will be very different, which also calls for a certain nuance and carefulness in applying it. It is essential to recognize the need for regional adaptation to account for variations in climate, geography, and local conditions, including prevailing socio-cultural, economic, and political realities. For historical city centres and cities in arid climates, for example, reaching 30% canopy cover and maybe also 3 larger trees in sight will often be difficult. In these cases, alternatives need to be explored, using other types of vegetation and maybe e.g., more building green such as green roofs or facades.

Although 3+30+300 is called a 'rule' it is more of a principle or guideline. It can be important to use the word 'rule', however, also in negotiations and coordination with planning, engineering, architecture, and other fields where clear norms and rules are more common. This will give a higher priority to trees and green space as essential infrastructure rather than just 'icing on the cake' when all other demands have been met. Green needs to be an integral part of health, housing, transportation, education, economic, and other agendas.

Zooming in on the three components of the rule, the following specific challenges (and opportunities) related to achieving 3+30+300 can be identified:

3 trees

In urban areas, the challenge of planting trees is compounded by limited space, especially in densely populated neighbourhoods with high-rise buildings and few green areas. Balancing the need for housing and infrastructure with the desire for greenery is a significant challenge. Trees in urban environments compete for essential resources like water and sunlight. Ensuring they have enough resources amidst demands from buildings, roads, and other infrastructure is complex. High-density urban areas also face the urban heat island effect, where surfaces absorb and re-radiate heat, leading to higher temperatures. Strategically planting and maintaining trees to mitigate this effect requires careful planning and coordination. Additionally, urban development projects often prioritise infrastructure expansion, which can conflict with existing trees. Balancing infrastructure needs with tree preservation and new planting initiatives requires collaboration between urban planners, developers, and arborists.



Photo 7. Three trees as seen from a residential window (photo by H  l  ne Littke).

30% canopy cover

Achieving and maintaining adequate tree canopy cover in cities is challenging despite the benefits of urban trees and green spaces. Common challenges are similar to those of 3 trees, but with the 30% canopy the size of the trees become even more important, and the need to preserve large old trees as long as possible, also for the health benefits they provide (Chi et al., 2022). Socioeconomic factors like income inequality and lack of community engagement can also influence tree distribution and access to green spaces.



Photo 8. The 30 component calls for at least 30% canopy cover (photo by Magnus Nilsson).

300 metres

In densely populated urban areas, access to parks and green spaces within a 300-metres radius may be limited, particularly in marginalised communities or areas with high population density. This lack of access disproportionately affects residents' health and well-being. Acquiring land for new parks or green spaces within urban areas can be challenging and costly. Municipalities must navigate land-use regulations, property ownership issues, and competing demands for land to create accessible green spaces. Establishing new parks or green spaces is just the first step; ensuring their ongoing maintenance and management is equally important. Limited municipal budgets and resources may hinder efforts to maintain these spaces adequately, leading to degradation over time. Safety concerns, such as crime and vandalism, can also deter residents from utilising parks and green spaces. Creating safe and welcoming environments requires careful design, community engagement, and collaboration with law enforcement agencies.

Cities must address these challenges through strategic planning, policy interventions, community partnerships, and implementation of state-of-the-art knowledge and practices. This may involve prioritising green infrastructure investments, integrating urban forestry goals into land use planning and development policies, providing incentives for private property owners to plant and

maintain trees, and engaging residents in tree planting and stewardship programs. By addressing barriers to tree canopy cover expansion, cities can enhance the resilience, sustainability, and liveability of urban environments.



Photo 9. High quality public green space in Malmö, Sweden (photo by Clara Lind).

3+30+300 implementation in a Nordic setting – policies, practices, and opportunities

The 3+30+300 principle can serve as a guide to reach green, resilient, and healthy Nordic cities. As mentioned above, Nordic cities (and especially Swedish cities to date) have been some of the first to implement the principle, for example as part of their green space strategies but in some cases even in city comprehensive plans. The Yggdrasil project has shown that there is considerable potential for more implementation remains, recognising the large differences between urbanisation, climate, biodiversity, and other conditions between the Nordic countries and municipalities.

Implementation of the 3+30+300 principle, in ways that takes these differences into account the project will contribute to making the case for more resilient and healthy cities with more nature-based solutions that address both biodiversity, climate change, health and equality in the same measures, which includes multiple

vision objectives in the Nordic Council of Ministers' *Our Vision 2030*. The project contributes to the region's sustainability and resilience which is the overarching goal of *Our Vision 2030*.

Initially the project was particularly linked to Vision objective 9 Health and welfare of "A socially sustainable Nordic Region", due to the focus of the 3+30+300 principle on humans and their wellbeing as well as given that much analysis will be done to ensure that trees and greenspaces are accessible for the inhabitants in the cities where these are of the greatest importance. With the use of data on noise levels, air quality, and climate-related parameters, such as heat mapping, as well as specific work on the relations between urban forests and human health, the project has had a strong focus on health and wellbeing. The project also evaluated how vulnerable populations would be influenced by adopting the 3+30+300 principle, ensuring that the implementation is done where the need is the biggest to secure equal health and welfare for all, a strong contribution to vision objective 11 can be made. This is in line with the strong focus of 3+30+300 on environmental equity.

Moreover, as the project has focused on greener cities it also contributes to the carbon neutrality and climate adaptation objective of the Nordic vision (Vision objective 1). Additional focus has been on the preservation and increase of the proportion of local native trees in urban areas, thus ensuring a contribution to objective 2 on safeguarding biodiversity and the sustainable use of the Nordic regions nature. The broad collaboration across the Nordic countries also fostered by Yggdrasil promotes an inclusive and equal region with a common goal to transform our cities according to the 3+30+300 principle. This contributes to a strong and sustainably Nordic region that co-operates on the environment and climate issue (Vision objective 5). The Yggdrasil network also aimed to contribute to maintaining trust and cohesion in the Nordic region by creating a discussion forum during the workshop series where municipalities could share experiences and ask questions, present practical case studies to inspire and learn from each other (Vision objective 12). The project has been producing communication materials in several Nordic languages, including Finnish, Icelandic, Norwegian, and Swedish. This enhances knowledge dissemination across the Nordic countries with a focus on clear and simple step-by-step guidance for implementing the 3+30+300 principle (Vision objective 6), which has been achieved through data collection, analysis, and dissemination (Vision objective 8). This will make it easy for municipalities and other organisations to take full advantage of the output from the project. This, together with the well-established network, will assist the Nordic Region with its green transition (Vision objective 10).

The Nordic Council of Ministers has already given prior attention to the 3+30+300 rule, for example through the work of its past Nordic Working Group on Sustainable Cities. This group developed a policy brief titled "Nordic Cities - Green, Resilient, Healthy" (with the help of Yggdrasil contributor Cecil Konijnendijk) in which use of 3+30+300 is recommended (Nordic Council of Ministers, 2022). It links implementation of this principle to four strategic principles for urban green space planning, namely proximity, diversity, connectivity, and equity. In brief, diverse, high-quality, and well-connected urban green trees and green space need to be proximate and readily available to all.

Swedish government bodies, including the Swedish National Board of Housing, Building and Planning ('Boverket'), also hosted two conferences in which there was considerable focus on the potential of using 3+30+300. One of these events was held under the Swedish chairmanship of the European Union during the first half of 2023.

Opportunities for use of 3+30+300 in the Nordic Region exist at different levels, including the Nordic and national scale as part of relevant strategies and policies. Specific ways of integrating the guideline into green and other policies and strategies have been discussed in earlier parts of this report. The local context and needs will determine how the principle can best be used, ranging from a tool for analysing existing tree and green space provision to inclusion in comprehensive plans. However, as shown by e.g., the work of the Region of Scania (Region Skåne, 2023), opportunities also exist at the regional level. The most relevant level of implementation is that of municipalities throughout the Nordic countries, and even that of district and neighbourhood scales (e.g., in the case of neighbourhood transformation and new development). It is important to link local policies and strategies that use 3+30+300 with national policies, legislation, and recommendations. In Sweden, for example, a recommendation of reaching at least 25% tree canopy cover by 2030 was made by the Swedish Environmental Protection Agency (Naturvårdsverket) (Växtforum, 2022). Also in Sweden, the Swedish National Board of Housing, Building and Planning has provided several guidance documents related to urban green spaces for municipalities (Boverket, 2024).



Photo 10. Urban parks are important for people of all ages (photo by Pixabay).

Making the health connection

In alignment with the project's objective to evaluate the effectiveness of the 3+30+300 principle in enhancing public health (Figure 5), this chapter begins by discussing the broader health benefits of urban greenness and urban nature. It then delves into specific considerations required when planning for maximised health gains by planting and managing urban trees, concluding with the role of urban green (and trees as important components) in promoting human health within the Nordic context.

Human health is deeply connected to the health of the planet, and forests and trees are a key part of the Earth's ecosystems. Understanding the interdependence between humans and forests and trees is essential for ensuring optimal health for current and future generations. A planetary health (Myers, 2017), or One Health approach (Atlas, 2013) integrates environmental protection with health solutions, and trees and forests play a crucial role in this framework. Healthy ecosystems contribute to promoting healthier lifestyles, preventing disease, and supporting livelihoods.

Urban green spaces and trees absorb pollutants like nitrogen dioxide (NO₂), sulphur dioxide (SO₂), and particulate matter, contributing to cleaner air (Nowak et al., 2002; Eisenmann et al., 2019). This has direct health benefits, by reducing morbidity and mortality attributed to air pollution (Lee, 2011; Kuo, 2015; Khomenko et al., 2021; Sang et al., 2022). Additionally green spaces and urban forests have been shown to lower stress, reduce symptoms of anxiety and depression, and improve overall mental well-being. (Kaplan et al., 1989; Bratman et al., 2015) The mechanisms for urban green spaces and its link to improved mental health, may be through lowering cortisol levels and fostering a sense of social cohesion. Bratman and colleagues propose a model that highlights the effects of natural environments on mental health through four key steps: (1) "natural features," which include environmental factors like type, size, and quality that can affect mental health; (2) "exposure," referring to the extent of contact with nature; (3) "experience," focusing on the subjective aspects of nature exposure; and (4) "effects," which are the resulting mental health outcomes from these nature experiences (Bratman et al., 2019).

Access to green spaces encourages physical activity, promoting healthier lifestyles (Sugiyama et al., 2008). Their shade reduces exposure to harmful ultraviolet (UV) rays, lowering the risk of skin cancer (Heisler, 2005; Na et al., 2014). Further, trees provide shade and cool the air through transpiration, mitigating the urban heat island effect (Oke, 1982; Bowler, 2010). This reduces heat-related health risks. International research shows that particularly low-income neighbourhoods may be disproportionately affected by extreme heat (Chakraborty et al., 2019).

Additionally, urban trees play a role in reducing noise pollution and in sequestering carbon, the latter addressing climate change impacts that can exacerbate health conditions (Nowak et al., 2002; Oliveira, 2022). Lastly, by reducing stormwater runoff and filtering pollutants, urban trees may improve water quality and prevent flooding, further safeguarding public health (Berland et al., 2017).

Tree-related cooling has for example been shown to contribute to as much as 30% decrease in ambient particulate matter (PM) on average in one study (Yang et al., 2023). Research has however revealed non-linear patterns between tree coverage and indicators such as PM and heat, highlighting the complexity of these interactions. The density of tree planting may furthermore play a crucial role in maximising the reduction of air pollution. Under certain circumstances, air pollution levels can even increase with tree planting, particularly in urban environments, for example by trapping pollutants in street canyons, by emission of Volatile Organic Compounds or by blocking wind flow. One study highlights the significant benefits of trees, especially in reducing inhalable particles on sidewalks (Ren et al., 2023). In that particular study however, medium tree spacing seemed optimal, roughly equal to crown diameter, being the most effective in reducing air pollution along bicycle

lanes and sidewalks, compared to traffic lanes. The impact became even more pronounced under heavy traffic conditions. However, with sparse or dense tree spacing, the benefits may diminish as traffic increases. Urban planners with the necessary expertise are key to designing healthier cities that balance urbanisation with environmental and public health needs.

Regarding the 3+30+300 principle specifically, and its relation to health, there is a study from Barcelona, where surrounding residential greenness was significantly associated with improved mental health, reduced medication use, and fewer visits to psychologists or psychiatrists (Nieuwenhuijsen et al., 2022). However, no significant associations were found between mental health and having a tree view from windows or proximity to major green spaces. Adhering fully to the 3+30+300 principle was linked to better mental health outcomes, reduced medication use, and fewer visits to psychologists or psychiatrists, though statistical significance was observed only for the latter. In another study, from Chongqing, China, the findings indicated that participants who had a view of at least three trees through their windows experienced higher levels of both nature connectedness and mental well-being compared to those without such views (Li et al., 2024). Nature connectedness played a significant role in mediating the relationship between tree visibility and mental well-being, although the overall effect size was relatively modest. Although there are relatively few studies related to the 3+30+300 principle and health outcomes, and the results vary somewhat, the available research suggests that it could be a valuable and relevant tool for promoting health. This measure, focusing on increasing access to nature through tree visibility, neighbourhood greenery, and large green spaces, shows potential as a practical guideline for urban planning aimed at improving both physical and mental well-being.

Unfortunately, green spaces and their beneficial effects are often unevenly distributed within cities, with individuals of lower socioeconomic status (SES) facing greater challenges in accessing high-quality green areas. For example, those with lower SES are more likely to live in densely populated urban environments where green space is limited. This socioeconomic gradient in access to green spaces, often referred to as environmental injustice, was highlighted by the 2016 European Quality of Life Survey and has been observed across various European countries. The United Nations' Sustainable Development Goal 11.7 specifically advocates for "universal access to safe, inclusive, and accessible green and public spaces" (United Nations, 2024). It's important to recognize that inequalities in access to greenery and trees may be more complex in the Nordic context compared to many countries. This complexity may arise from the high status associated with living in city centres, combined with the generally high levels of access to greenery enjoyed by the population as a whole. This is highlighted in the section on socioeconomic perspectives on urban trees below. Indoor environments in disadvantaged

neighbourhoods are often more crowded and of lower quality, which can exacerbate health risks. This makes the health benefits of accessible, high-quality green spaces – particularly those perceived as safe – even more significant for these communities.

Incorporating green spaces, trees, and other vegetation into urban landscapes thus has the potential to offer significant health benefits, such as reducing air pollution and mitigating the urban heat island effect. However, maximising these advantages requires careful planning. Urban planners with expertise in environmental and public health are essential for selecting tree species that optimise air quality and cooling benefits while minimising pollution risks. They must also design green infrastructure to ensure adequate airflow and prevent pollutant trapping in dense areas. Key strategies include effective tree spacing and placing, the use of tree species with favourable characteristics for providing different benefits, the use of native species, and integrating trees into broader environmental policies to address environmental injustices. Collaboration among urban planners, environmental scientists, public health officials, and landscape architects is crucial for creating holistic designs that foster green, liveable cities for all populations. By tailoring approaches to the specific needs of different urban environments, planners can enhance both environmental sustainability and human health. In summary, informed urban planning is vital for maximising the health benefits of greenness and trees while minimising the risks of localised pollution and heat retention.

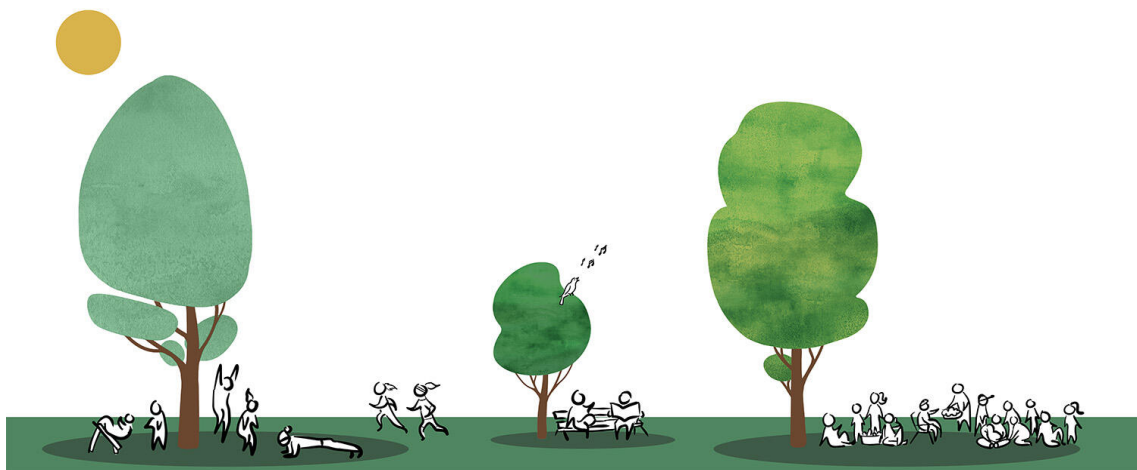


Figure 5. Visualisation of some of the health benefits of trees (illustration Ellinor Scharin, Ekologigruppen).

Urban trees, urban green spaces, and human health in the Nordic setting

In the Nordic countries, urban trees and urban green spaces play a crucial role in enhancing health and well-being, influenced by the region's unique climate, urban design, and commitment to sustainability and nature. Nordic cities have long prioritised the integration of green spaces into their planning, emphasising the vital connection between nature and public health (Aguilar Borges et al., 2024).

The mental health benefits of urban trees are particularly pronounced in the Nordic context, where long, dark winters can lead to Seasonal Affective Disorder (SAD) (Brancaleoni et al., 2009). Access to green spaces and urban trees has been shown to alleviate stress, improve mood, and reduce symptoms of depression. Additionally, the region's cultural affinity for nature, embodied in concepts like the Finnish and Swedish "everyman's right" (*jokamiehenoikeus* and *allmansrätten*), encourages citizens to engage with natural areas. This engagement promotes physical activity and helps mitigate the risks of chronic diseases such as heart disease, obesity, and diabetes. In a Swedish study during the COVID-19 pandemic results showed a significant increase in the number of individuals visiting natural areas "often" during the pandemic. Higher residential greenness was generally linked to better mental health, with improved well-being and vitality, and reduced symptoms of depression, anxiety, and stress, even after adjusting for demographics and walkability. These findings suggest that nature contact may support mental health during extreme circumstances (Löhmus et al., 2021).

The Nordic climate is characterised by extreme seasonal changes and harsh weather during a large part of the year. However, despite this an Icelandic study on restorative environments concluded that the positive effect on mental health rarely was affected by external conditions, like weather (Kristjánsdóttir et al., 2020). Ongoing climate change will have a significant effect on the Nordic climate. Studies show that the Arctic has warmed nearly four times faster than the globe since 1979 (Rantanen et al., 2022) and the Nordic Region is therefore particularly vulnerable. A result of a warmer climate is a longer pollen season and a higher risk of allergy connected health issues. An Icelandic study looking at urban design with consideration to allergic rhinitis and asthma argues that un-nuanced focus on the health benefits of urban trees might result in monodominant planting communities and reduced biodiversity that might worsen allergic problems (Schneider, 2024). This highlights the need to understand these effects of climate change in urban planning practice.

In the Nordic setting, various measures of increased greenness has for example been linked to a decreased risk of myocardial infarction in women in a Swedish study (Stucki et al., 2024), decreased risk of type 2 diabetes in a Danish study (Sorensen et al., 2018), to reduced risk for depression in a Finnish study

(Gonzales-Inca et al., 2022), and to increased birth weight in a multi-centre Scandinavian study (Sinsamala et al., 2024). In one Swedish study furthermore, higher long-term exposure to greenness was linked to a slower increase in waist circumference and a lower risk of central adiposity in women, but not in men (Persson et al., 2018). In both genders, living in less green areas, alongside other environmental risk factors seemed particularly detrimental, highlighting the need to investigate health effects of greenness simultaneously to other environmental risk factors for a holistic perspective.

Although the region is known for its cold winters, multiple studies have shown that people die in heat waves also in the Nordic countries. For example, it was estimated that more than 600 people died in the heatwave of 2018 (Åström et al., 2019). Cold temperatures also pose a risk on population health in the Nordic setting and urban trees also help insulate buildings by breaking cold winds, indirectly reducing energy consumption and preventing cold-related health issues. Despite generally good air quality in the Nordics compared with most of mainland Europe, urban areas still face air pollution challenges, particularly from transportation and wood-burning, but also from industry. For example, around 6,700 people are estimated to die prematurely every year in Sweden due to air pollution (Gustafsson et al., 2022). There is thus substantial potential for public health benefits by reducing air pollution, heat and cold, also in the Nordic setting, and mitigating extreme temperature events furthermore enhances the air purification effects of urban trees, demonstrating their dual role in improving urban environments.

There are very few studies on greenness in relation to health in Iceland, Faroe Islands, or Greenland, but the global rise in pollen allergies is driven by factors such as pollution, reduced biodiversity, and the prevalence of man-made, monodominant planting, particularly in urban areas. While green spaces are vital for the mental and physical well-being of city dwellers, they can also pose health risks by contributing to sensitization from local pollen. Unfortunately, most urban green spaces are not designed with conditions like allergic rhinitis and asthma in mind. Although research has focused on the medical and botanical aspects of allergies, there is a disconnect between this knowledge and its application in landscape architecture and urban planning. A bachelor thesis from University of Iceland addressed this gap by examining the health impact of allergenic vegetation, showcasing case studies of allergen-low designs, and proposing a redesign of the Stakkaborg playschool to minimise allergen exposure and pollution, as one example of how the design of outdoor spaces may be used to create healthier outdoors environment for children and teachers (Schneider, 2024).

Overall, it is important to acknowledge that the mechanisms for health benefits from greenness may be modified by perceived characteristics of the physical environment. One study for example indicated that the neighbourhood greenness score demonstrated a positive association with physical activity, while interestingly, neighbourhood cultural history also correlated positively with both physical activity and general health (Weimann et al., 2017). Additionally, the relationship between greenness and physical activity was moderated by safety, indicating that feelings of unsafety may undermine the positive effects of greenness on physical activity levels.

The intricate relationship between urbanisation, forest health, SES and human well-being underscores the importance of incorporating Indigenous knowledge into urban planning, particularly that of the Sámi people in the Nordic Region. This interconnectedness further reinforces the evidence supporting the positive impact of forests and trees on human health.



Photo 11. In Nordic cities the winter use of urban green spaces is often very important but challenging (photo by Kim Wyon/Visit Denmark).

Tree species diversity and 3+30+300 implementation

Tree diversity and the suitability of different tree species

The understanding of the need to plan for a broader variety of tree diversity in our urban landscapes to mitigate potential diseases affecting specific tree species has long been established. For example, a guideline to follow has been the 10-20-30 rule, which states that no more than 10% of any single species should be planted, no more than 20% of the same genus, and no more than 30% of the same family. This approach discourages the planting of large or contiguous areas of the same species or clones to prevent entire sections from being impacted by a potential disease outbreak (Santamour, 1990). Thus, creating ecological resilience allows an ecosystem to withstand and recover from disturbances such as disease outbreaks or the extinction of a species due to climate change. A broad species diversity with biological variety fosters a robust ecosystem that enhances resilience by spreading risks. If one species disappears, another with similar characteristics can take its place. Uniform tree populations or those with low diversity consequently have lower resilience and are therefore more susceptible to disturbances. Ongoing climate change is expected to lead to more extreme weather events, such as heavy rainfall and droughts. Therefore, we need to preserve and restore resilient ecosystems when planning our cities (Naturvårdsverket, 2024). A strong ecological resilience would thus support the implementation of the 3+30+300 principle by ensuring a consistent and sustainable level of vegetation without noticeable periods when species disappear in large sections.

To address these challenges a think tank activity was conducted on 25 September 2024 during which participants and experts from Trädkontoret and Ekologigruppen got together to discuss. In an increasingly warmer world, many native species will need to migrate to new locations, while others may adapt and remain in their current habitats. During the think tank discussions, the scenario was discussed in which trees lose their normal habitats due to climate change, resulting in a shift of species northward. This shift also places responsibility on northern regions, as Scandinavia may need to accommodate these species, referred to in the think tank discussions as "responsibility species". With new non-native tree species come accompanying species, such as insects and other organisms, that lose their natural habitats. How do we care for them? A concept discussed during the think tank activities was termed "on the edge", which refers to the possibility that our Nordic countries may become the last refuge for species moving northward as a result of climate change.

Trädkontoret AB (2024) has developed climate forecasts indicating how various species are expected to be affected by a warmer climate. For instance, it shows that downy birch's (*Betula pubescens*) natural occurrence is shifting from Northern

Europe and Southern Sweden towards Northern Sweden and Norway (Figure 6). This means that where this tree species has previously been common, it will gradually become extinct and need to be replaced by other species. In contrast, black locust (*Robinia pseudoacacia*), a non-native species, is expected to migrate northward with its natural distribution and may thrive in the southern half of Sweden. This species could potentially flourish in urban settings, although it poses challenges due to its invasive nature. Being able to anticipate future developments can better prepare us for climate change by planning how to manage these species. As our current native species move northward, we will also need new species suitable for urban environments to maintain good canopy cover and appealing outdoor spaces. By being proactive and analysing growth patterns and conditions for future species, we can create an overlap before native species disappear or migrate northward.

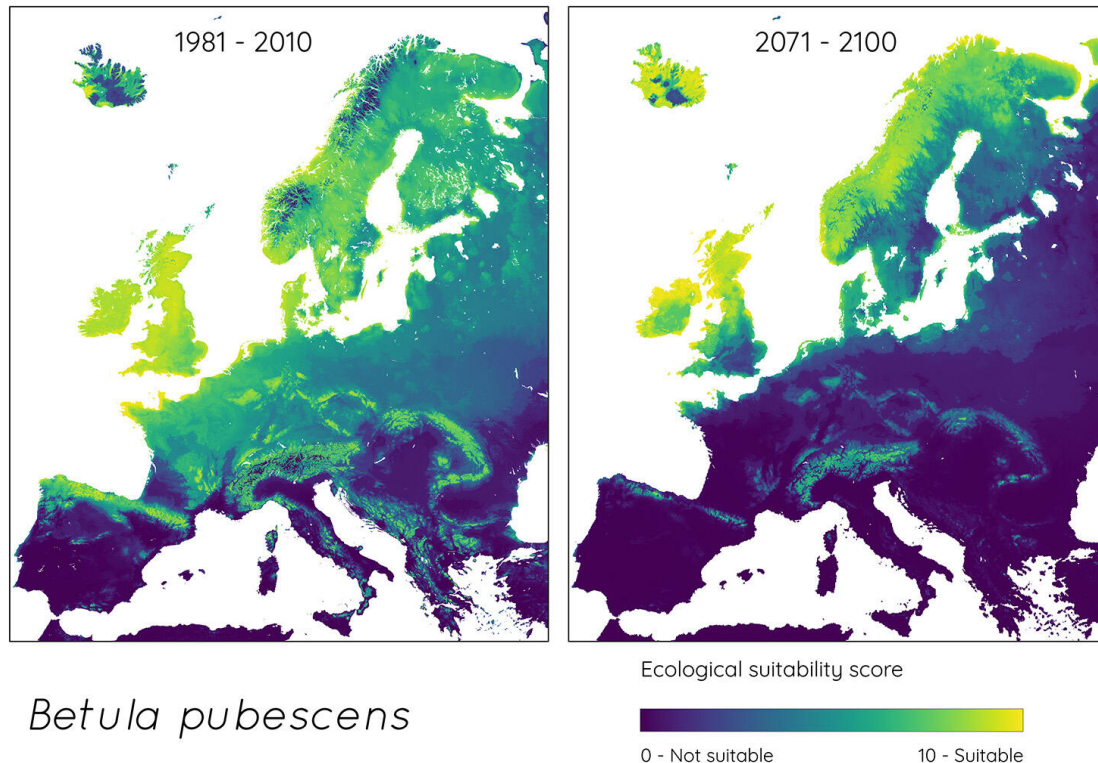


Figure 6. Climate prognosis: downy birch (*Betula pubescens*) for the years 1981–2010 and 2071–2100.

Different tools have been developed that can be utilised in urban planning to focus on selecting the appropriate tree species for specific locations in urban environments to maximise ecosystem services such as improved climate resilience,

increased biodiversity, and thus greater canopy cover. Through data collection, species that are suitable for the site and can provide the greatest benefit are identified to ensure that the right trees are placed in the right locations. The emphasis is on planting healthy large-growing trees that can withstand urban conditions and future climate change. This approach has been tested in Malmö, where information from inventories was combined with the city's tree database to enhance species selection and increase tree coverage in residential areas. The concept of "plantable spots," along with a "goal pyramid" that outlines function-based and target-based species selection, is described by Bellan et al. (2022). This methodology facilitates the creation of higher species diversity, ensuring that the quality-assured choice of trees results in more trees that can grow large, thereby establishing a stable high canopy coverage.

During the think tank discussions, several proposals for future planning tools emerged. One suggestion was to develop a concept of "typical sites" to categorise different urban environments as specific habitats, focusing on both macro- and microclimates, such as large areas, small areas, leftover spaces, park areas, protected parks, and large unprotected sites. A central question is which tree species thrive in these various typical sites, and what habitats are created? The discussion included the risks associated with creating so-called "unstable sites," meaning planning and establishing new habitats – such as squares or other urban spaces – that attract pollinators and other insects. If the site or other locations in a biological chain are remodelled, removed, or altered, it could instead become a death trap for species that cannot move large distances and have become dependent on that specific habitat. This does not support the biodiversity needed to create an ecological resilience that mitigates risks.

In recent years, the issue of invasive species and their spread, including their impact on biodiversity, has been taken more seriously, with extensive literature available on the subject. There are pros and cons that need to be considered, but creating sustainable and climate-resilient urban environments may require a more nuanced view of the matter. A research study from Lund University examined how the origin of trees (native versus non-native) and urbanisation affect the number of invertebrates and tree phenology in urban environments (Kjellberg et al., 2022). The researchers found that non-native trees supported fewer invertebrates and exhibited later phenological development than native trees. This could negatively affect the invertebrate fauna, particularly in cities where non-native species are common. The effect of tree origin was found to be stronger than the impact of urbanisation, highlighting the importance of preserving native species in cities to maintain biodiversity and ecosystem health. At the same time, we face the reality that native plant material will migrate northward due to climate change, making it essential to analyse which non-native species might be suitable for our

environments to create future resilience. The popular science article "Ett försvarstal för den förkättrade tysklönnen" (Åsegård et al., 2023) discusses the flexibility in species selection. It describes risk classification as a valuable tool for identifying foreign and invasive species that may threaten biodiversity. However, there also needs to be flexibility in introducing non-native species when diseases or climate change impact native species. Strict delineations are important to clarify management efforts, but excessive classifications should be avoided. For example, the sycamore maple (*Acer pseudoplatanus*) is discussed as a potential option for climate adaptation and increased biodiversity in Sweden, as there is no evidence that the species negatively affects native ecosystems. Some exotic species can also host a variety of insects and lichens.

Trafikverket, the Swedish Transport Administration (Hammarström et al., 2022) has developed a report to guide their plant selections during construction. The report states that the choice of plants in Trafikverkets projects is adapted to consider future climate change. The species proposed in their list for non-invasive projects include both native and non-native species but have been assessed based on risk classification to avoid creating new problems with invasive foreign species. They have determined that it is possible to use non-native plant material to address climate change while taking responsibility for species selection by carefully scrutinising the proposed plant materials. Similar conclusions are drawn by Östberg (2024) in the article "Balans i trädbeståndet: inhemska, exotiska och invasiva träd i urban miljö". The article discusses how native trees benefit local biodiversity, while exotic species may be important for climate adaptation and resistance to diseases. At the same time, the article warns against invasive species that threaten ecosystems. Therefore, the management of urban tree populations must include careful species selection and risk assessments to optimise benefits and minimise negative effects. With climate change, many of our native species are struggling to survive in urban environments, and several native species have been severely impacted by pests, leading to significant die-offs. This could be catastrophic for canopy cover or for the ability to see trees from your window, as our parks and green spaces would also be affected by the loss of species, along with the biodiversity in our urban environments. Exotic trees are often planted for their different properties compared to our native trees, such as aesthetic values, greater tolerance to pests, and resilience to climate change, including increased resistance to temperature, water scarcity, and compacted soils. Exotic trees contribute to greater species diversity, while many of our red-listed animal and insect species largely depend on our native trees.

An article by Nässlander et al. (2024) discusses similar critical factors for selecting tree species adapted to urban environments, particularly for improving species diversity and managing changing environmental conditions such as drought and

heat stress. The article emphasises the importance of selecting a wide variety of species to enhance resilience in urban environments against diseases, pests, and climate change. This is especially vital in harsh environments such as streets and squares, where soil volume and water access are limited. Many traditionally used species in urban environments come from moist and cool forest habitats, making them less suitable for warm and dry urban settings with the changing climate and environmental conditions currently present in cities. This includes factors such as drought, heat stress, and compacted soil conditions, which not all species can handle well. Therefore, the report suggests considering new, more resilient species that may not have been previously used in cities to ensure better survival and performance under these conditions. Species with high tolerance to water scarcity and other environmental stress factors are highlighted as crucial for successful establishment and long-term health in urban environments. For instance, species that can withstand both drought and flooding should be prioritised in climates expected to experience extreme weather events as part of ongoing and future climate change. The importance of having fewer larger trees positively impacts residents' health more than a greater number of smaller trees is noted by Konijnendijk et al. (2022) and also recently in a study in Brussels, Belgium (Chi et al., 2022). The size of green areas is important, as larger parks and other green spaces typically provide more opportunities for recreational activities, are more popular, and contain greater biodiversity.

Ways forward for diverse and healthy urban tree populations to support 3+30+300 implementation

It is evident that we are currently facing significant challenges, with even greater ones looming in the realm of urban ecology and tree selection. Research findings may not always align with the perspectives of practitioners, consultants, and field workers, particularly regarding the use of native versus non-native plant materials in addressing climate change and invasive species. A new responsibility emerges in the Nordic Region as climate change pushes new species of plants, insects, and animals northward. Multiple aspects need to be considered; staying at the forefront of analysis allows various professionals to agree on effective strategies for the future. We are confronted with the reality of ongoing climate change, which is expected to intensify, necessitating prudent actions. Several well-developed tools, such as "plantable spots" (Bellan et al., 2022) and the "species selection process" (Nässländer et al., 2024) can aid in long-term planning and maintenance to mitigate climate change effects and create sustainable urban green spaces. By utilising these tools collectively, measurable results can be achieved, providing statistics on the efficacy of our actions. Learning from each other's outcomes through various networks can expedite our progress toward goals. Additionally, it is crucial to look further ahead and consider the evolution of the tools and methodologies we develop today, setting proactive targets for the future.

Another pressing issue is ensuring that the urban spaces created today remain intact amidst future urban densification. Can we generate sufficient analytical data and statistics regarding biodiversity development, socio-economic impacts, attraction to the area, temperature reductions, or drainage improvements to ensure these decisions are irrevocable?

It is clear that species diversity and tree size are pivotal to the 3+30+300 principle. Given ongoing and anticipated climate change, it is crucial to plan meticulously for each species selection at specific locations, choosing tree species that can thrive in harsh urban conditions and adapt to future climate challenges, thus providing essential ecosystem services. Future species selections may not include native trees, necessitating a current assessment of which species will be available and their respective attributes. Proactive research enables us to be well-prepared for invasive species that could threaten biodiversity and species diversity, equipping us with strategies for managing them in urban green planning. There is a risk that non-native species that perform well in a given context may need to be removed if they are later classified as invasive by legislation.

Knowledge regarding the importance of selecting a diverse range of species to enhance resilience in urban environments against diseases, pests, and climate change has existed for a long time. However, in recent years, the issue of invasive species and their spread, along with their impact on biodiversity, has gained greater attention, leading to extensive literature on the subject. Many have devised effective strategies for confronting invasive species and avoiding the introduction of unsuitable ones. While there is considerable research on the impacts of native and non-native species on biodiversity, practical experiences can also shed light on alternative approaches. Thus, varying attitudes toward this issue could become problematic if consensus is not reached on how to address climate change going forward. What plant materials should we use if native species are being forced northward while non-native exotics that may suit our changing climate emerge?

There are effective tools available for planning suitable species selections in urban environments that consider the specific needs of each site. Larger trees contribute to canopy coverage, provide shade, offer cooling effects, and filter out air pollutants. They absorb rainwater, reducing flooding and improving drainage, while fostering ecological resilience and enhancing biodiversity. Collectively, this results in attractive green environments, both visible from residential windows and in local areas, encouraging city residents to visit these spaces and enhancing mental well-being. Everything is interconnected, and while this has been understood for some time, we are now beginning to establish common strategies to address climate change.



Photo 12. Park in Copenhagen, Denmark (photo by Jonas Schöne/Unsplash).

3. GIS-analysis of 3+30+300 status in Nordic cities

Methodology

For the first time, the 3+30+300 principle has been calculated and assessed for the entire Nordic Region. The following input datasets have been used for this work:

- Buildings: [The Overture Global Building dataset](#) (Version July 2024),
- Tree Canopy Cover: European Space Agency (ESA) [World Cover Map 2021](#)
- Roads: [OpenStreetMap](#)
- Parks: A mix of OpenStreetMap and ESA World Map 2021
- Administrative areas for aggregations: [Global Administrative Map](#)

To calculate the 3-component within the principle: We buffer each building with a 25-metre buffer (halo buffer). Then we count the number of canopy pixels from the ESA Land Cover Map intersecting the buffer. Each pixel of 10x10m represents one significant tree. The result is stored as an integer number, depicting the number of significant trees surrounding the building.

The 25-metre distance has been chosen based on research at what distance individual leaves are still visible. With average eyesight, if you move beyond 25 metres away from a tree, the vegetation starts to become a green blur. Around 25 metres and less, you see the individual leaves rattling in the wind, you notice the fractal structures the vegetation is built up from. This enhances the mental and physical distress. Obviously, this choice can be debated, as viewing trees at a larger distance can also be beneficial.

To calculate the 30-component: We buffer each building with a 500-metre buffer. We count the number of land pixels within the buffer, and we count the number of canopy pixels within the buffer. The canopy cover is then calculated as $\frac{\text{canopycoverarea}}{\text{Landcoverarea}} \times 100\%$. The value is stored as a floating point number, depicting the canopy cover of the synthetic neighbourhood surrounding the building.

The 500-metre buffer has been chosen to represent an average neighbourhood. After running some tests with different distances, and in accordance with Prof. Konijnendijk, the choice was made that a 500-metre buffer best represents the daily basis liveable area of people, also in terms of walkability.

To calculate the 300-component: For the parks, a machine learning model is used to predict urban green spaces based on ESA Land Cover Map. We then subtract obvious non-parks based on OpenStreetMap (for instance, we remove airports and military compounds), and we add obvious parks from OpenStreetMap (digitised green spaces with a name containing 'park'). This algorithm can be applied globally, making results comparable. The result of this step is a database with park polygons, describing the area of the parks.

For the roads we use the OpenStreetMap roads layer, and remove non-walkable roads from it (motorways, bus lanes, etc). It does contain small footpaths and tracks. For the park entrances we then overlay the OpenStreetMap roads layer with the parks. We mark the spots where the OpenStreetMap data enters a park as a Park Entry Point. To then assess the 300-rule (i.e. within a 300-metres walk), we calculate for each building, over the road, the distance to the nearest Park Entry Point. The distance is stored as a floating point value, depicting the walking distance to the nearest high class urban green space.

To calculate the overall score used for this analysis: The score is calculated by normalising the 3-, the 30- and the 300-component on a scale from 0 to 10. The turning point for each rule (so 3 trees for the 3-rule, the 30% for the 30-rule, etc) is set to a score of 6. Lower scores are scaled between 0 and 6, higher scores are scaled between 6 and 10.

We then take a weighted average based on the three scores. The weights are:

- The 3-component counts for 25% of the overall score
- The 30-component counts for 50% of the overall score
- The 300-component counts for 25% of the overall score

The result is a map with 22 million buildings for the whole Nordic Region (see Figure 7).

It is important to note that the overall score is not part of the actual 3+30+300-rule. It is provided as a helper layer to municipalities, to be able to combine all information into one map. It is also relevant to note that all maps in the document are north-oriented.

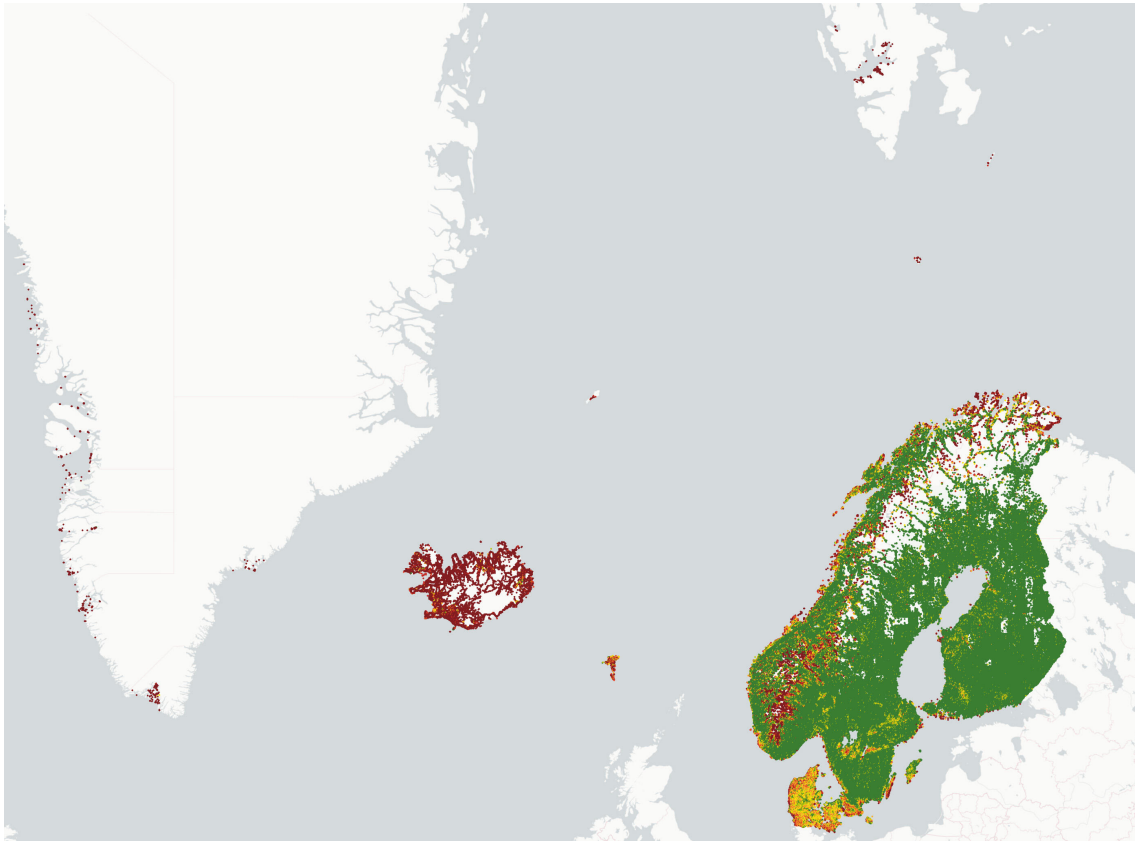


Figure 7. Overview map of 3+30+300 scores for the entire Nordic Region. Green shows 3+30+300 compliance, while red indicates areas where the principle is not met. The white area in the Nordics is free of buildings.

Nordic Cities current adherence to the 3+30+300 principle

When it comes to the amount of trees and green space, and meeting the 3+30+300 principle, the Nordic Region is a lovely region to live in. The average Nordic building scores an 8.4 out of 10 on the 3+30+300-rule. There are big differences between the specific regions though, ranging from 0.02% of the buildings reaching the 30% canopy cover goal in Greenland, up to 97.7% for the 300-rule in Finland (see Table 3).

Table 3. Overview of 3+30+300-principle scores for the Nordic countries. The percentages and averages refer to all buildings in every respective country. Scores are for all buildings in the respective countries, including cities and rural areas. Green space is defined in this context as a publicly accessible park or green space of at least 1 ha in size.

Country	Adherence of buildings reaching					Averages per building		
	3-component (%)	30-component (%)	300-component (%)	Positive overall score (%)	All 3 rules at once (%)	n° of trees	Canopy cover (%)	Distance to green space (m)
Norway	85.63	84.06	95.88	92.29	74.48	40.39	54.83	42.0
Denmark	71.70	32.83	93.45	66.96	26.73	24.31	26.25	60.6
Sweden	83.11	79.94	97.23	89.74	70.74	38.24	53.99	27.1
Åland	86.48	92.48	51.40	88.02	43.89	40.96	60.25	329.9
Finland	97.55	92.54	97.70	97.12	87.39	56.69	56.24	22.6
Faroe Islands	73.67	18.56	80.75	51.74	17.17	28.47	16.23	140.2
Iceland	39.26	4.08	51.52	23.50	3.57	11.00	7.93	327.7
Greenland	1.46	0.02	2.73	0.10	0.01	0.18	0.43	632.2

Gap analysis to pinpoint areas with less than 30% canopy cover

Out of the 22,589,315 buildings in the Nordic Region, close to 6 million (5,859,386) do not reach the 30% goal. As such, they have a gap impacting 25.9% of the Nordic buildings. The gap is more apparent in the northwestern Nordic Region (Iceland, Svalbard, Jan Mayen, Greenland), but even in the "green countries" you can observe gaps. This happens mostly in the centre of urban settlements and in harbours and industrial areas. See Figure 8 as an example of this for Bergen in Norway.

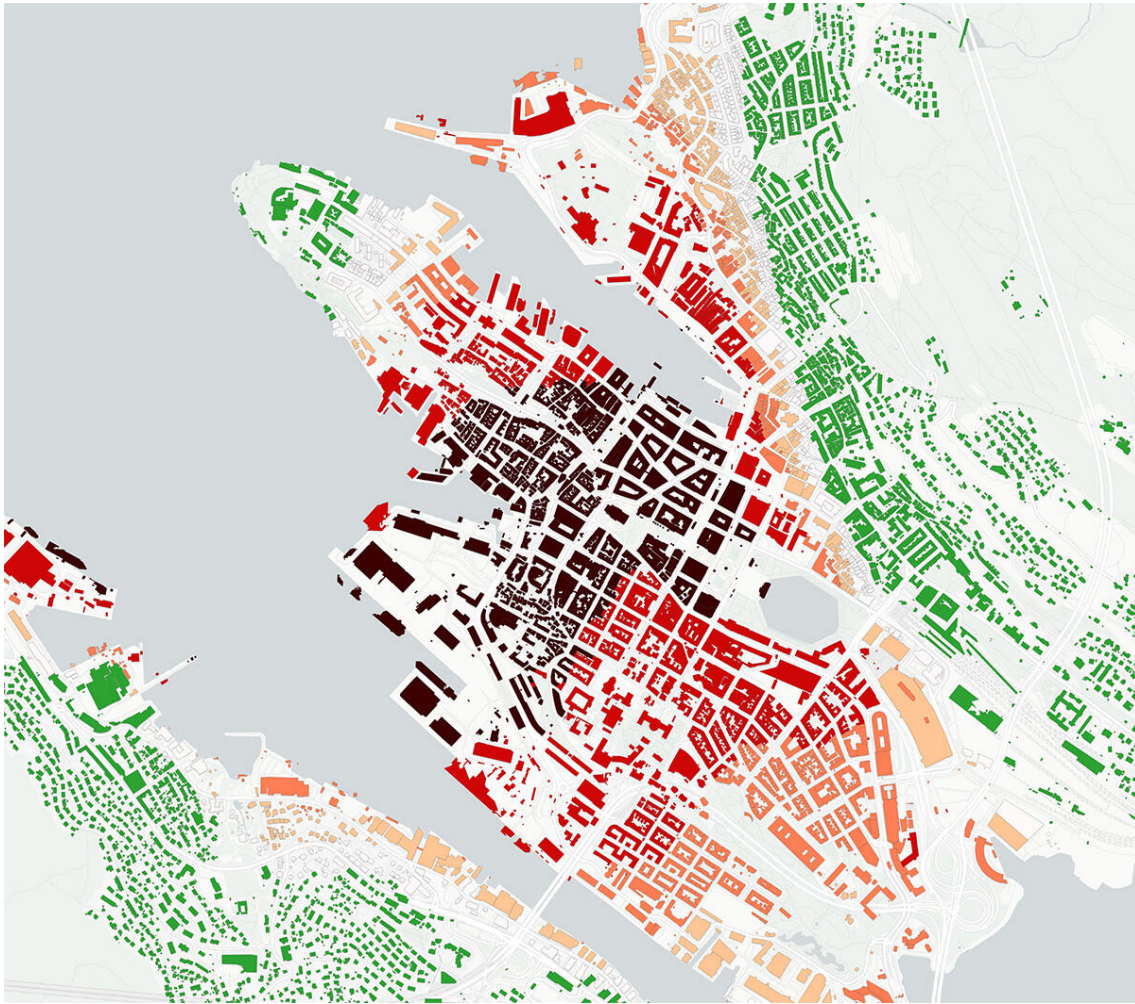


Figure 8. Gap analysis of Bergen, Norway. Green buildings adhere to the 30-rule, red buildings do not (ranging from a 0% gap up to a 30% gap). Spatial patterns immediately become visible.

30-rule: size of gap per building

- 0 - 4% canopy gap
- 4 - 8% canopy gap
- 8 - 12% canopy gap
- 12 - 20% canopy gap
- 20 - 30% canopy gap

Figures 8 through 26 show 3+30+300 scores as well as gap analysis specifically for the 30% canopy component of the principle for the municipalities participating in the Yggdrasil project. The 3+30+300 maps easily indicate neighbourhoods and other areas (for example, industrial areas and business parks) where there is an absence or lack of trees and public green space. This type of analysis can assist with making policy and planning decisions, e.g., on which areas to prioritise for improving tree visibility, expanding local tree cover, and providing better access to high-quality public green space. In this case focus is on the 30-component, as research suggests

that this component is of particular importance to both cooling and public health promotion, but similar analyses could be carried out for the other two components and the principle as a whole.

Addressing the identified gaps can obviously imply planting more trees. To be most effective, it is good practice to focus on the areas with a big gap (far below 30%) and where many buildings with a big gap group together. The combination implies that you can catch many birds with one stone by planting some trees there. For a schematic representation of this, see Table 4.

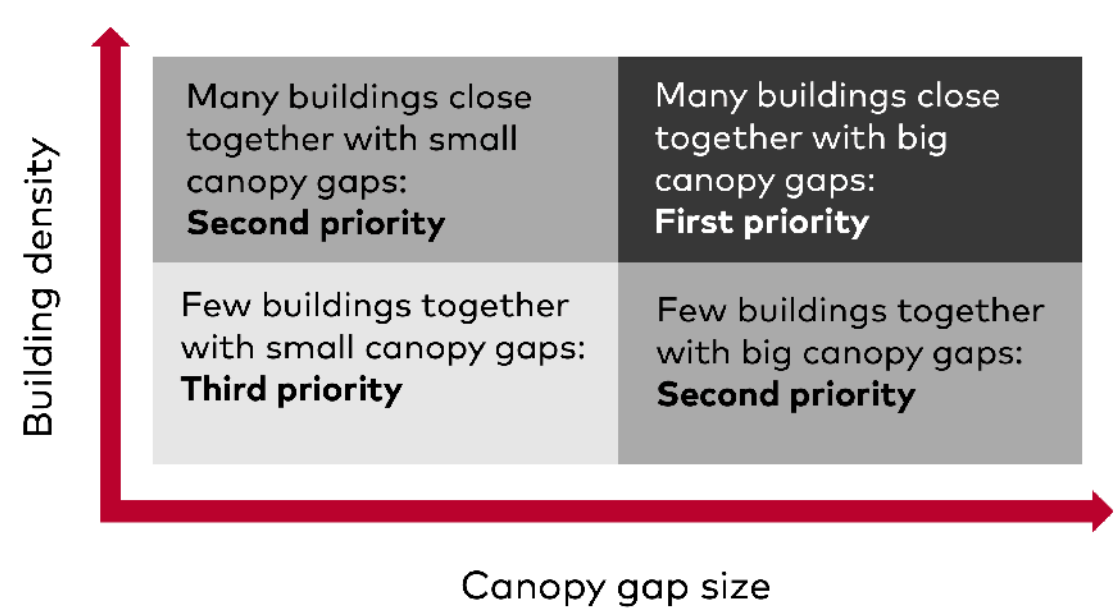


Table 4. Schematic overview of different tree planting scenarios and priorities.

In the 30-component gap analysis through GIS, we can identify those areas with many buildings together, having a big canopy cover gap. These are marked in blue in the gap analysis maps for the different Nordic municipalities. See Figure 9 as an example of a gap-analysis for Bergen in Norway. Not surprisingly, often these priority areas are found in dense (and historical) city centres where it will be more difficult to find space for new trees. This is important, however, as these densely built centres often have a high population density and also face the heaviest consequences from the urban heat island effect and resulting health challenges.

The maps also show that residential areas outside of the centre, and especially the suburbs have good 3+30+300 scores. Here canopy cover is often higher than in the dense urban core.

The 3+30+300 principle is most relevant for built-up areas where communities live. It does not have the same impact in surrounding countryside or forested areas where building density is low. Here, other landscape qualities will play an important role (such as meadows and other types of agricultural landscapes, some of which can be diverse and have high cultural values, and residents often have good access to trees and nature).

The maps will also make it possible to e.g., compare different types of neighbourhoods and see how newer neighbourhoods are doing in comparison with older ones. Moreover, new developments and neighbourhoods that are to be redeveloped require special attention, ideally projecting 3+30+300 scores in the longer term as newly planted trees mature and obtain bigger sizes and canopies.

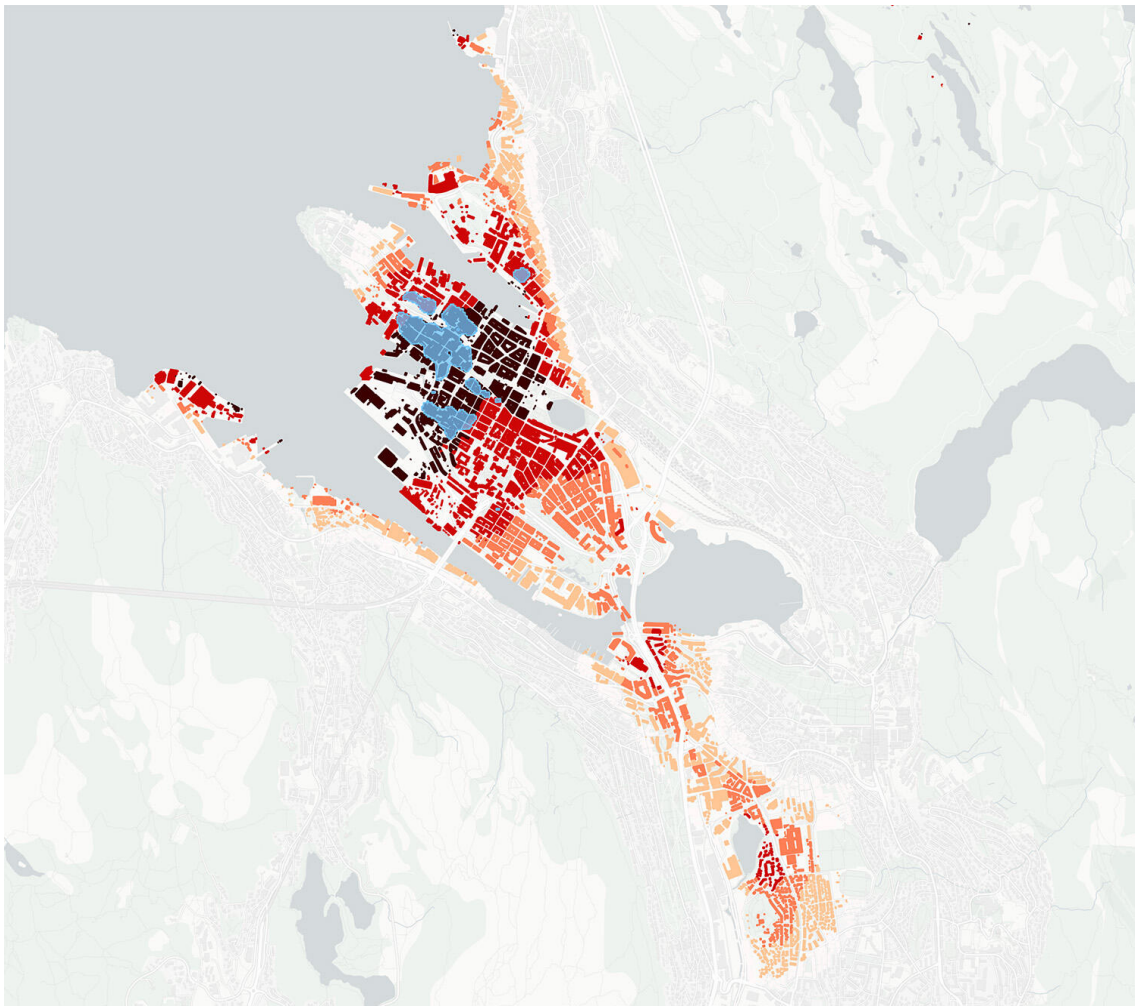


Figure 9. Focal areas for Bergen, Norway based on 30-component gap analysis. By planting trees in the blue areas, one will have a lot more impact than when planting elsewhere.

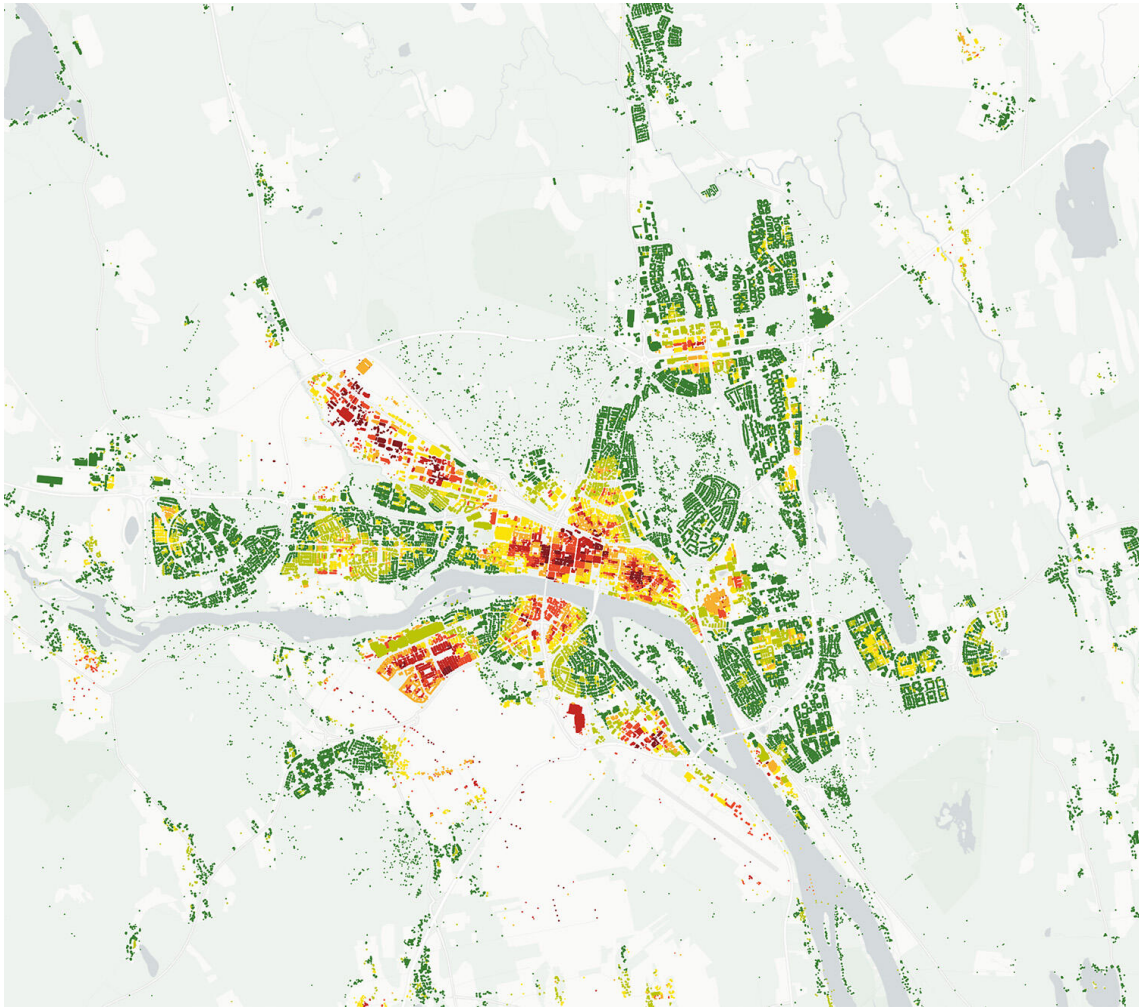


Figure 10. Overall 3+30+300 score for Umeå, Sweden. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

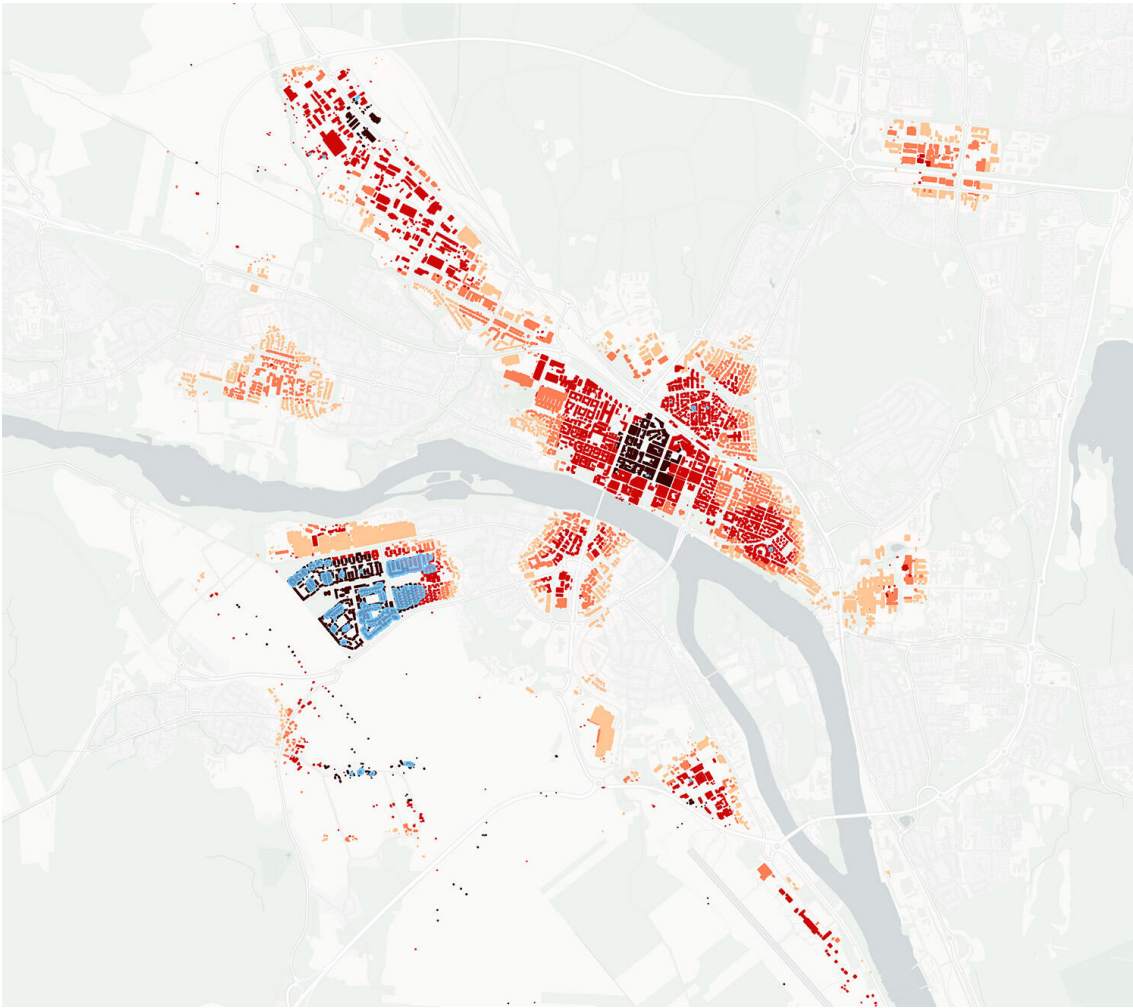


Figure 11. Gap analysis for Umeå, Sweden for the 30-component. Red buildings score too low and require attention. Blue areas depict the focus areas with the highest impact on gap fixing.

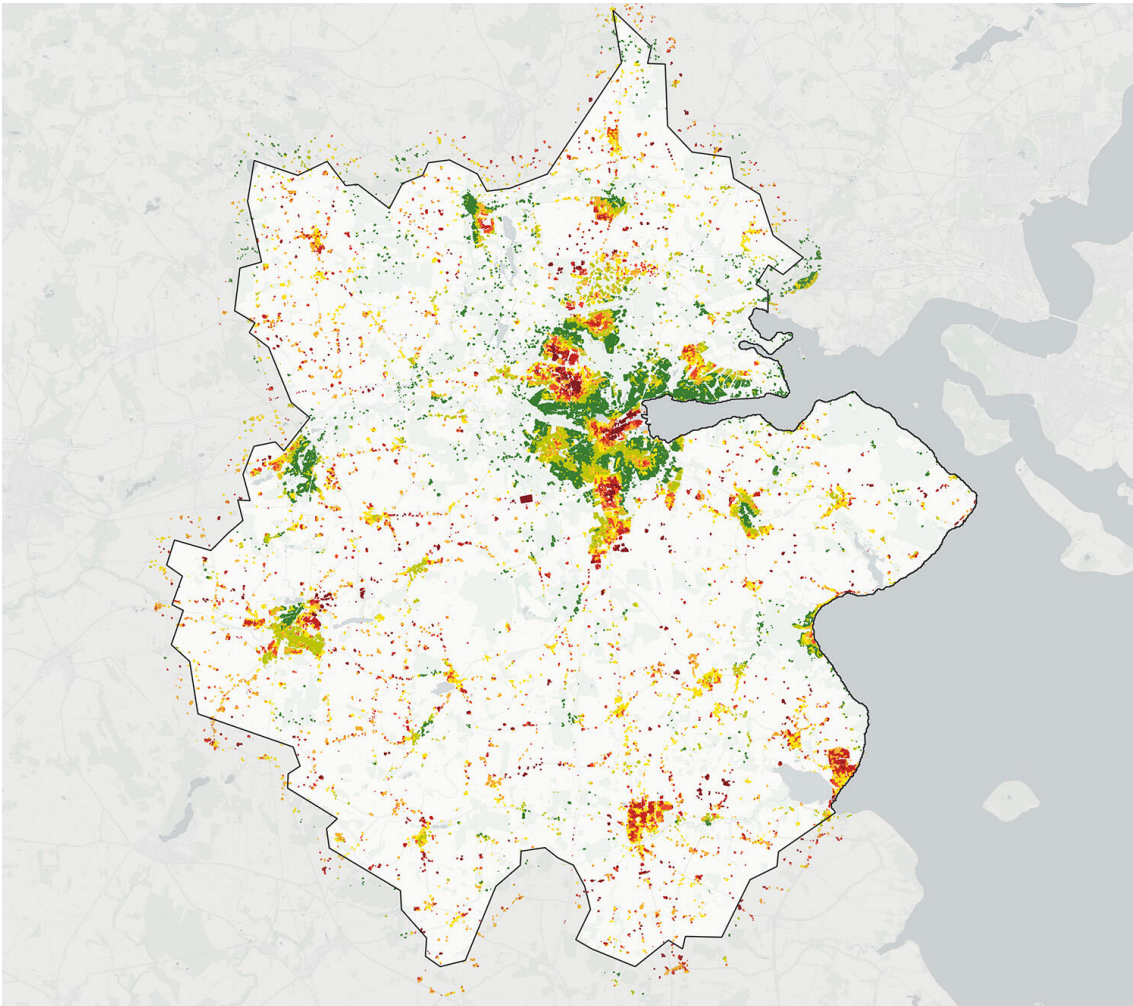


Figure 12. 3+30+300-rule overall score map for Kolding, Denmark. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

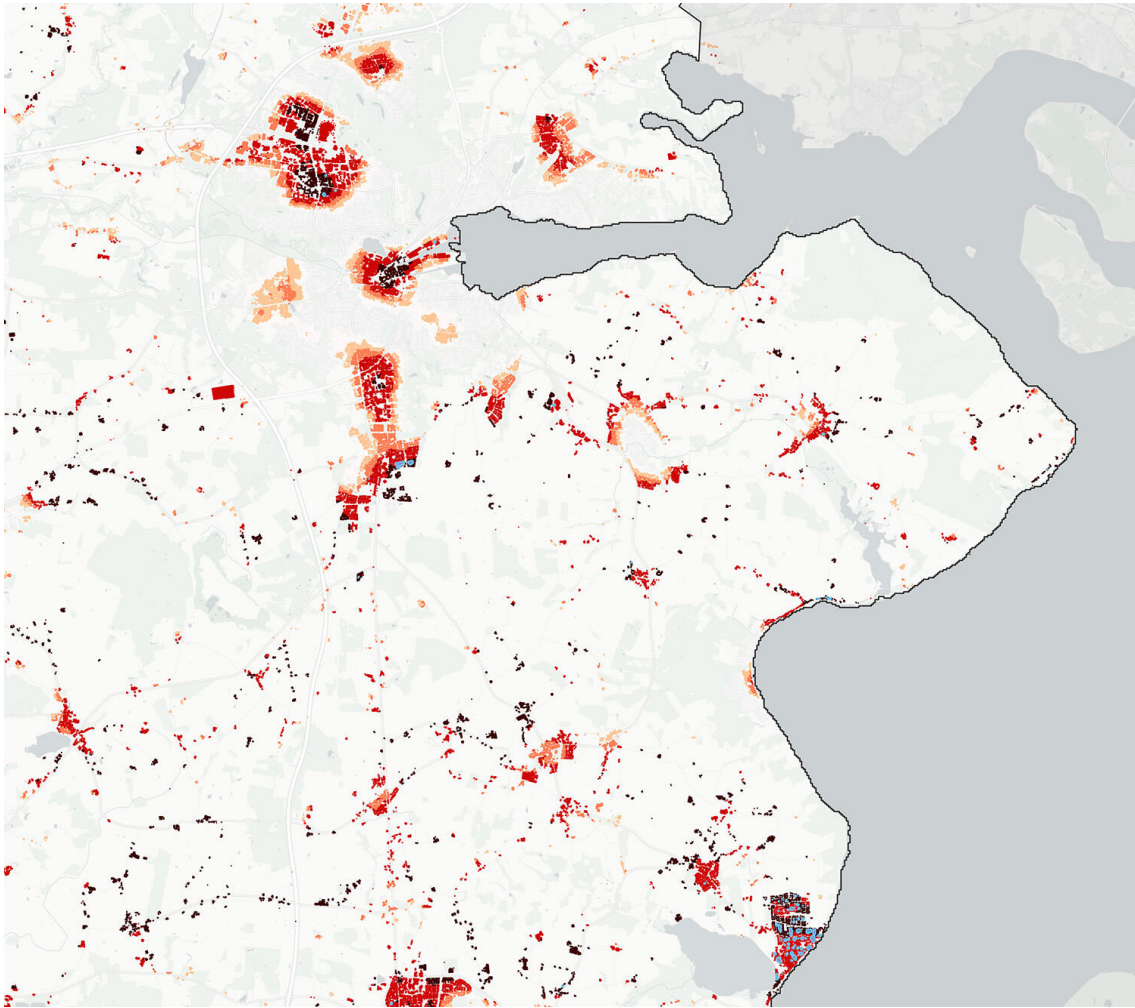


Figure 13. Gap analysis for Kolding, Denmark. Red buildings have a gap towards the 30-rule, and the intensity of the red-tone depicts the size of the gap. Blue areas mark focal areas, where planting trees has the most significant impact on fixing the gap.

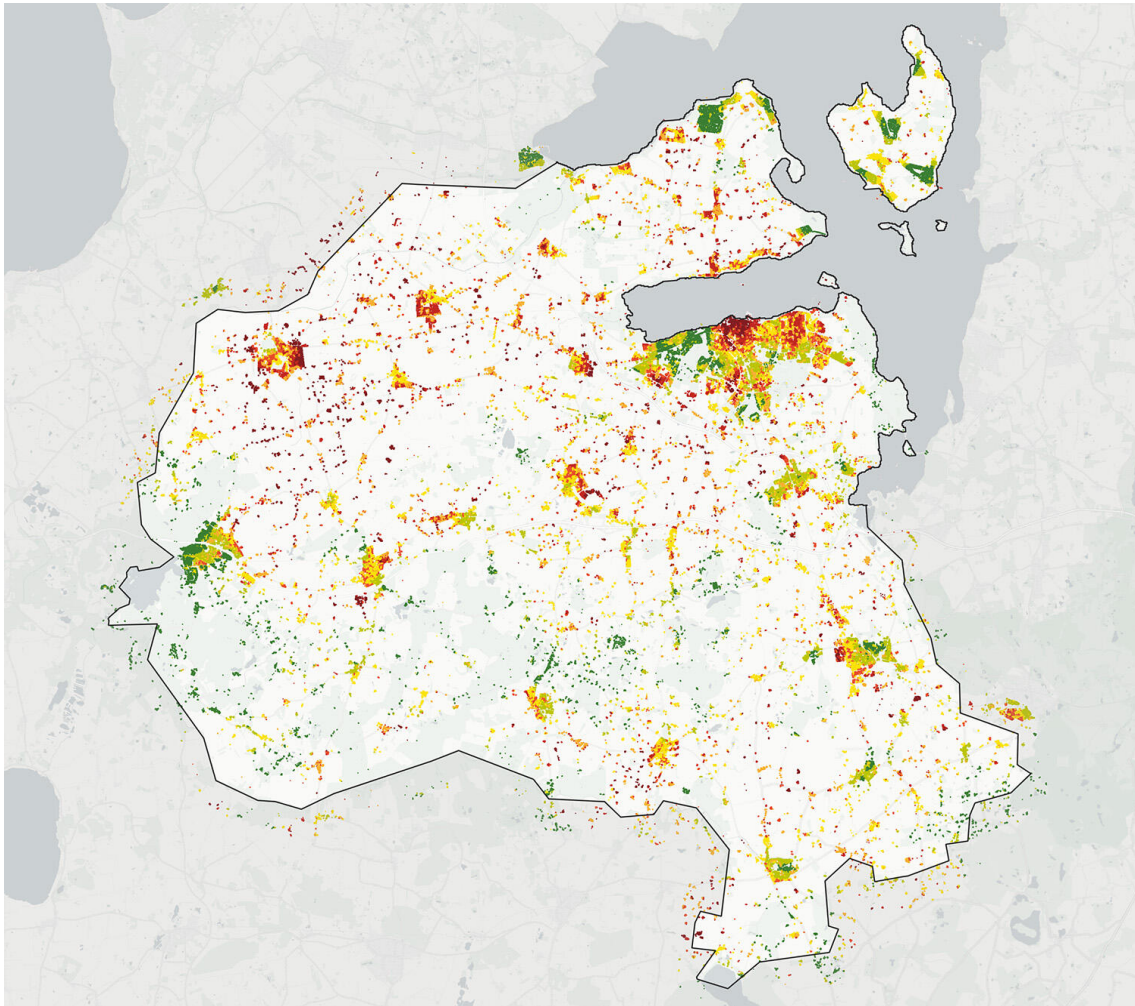


Figure 14. Overall 3+30+300-principle score for Holbæk, Denmark. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

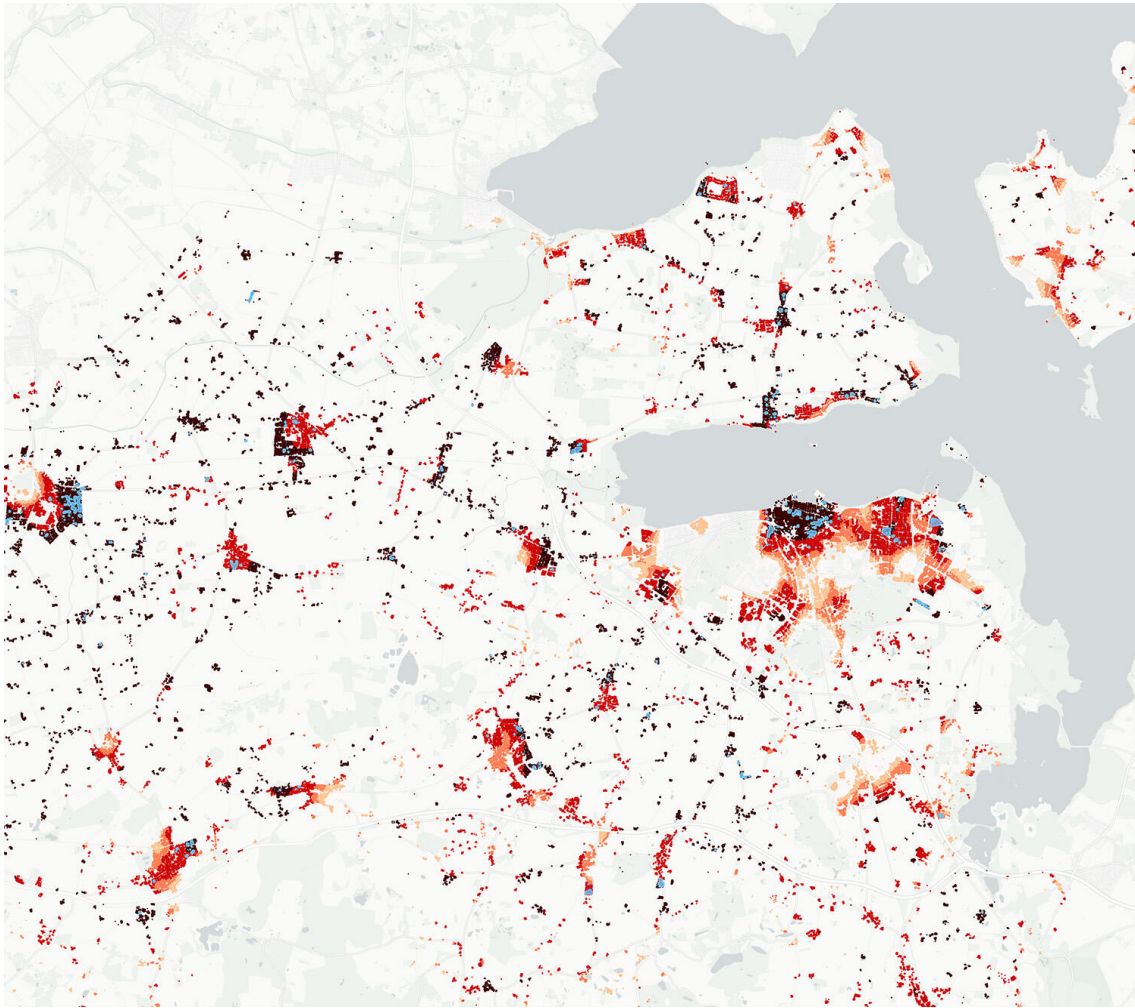


Figure 15. Gap analysis for Holbæk, Denmark. Red buildings have a gap towards the 30-component, the intensity of red depicts the size of the gap. Blue areas are focal areas for fixing the gap.

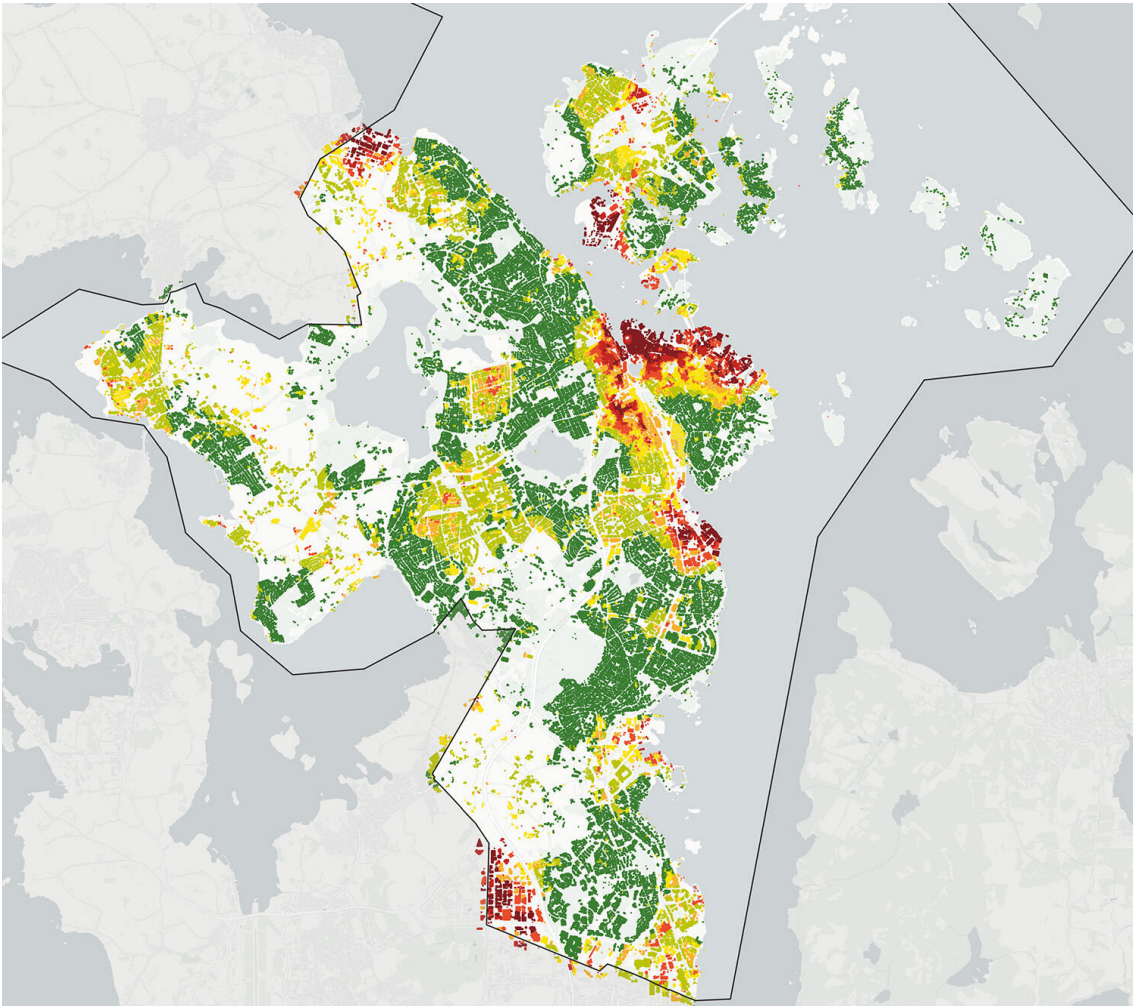


Figure 16. 3+30+300-principle map of overall scores for Stavanger, Norway. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

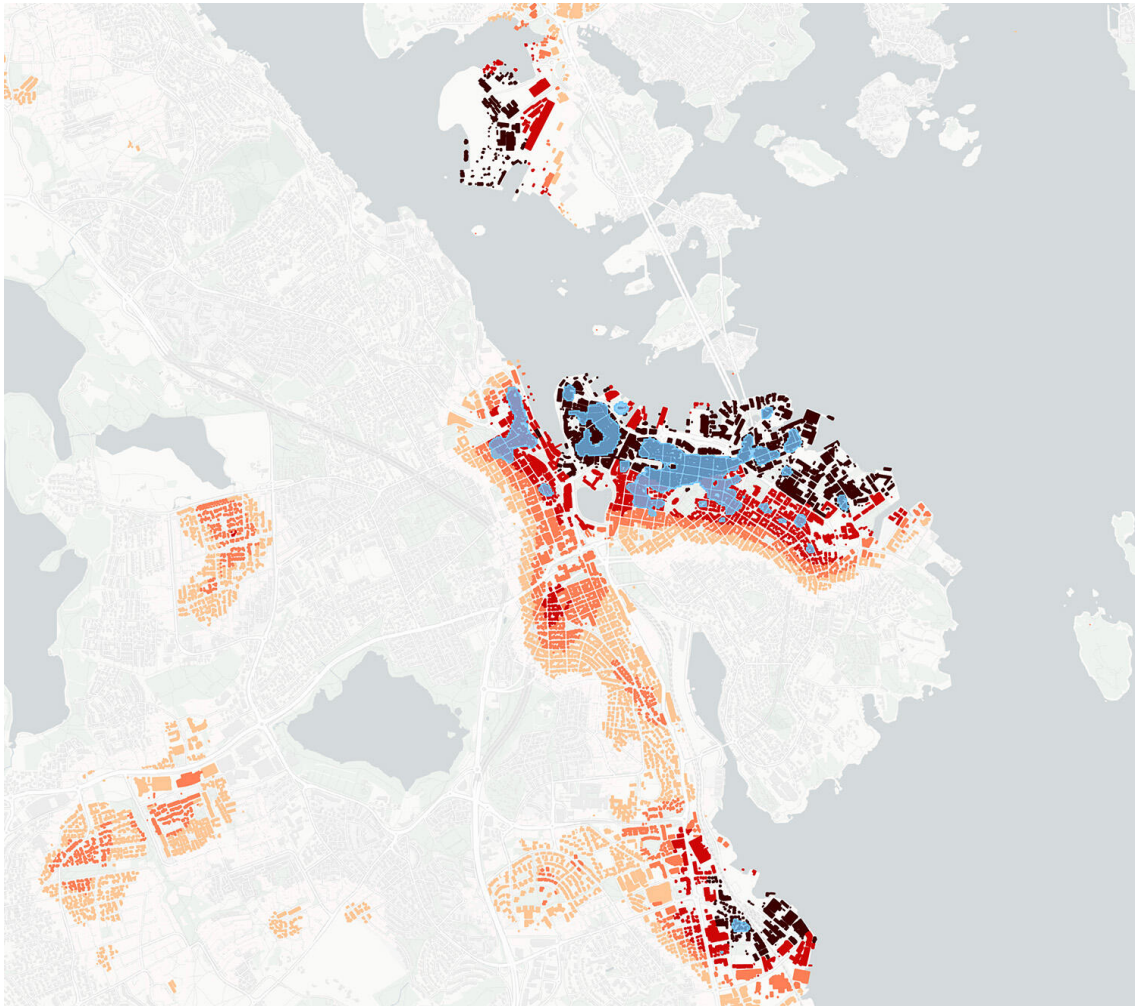


Figure 17. Gap analysis for Stavanger, Norway. Red buildings have a gap towards the 30-rule. The blue areas are focal areas for action.

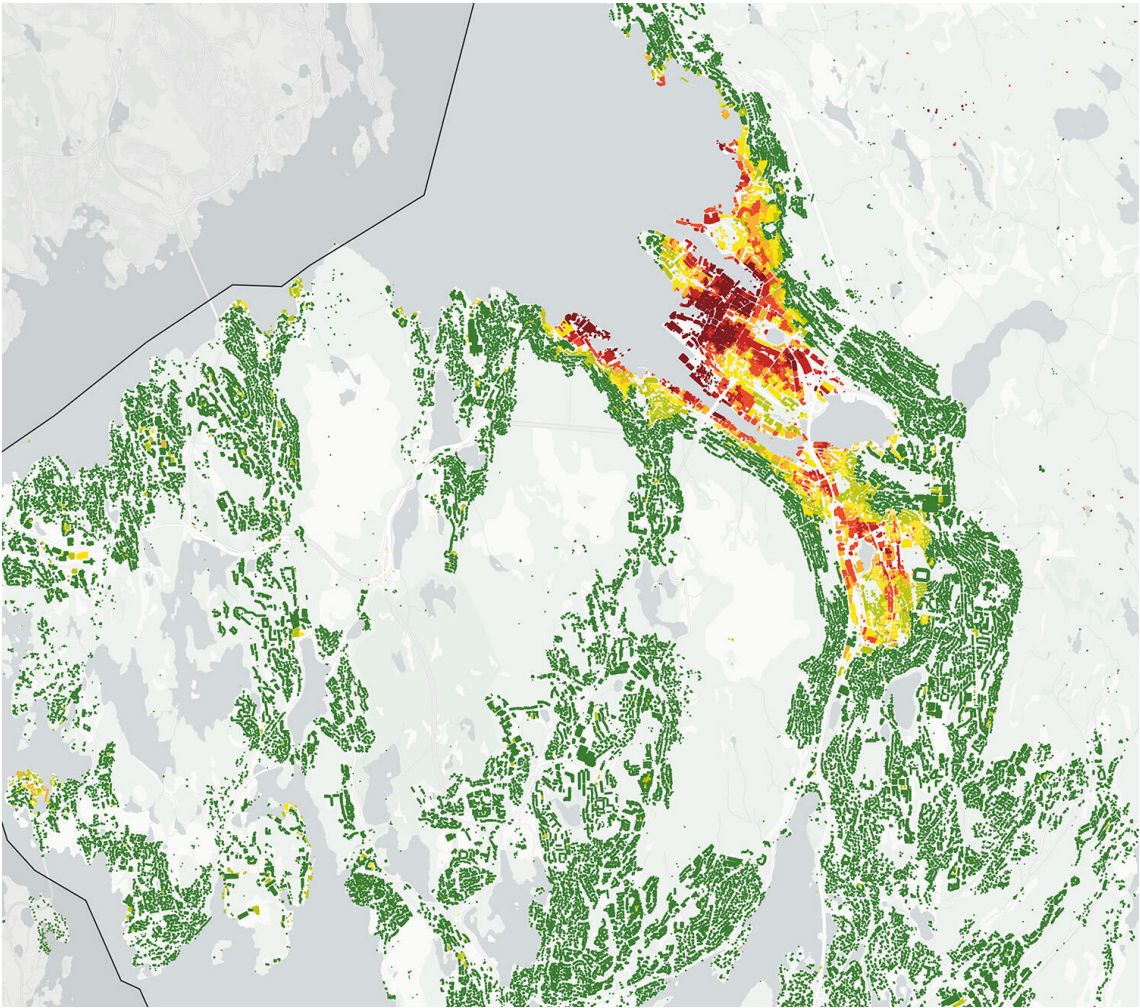


Figure 18. The 3+30+300-rule overall score for Bergen, Norway. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

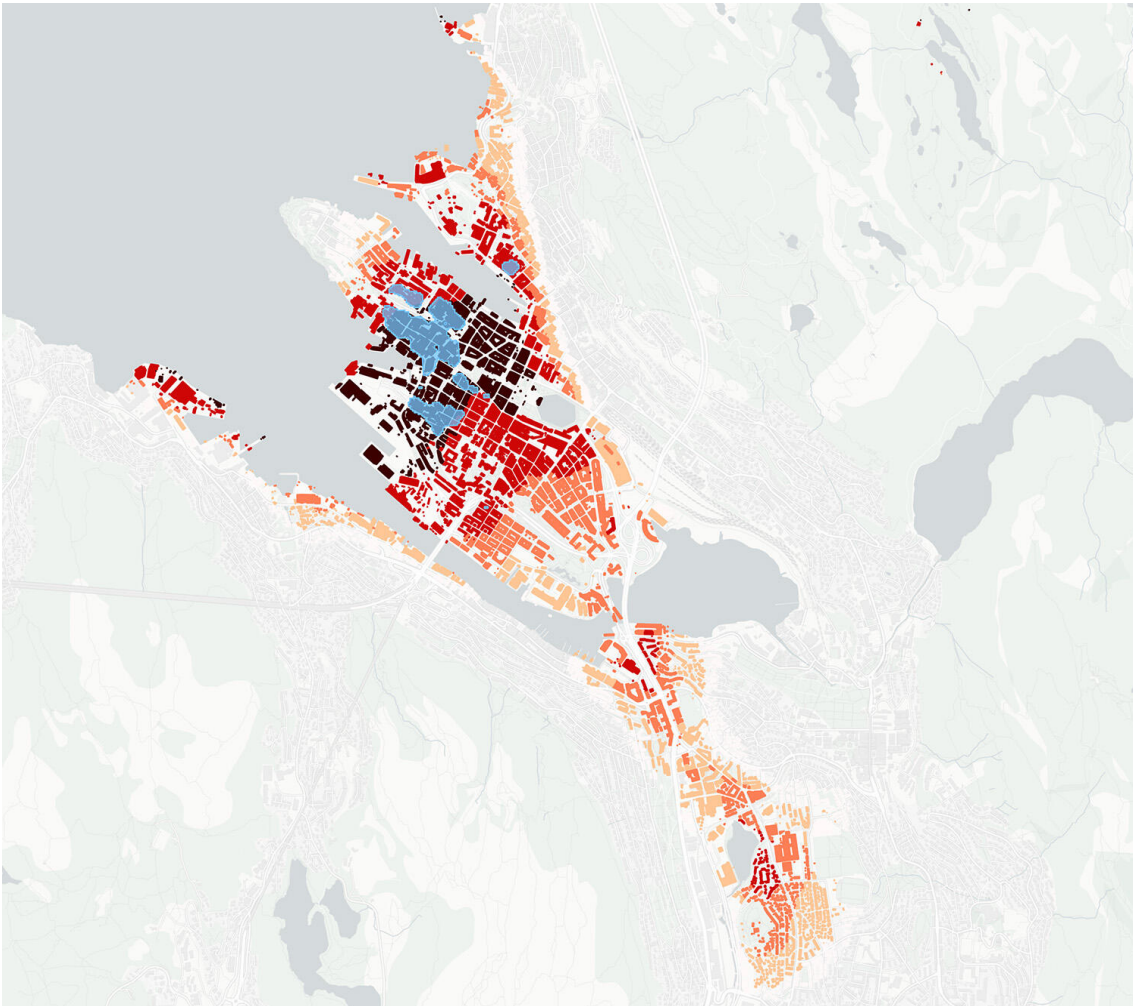


Figure 19. Bergen, Norway gap analysis. Red buildings do not adhere to the 30-rule, and show a gap. Fixing the blue regions will have the biggest impact on solving the gap problem.

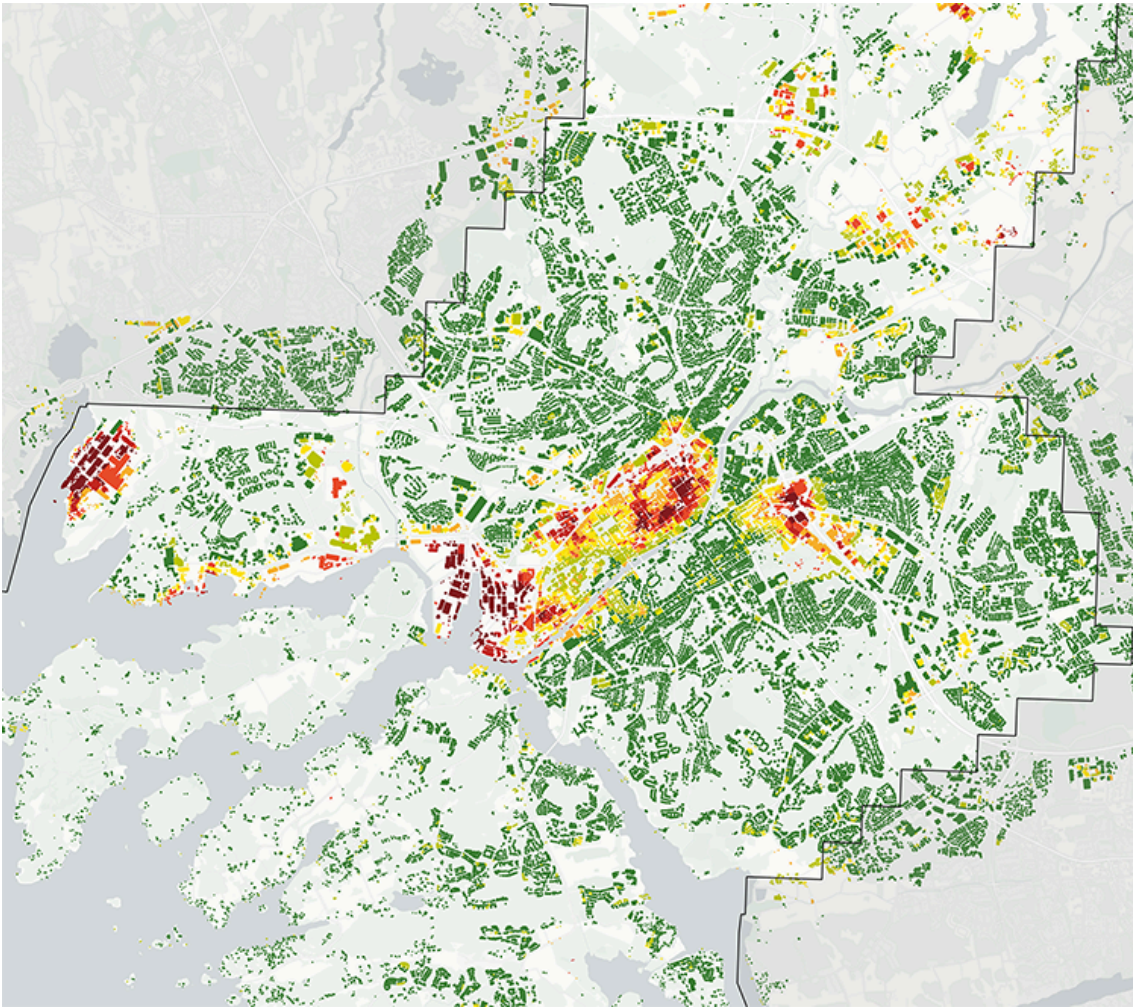


Figure 20. Overall 3+30+300 score map for Turku, Finland. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

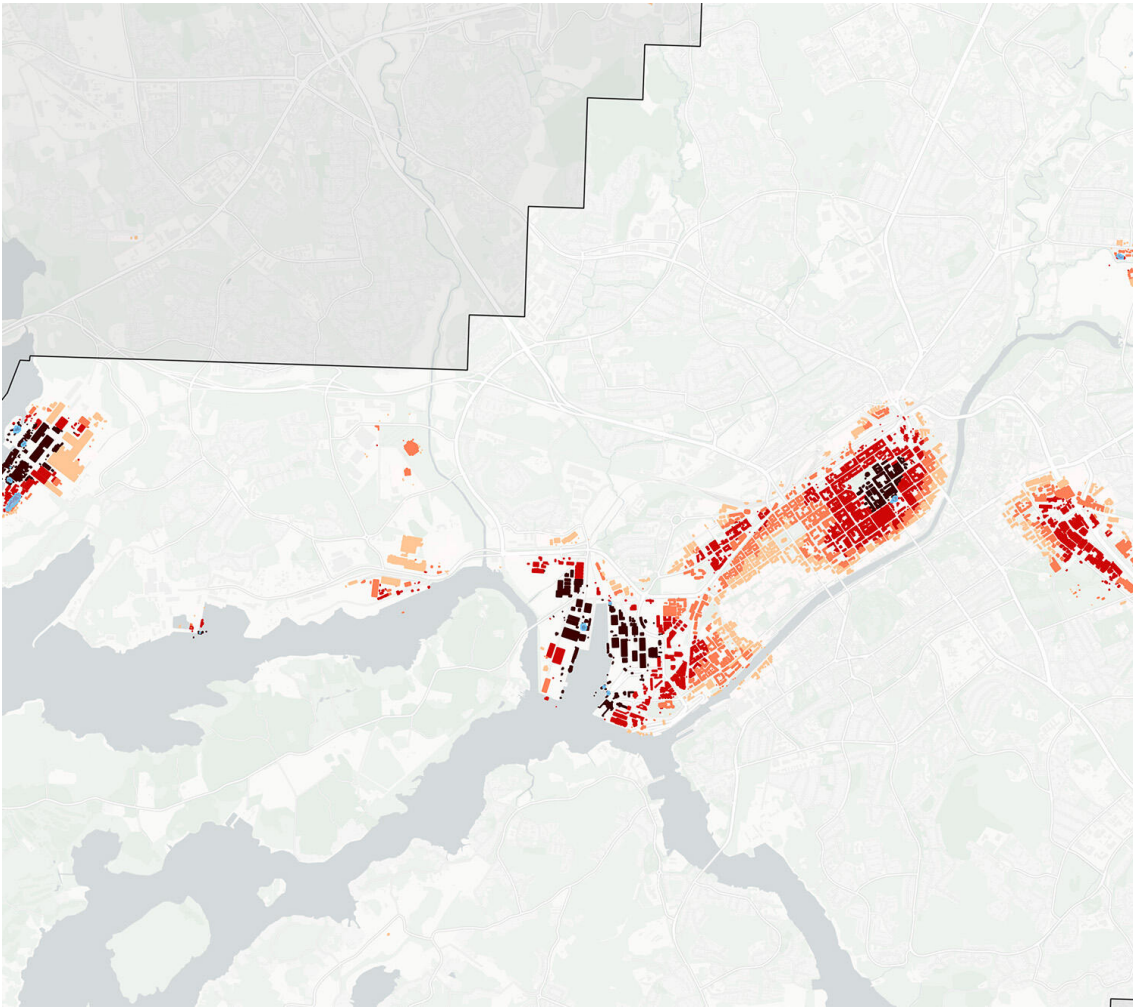


Figure 21. Gap analysis for Turku, Finland. Red buildings do not meet the 30-rule. The blue areas are focal areas for fixing the gap.

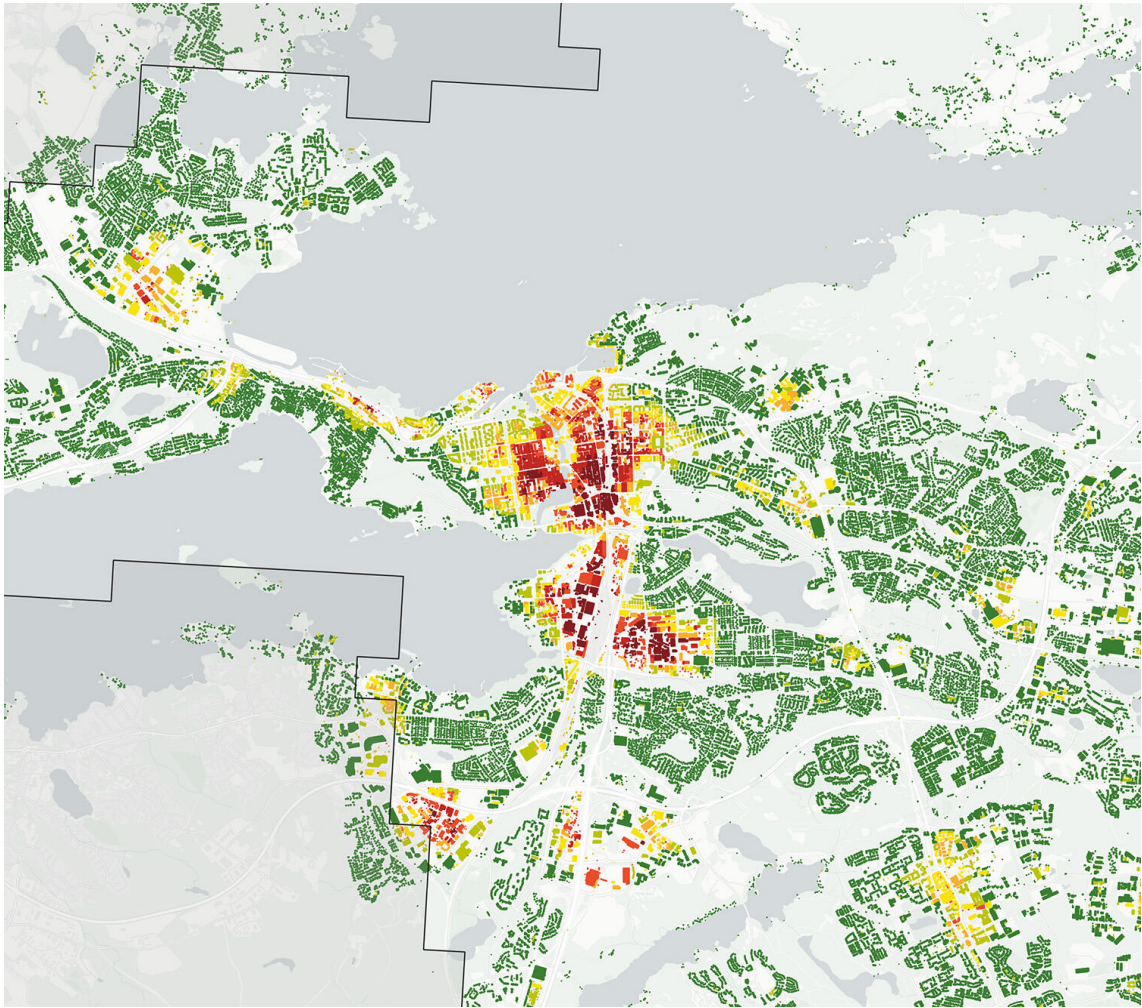


Figure 22. The overall 3+30+300 score for Tampere, Finland. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

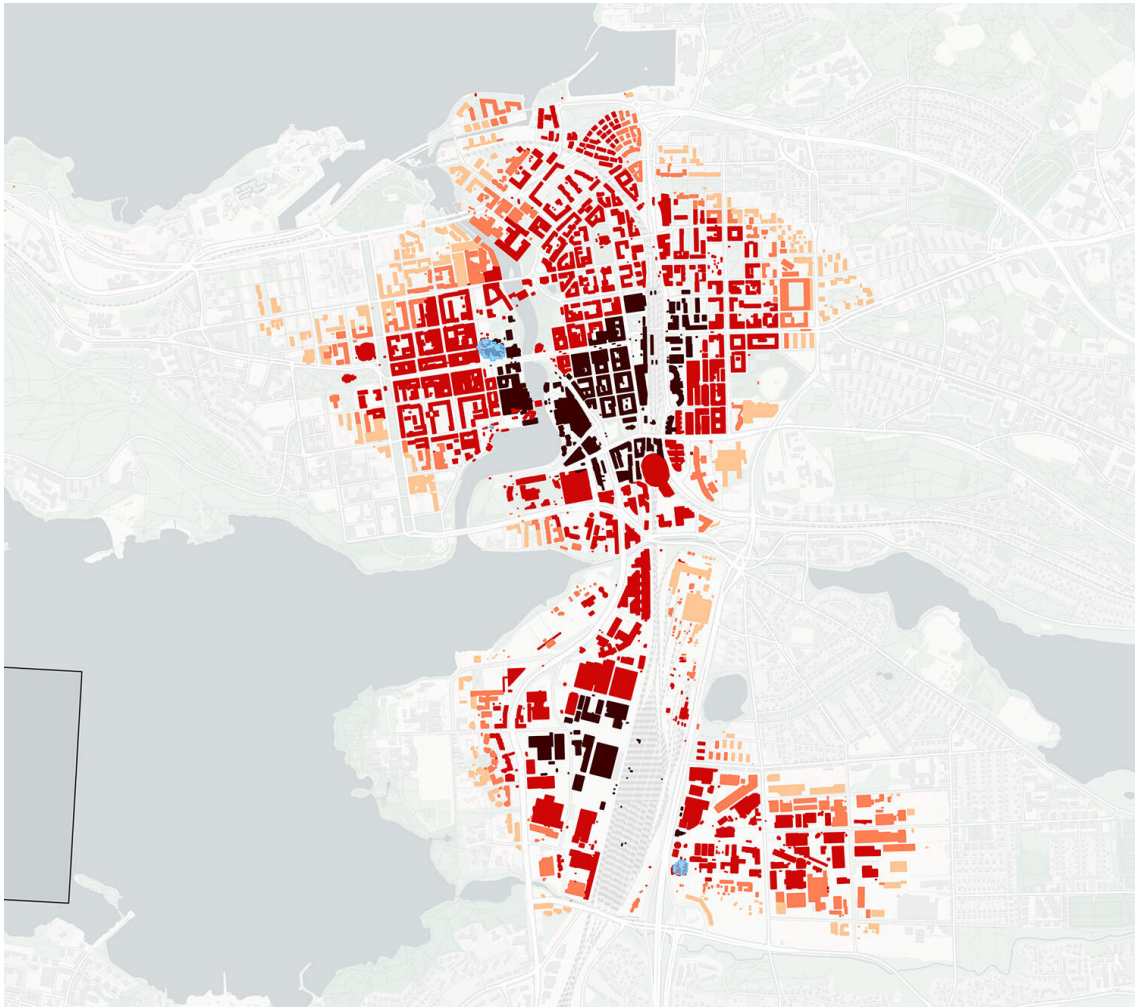


Figure 23. Gap analysis for Tampere, Finland. The red buildings require interventions in the canopy cover. Blue areas depict the focal areas where the biggest impact can be made.

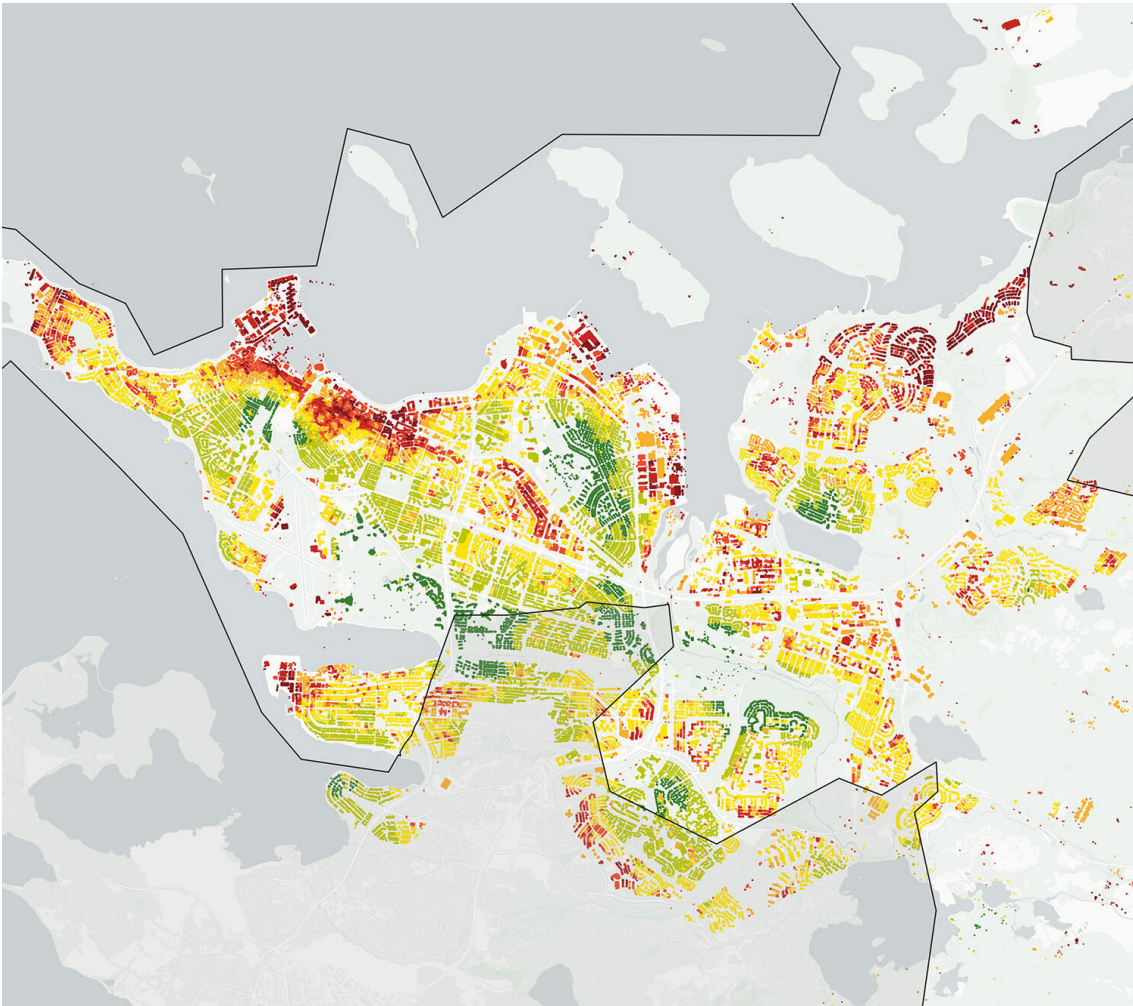


Figure 24. 3+30+300-principle presented as an overall score for Reykjavik, Iceland. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

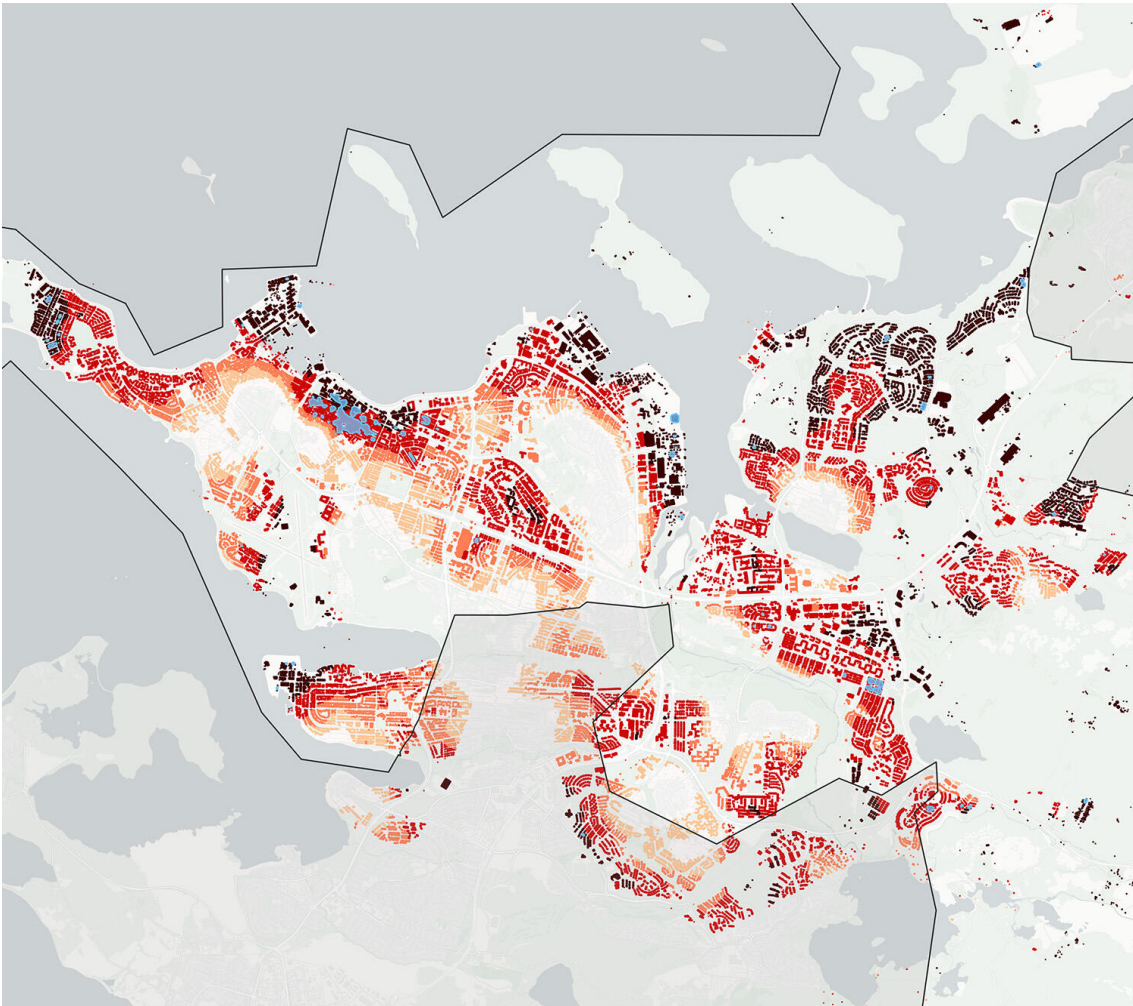


Figure 25. 30-component gap analysis for Reykjavik, Iceland. Red buildings require extra attention. The blue areas depict the zones where the effect on bridging the gap is the biggest.

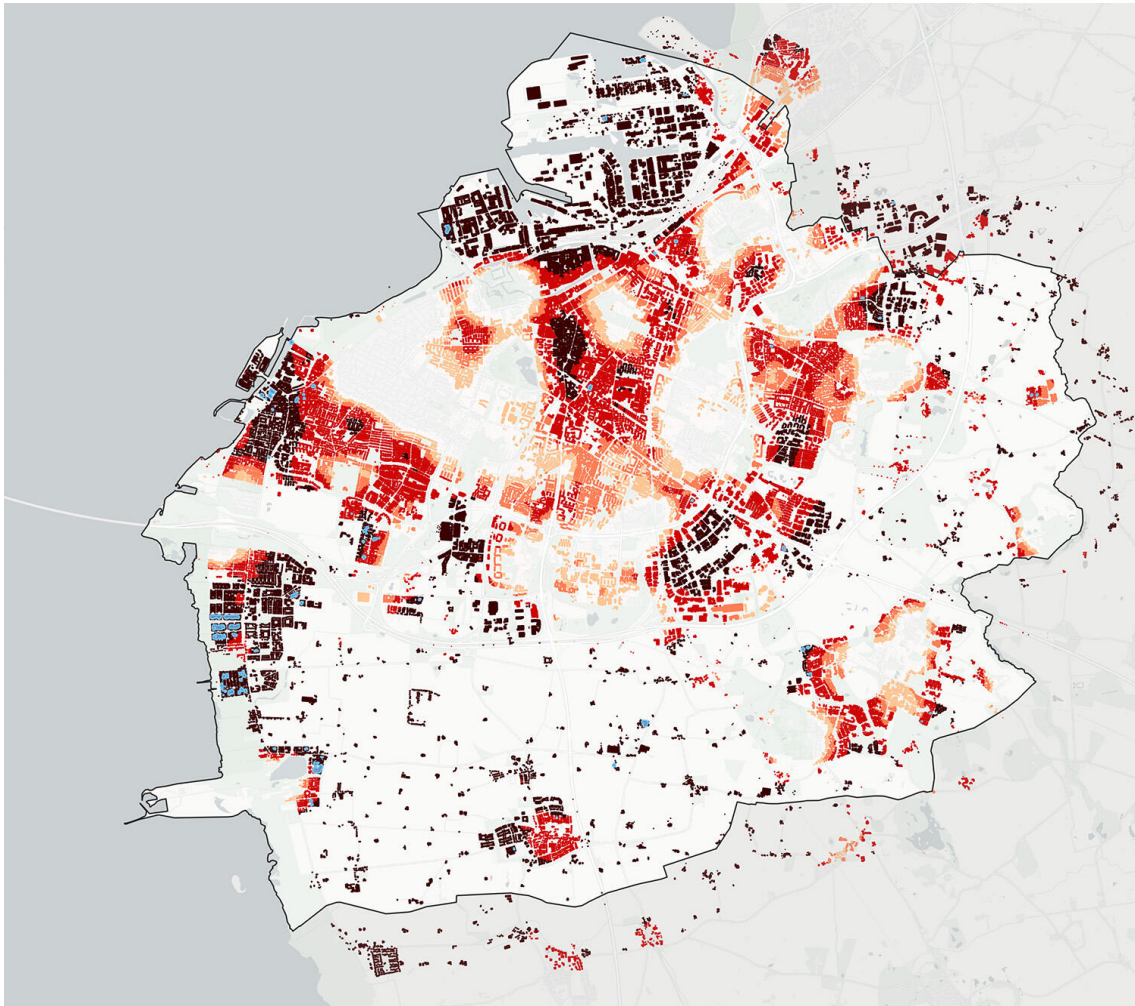


Figure 26. 30-component gaps analysis for Malmö, Sweden. Red buildings require extra care. The blue areas depict the zones where the effect on bridging the gap is the biggest.

These gap analysis maps were used during the second workshop with the participating municipalities (see also [Appendix A2](#)). Participants found the maps useful and agreed with many of the priority areas for greening and expansion of tree canopy cover, although they also disagreed with some others. In some cases there were logical explanations for 'blue' gap areas that did not require further action, such as the specific land-use type (industrial harbour areas) or the presence of other landscape qualities (location on a coast or river, presence of open cultural landscape with high recreational values).

Socioeconomic perspectives on urban trees

When working with the 3+30+300 principle and carrying out assessments and gap analyses as those presented in the previous section, it is important to keep in mind what trees and green spaces are supposed to achieve. Here it is also important to differentiate between communities with different socio-economic characteristics and associated different needs.

Urban trees and urban green spaces hold significant socioeconomic value, impacting various aspects of life. From improving public health and reducing pollution to contributing to economic growth, even access to urban trees and green space is crucial for environmental and social justice.

Key socioeconomic perspectives on urban trees include those of:

Public health and well-being

As discussed in the section on urban trees and health above, trees absorb pollutants like nitrogen dioxide (NO₂), sulphur dioxide (SO₂), and particulate matter, contributing to cleaner air (Nowak et al., 2002; Eisenmann et al., 2019). This has direct health benefits, particularly for vulnerable populations like children, the elderly, and people with chronic diseases, by reducing respiratory and cardiovascular illnesses (Lee, 2011; Kuo, 2015). Additionally urban forests and other green spaces have been shown to lower stress, reduce symptoms of anxiety and depression, and improve overall mental well-being (Kaplan et al., 1989; Bratman et al., 2015). Access to green spaces encourages physical activity, promoting healthier lifestyles (Sugiyama et al., 2008). Further, trees provide shade and cool the air through transpiration, mitigating the urban heat island effect (Oke, 1982; Bowler, 2010) – an important underlying argument for the 3+30+300 principle. The cooling effect of urban tree canopy reduces heat-related health risks. International research shows that particularly low-income neighbourhoods may be disproportionately affected by extreme heat (Chakraborty et al., 2019).

Economic contributions

Trees enhance the aesthetic appeal of neighbourhoods and streets, resulting in higher property values. Studies show that homes located near well-maintained trees or parks can see a rise in their market value by up to 10–20% (Crompton, 2001; Kardan et al., 2015). This is not necessarily only a positive impact, as higher property and rental prices can push out lower-income residents from neighbourhoods, known under the term 'green gentrification' (e.g., Anguelovski et al., 2022). Urban trees can reduce energy costs by providing natural shade, lowering the need for air conditioning in summer, and acting as windbreaks in winter. This translates into lower utility bills for residents and businesses (Hsieh, 2018; Sailor,

2008). Well-maintained urban forests attract tourists and provide recreation opportunities for residents, contributing to local economies (Crompton, 2001). Parks, botanical gardens, and tree-lined streets enhance the aesthetic value of cities, making them more attractive places to live and visit (Kaplan, 1985; Nasar, 1992). While there are several studies showing that green space also may reduce the need for health care, prescription medications, and associated costs (Becker et al., 2029; Buckley et al., 2022; Adewuyi et al., 2023), a systematic review by Patwary et al. (2024), indicated that many studies had a risk of bias and that factors related to healthcare accessibility may influence the relationship.

Environmental justice and equity

Based on studies on American cities and cities in the global south, research indicates that there is often an unequal distribution of urban trees, with wealthier neighbourhoods enjoying more tree cover than low-income or marginalised communities (Wolch et al., 2014; Lin et al., 2021). This disparity highlights environmental justice issues, where those who could benefit most from green spaces – due to higher levels of pollution and heat stress – often have the least access (Cruz-Sandoval et al., 2020; Woodward et al., 2023). This injustice is further articulated as trees help neighbourhoods become more resilient to climate change by reducing flood risks through better stormwater management. This is particularly crucial in underserved areas that are more vulnerable to environmental hazards (Maantay et al., 2010; Salmond et al., 2016). Additionally urban trees and parks offer social spaces that strengthen community ties, serve as gathering places, and foster a sense of belonging. They contribute to cultural identity and neighbourhood pride, particularly in urban areas with a high population diversity (Kuo, 2003).

Urban trees are not just a natural asset; they are socioeconomic drivers that enhance quality of life, contribute to economic vitality, and promote sustainability. Equitable access to green spaces, combined with strategic urban planning and community engagement, ensures that all city dwellers benefit from the advantages trees provide (Zang, 2017). Balancing the costs of tree maintenance with their long-term benefits is crucial for creating resilient, livable cities.

Socioeconomic status and vulnerability

To investigate socioeconomic perspectives on urban trees in the Nordic context we must first define what we mean with socioeconomic status and socioeconomic vulnerability. The term socioeconomic status is often linked to education level, income level, and employment. Educational attainment is often used to describe the socioeconomic position of a person or group in society. Education generally contributes to increased chances in professional life and thus also affects the income level of the individual or group (Folkhälsomyndigheten, 2021).

Socioeconomic vulnerability can be understood as the likelihood or risk of being harmed or exposed to stresses and little or no opportunity to adapt accordingly (Nikkanen et al., 2021). The concept can be applied to individuals and groups as well as to societies. Social vulnerability is linked to a susceptibility based on social, economic or political factors, and varies across social and geographical space. Social space refers to who is vulnerable, which is determined by economic, political and institutional factors, while geographical space refers to where an individual or group is vulnerable (MSB, 2021).

Socioeconomic status is an important determinant of health (EEA, 2018; Scientific Council for Sustainable Development, 2018; Public Health Agency of Sweden, 2021). In general, groups with low socioeconomic status are at increased risk of exposure to climate and environmental risks. These are groups that tend to live in poorer environmental conditions in terms of, for example, noise and air pollution (EEA, 2018), but also in areas that tend to get much warmer (Jensen Karlsson and Nuder, 2023). Temperature differences can be noted between areas with different socioeconomic status. Areas with dense buildings, a lot of impervious surfaces, large lawns and large roofs get much warmer, which according to a mapping carried out by the Swedish national public television broadcaster (Jensen Karlsson and Nuder, 2023) coincides with areas with socioeconomic challenges.

Nordic definitions of socioeconomic vulnerability

While the Nordic Region is often portrayed as sharing many similarities in culture and society, there is no standard or regional definition of what constitutes socioeconomic vulnerability. This poses challenges when it comes to analysing and understanding impacts of urban vulnerability on one hand, and access to green space and trees on the other. While Denmark and Sweden have official definitions and identify vulnerable areas based on official statistics, Finland, Iceland, and Norway do not. In Finland, there is generally an even distribution of wealth across the population (Nikkanen et al., 2021). Finland has been working on a policy of socially mixed housing for decades (Nordic Welfare Center, 2019) (Table 5).

A similarity with Sweden and Norway is that both countries are interested in areas where unemployment is higher and where fewer people are in education, while Denmark has a different focus on ethnic segregation (Nordic Welfare Centre, 2019). However, one concern is that a regional Nordic definition of socioeconomic does not exist.

Table 5. Summary of the different definitions of the term socioeconomic vulnerability between the Nordic countries.

Nordic definitions of socioeconomic vulnerability	
Denmark	Vulnerable areas ('udsatte områder') is an official term in Denmark, defined within the "Public Housing Act" ("Lov om almene boliger"). Denmark defines areas with socioeconomic vulnerability as vulnerable areas, parallel communities, transformation areas, and prevention areas. The areas are defined based on the percentage of residents who are non-Western immigrants as well as criteria of unemployment, criminal convictions, education and average gross income. Parallel communities are defined as areas that have more than 50% of residents who are immigrants or descendants from non-Western countries, as well as fulfilling all criteria as a vulnerable area and transformation areas are areas that have been designated as parallel communities for five consecutive years. (see more at bl.dk/viden-kartotek/udsatte-boligomraader (BL, undated). The Danish government has published an official list of vulnerable residential areas annually since 2010, with changes in the definition and/or terminology in 2013, 2018 and 2021.
Faroe Islands	The Faroe Islands do not have a formally defined concept of socioeconomically vulnerable areas. Like other small island communities, the Faroe Islands have regions where residents face challenges accessing essential services such as healthcare, education, and employment opportunities. While the Faroe Islands enjoy a relatively high standard of living, disparities can exist between different areas, particularly between more urban and rural locations, read more at the Faroe Islands official site for statistics and through the Nordic statistics database
Finland	In Finland, terms such as socioeconomically challenged areas or areas with a low standard of living describe areas where the population has poorer living conditions. Statistics Finland (Tilastokeskus) collects and analyses data related to unemployment, income and education, which is used to map socio-economic differences between different regions and neighbourhoods (stat.fi/index_en.html , undated)
Greenland	Greenland does not have a formalised definition of socioeconomically vulnerable areas. However, socioeconomic vulnerability in Greenland is often linked to broader issues related to poverty, unemployment, access to education, healthcare, and infrastructure, particularly in remote and rural communities. Key factors associated with socioeconomic vulnerability in Greenland include geographical isolation as many small settlements and villages in Greenland are geographically isolated, which can limit access to essential services such as healthcare, education, and employment opportunities. This isolation often exacerbates socioeconomic challenges. Read more the official statistical agency for Greenland stat.gl and the Nordic statistics database
Iceland	Iceland does not have a specific legal or governmental definition for socioeconomically vulnerable areas. However, the country does recognize socioeconomic vulnerability in its broader policies regarding poverty, housing, and welfare. Read more at oecd.org/en/countries/iceland.html , Iceland's National Statistical Agency (statice.is) and the Icelandic Ministry of Social Affairs (stjornarradid.is).
Norway	Norway does not use a formal definition of 'socioeconomically disadvantaged area' like Sweden or Denmark but there is extensive analysis of areas with socioeconomic challenges through various indicators such as unemployment, income levels, and education levels. Statistics Norway (SSB) collects data on such factors to map and analyse living conditions in different areas. 'Levekårsutfordringer' (living condition challenges) is a term often used in Norway to describe areas with high unemployment rates, low income, low education levels and high levels of welfare dependency. The Norwegian government has initiated various programmes to support these areas, for example through 'Områdeløft' and other urban renewal initiatives.
Sweden	Vulnerable area is a term used by police authorities in Sweden since 2015. They define vulnerable areas as "[...] geographically defined places with low socioeconomic status and where criminals have an impact on the local community." (Polisen, 2023). However, it is unclear what is meant by low socioeconomic status. These areas are divided into three categories: vulnerable areas, risk areas, and particularly vulnerable areas. A vulnerable area is characterised by low socioeconomic status defined as low levels of education, high unemployment, and economically vulnerable households. A study from 2019 shows that more than 13% of households in vulnerable areas receive some form of financial assistance, the unemployment rate is roughly doubled and 7.9% of residents in vulnerable areas are openly unemployed, compared with the 3.1 average. Households are larger, averaging 2.5 people per household compared to the national average of 2.2. (Global village, 2017)

3+30+300 and socioeconomic parameters in the Nordic context

As seen earlier in Table 3, on the city level, the Nordic cities generally score high on the 3+30+300 principle, although reaching 30% tree cover represents a common challenge. Within the cities, there are significant differences between parts of the cities linked to how the built environment is designed.

Locations where the cities have developed play a major role in the appearance and conditions of their urban green space. Proximity to water and harbours has had a significant impact on where cities are located in the landscape, but the surroundings affect how much and where the public green structure is. In Denmark as well as in southern and central Sweden, many cities are located in agricultural landscapes, which means that the availability of trees and publicly accessible green spaces is generally higher in the cities than in the surrounding areas. Holbæk, Kolding, and Malmö are all examples of cities that are largely surrounded by agricultural land, and where agricultural land has been claimed as the cities have grown. The growth of the cities has, in many parts, meant that more trees have been planted than if the land had continued to be farmed, even if high nature values linked to field mounds and ditches have disappeared. Umeå in northern Sweden, on the other hand, is surrounded by forest, which means that natural land and trees have been claimed as the city has grown. Stavanger and Bergen are located in a fjord landscape where large differences in altitude and proximity to the sea have contributed to the compact growth of the cities, where forests and nature are located close to the city boundaries, and green areas that have been utilised as the cities have grown.

To investigate the Nordic dimension of socioeconomic vulnerability, and trees and green space data on employment rate, income, educational level, ethnicity and public health has been compared to the fulfilment of the 3+30+300 principle. Based on data availability, Malmö has been used as an in-depth case study. In the remaining network cities, areas defined as vulnerable or areas identified as facing socioeconomic challenges have been used to analyse local dimensions of how socioeconomic parameters correspond to green space and tree availability.



Photo 13. Large trees close to buildings in the Rosengård district of Malmö, Sweden (photo by Wösel Thorensen).

Nordic cities

Results of the analysis of the nine Nordic cities participating in the Yggdrasil project show that the correlation between access to urban trees and green space and socioeconomic vulnerability needs a contextualised understanding. Vulnerable areas have been identified using official sources but differ in how they are defined and which data is used. Malmö is used as an in-depth case study below but common traits are found in a majority of the cities.

Case study Malmö

Although many Nordic cities generally score high on the 3+30+300 principle, Malmö, due to the city's dense urban form and being surrounded by agricultural land and the sea, has significant challenges reaching acceptable levels of all three components (Figure 27).

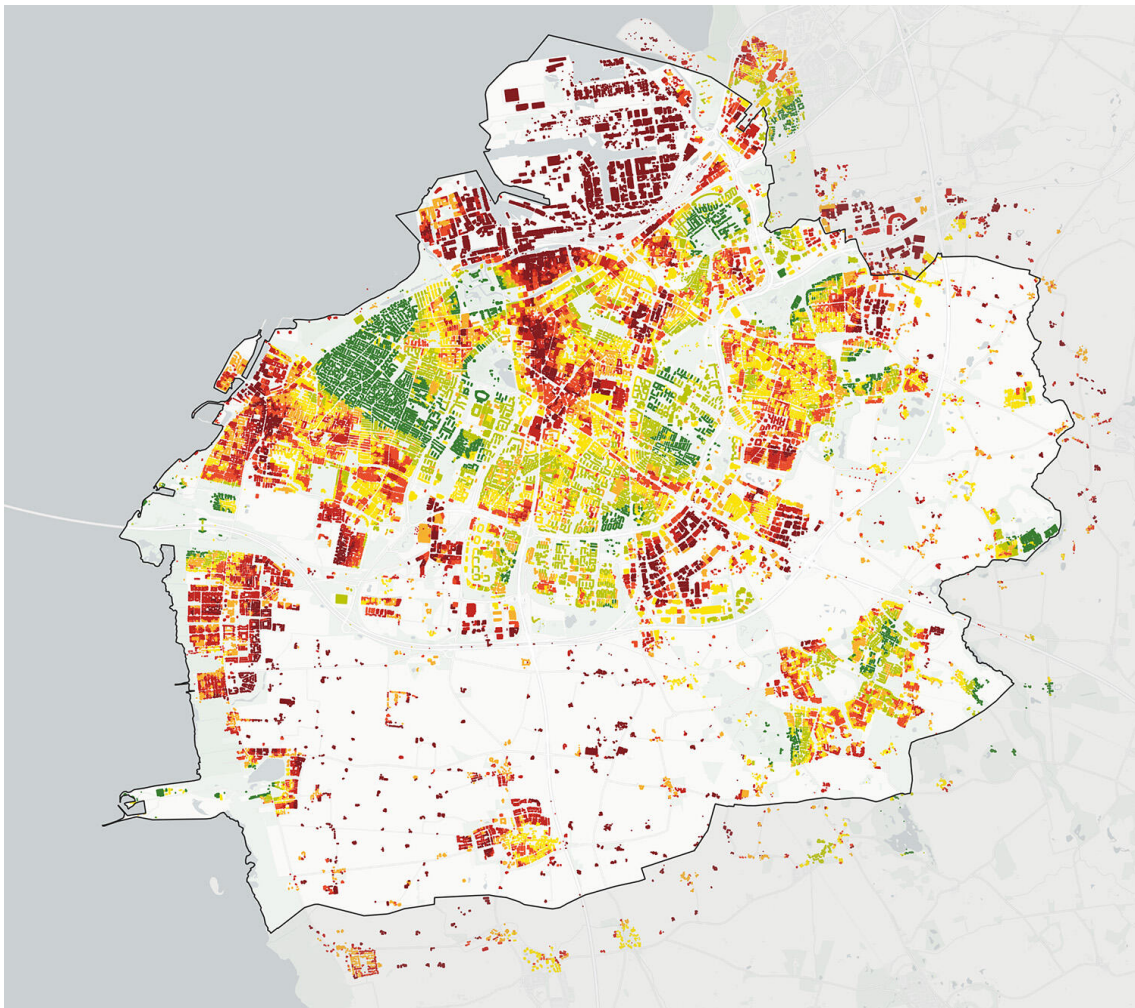


Figure 27. 3+30+300-rule overall score per building in Malmö, Sweden. Yellow and green colours indicate buildings and areas with positive 3+30+300 scores, orange and red tones depict scores that are too low.

In Malmö much of the inner city as well as harbour and industry areas have substantial challenges and the dense urban form in the central parts makes it difficult to find space to add trees.

To investigate the relationship between green space on the one hand, and on the other tree access and socioeconomic variables data on employment rate, median income, proportion of population with first and second generation migrants (here defined as born outside of Sweden or has two parents born outside Sweden) as well as number of sick days has been compared to the results of the 3+30+300 analysis. Additionally, three areas in Malmö are defined by the Swedish police as vulnerable (Table 5). These are marked with black outlines in the maps below (Figures 28–31).

Employment ratio

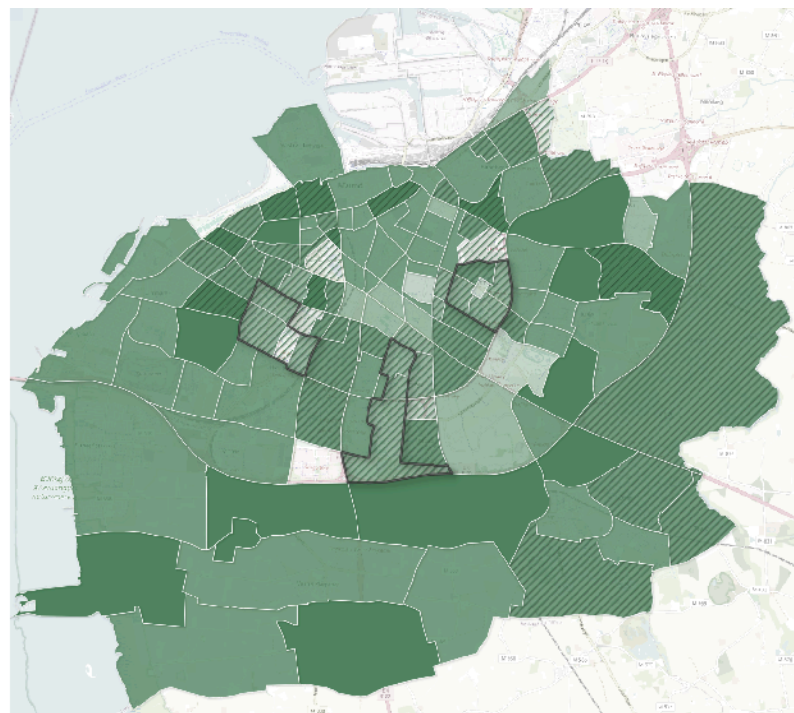
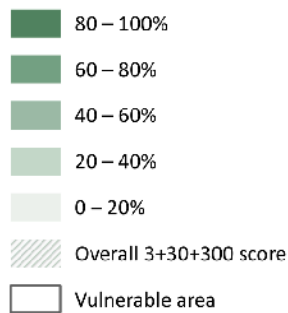


Figure 28. Map showing employment rate in % as well as the threshold for acceptable level of 3+30+300 (i.e. overall score over 6 out of 10). The areas defined by the Swedish police as vulnerable are framed in black.

Mean yearly income (thousand, SEK)

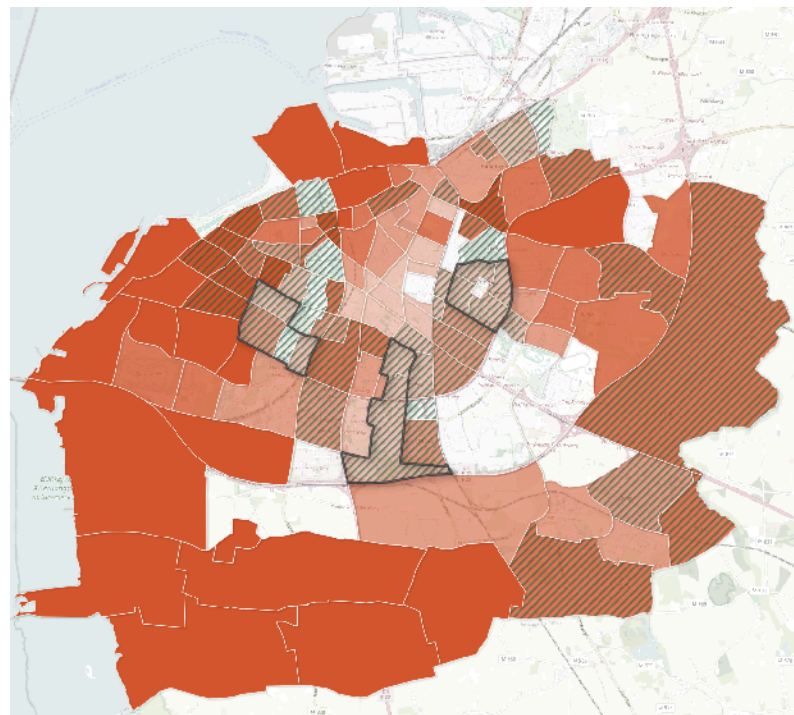
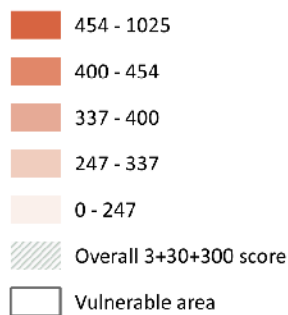


Figure 29. Map showing mean yearly income as well as the threshold for acceptable level of 3+30+300 (i.e. overall score over 6 out of 10). The areas defined by the Swedish police as vulnerable are framed in black.

Looking at both employment rate and mean yearly income, areas that score acceptable on 3+30+300 can have both high and low scores on these socioeconomic aspects (Figure 29). Additionally, the three defined vulnerable areas in Malmö score relatively low on both these factors. As the maps above show, there is no visible relationship between these parameters of socioeconomic vulnerability and access to green space or trees.

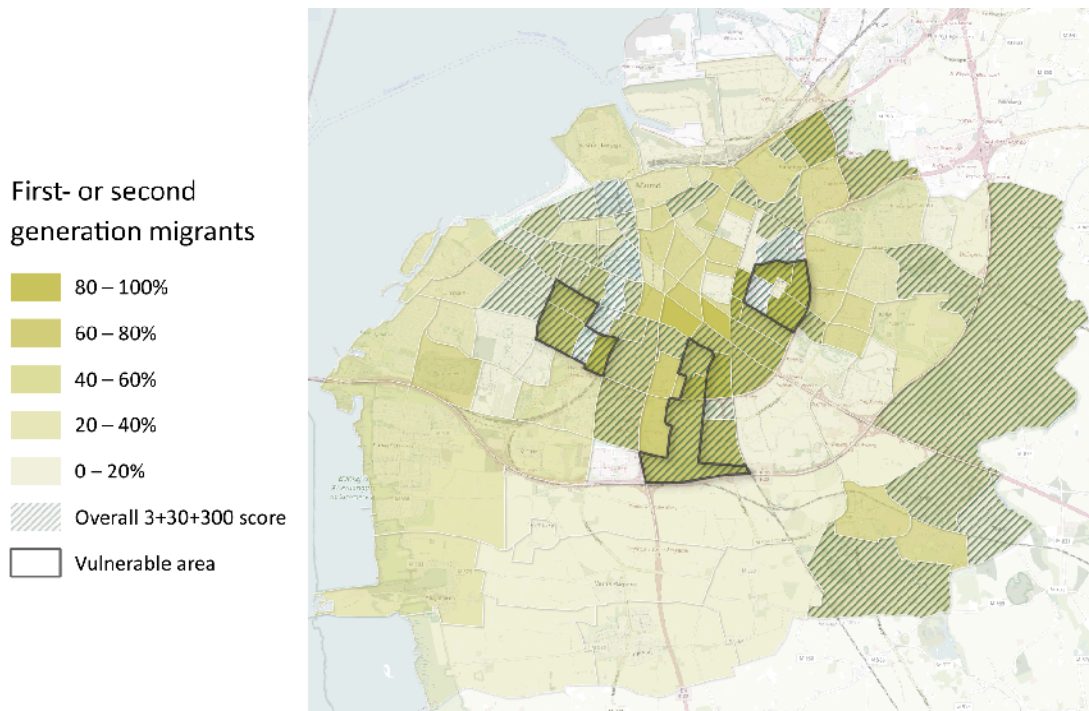


Figure 30. Map showing mean yearly sick days rate as well as the threshold for acceptable level of 3+30+300 (i.e. overall score over 6 out of 10). The areas defined by the Swedish police as vulnerable are framed in black.

For yearly sick days, a majority of the areas that score high on this variable also have an acceptable 3+30+300 level (Figure 30), indicating that health correlates to the socioeconomic parameters rather than green space accessibility in Malmö.

Mean yearly sick days

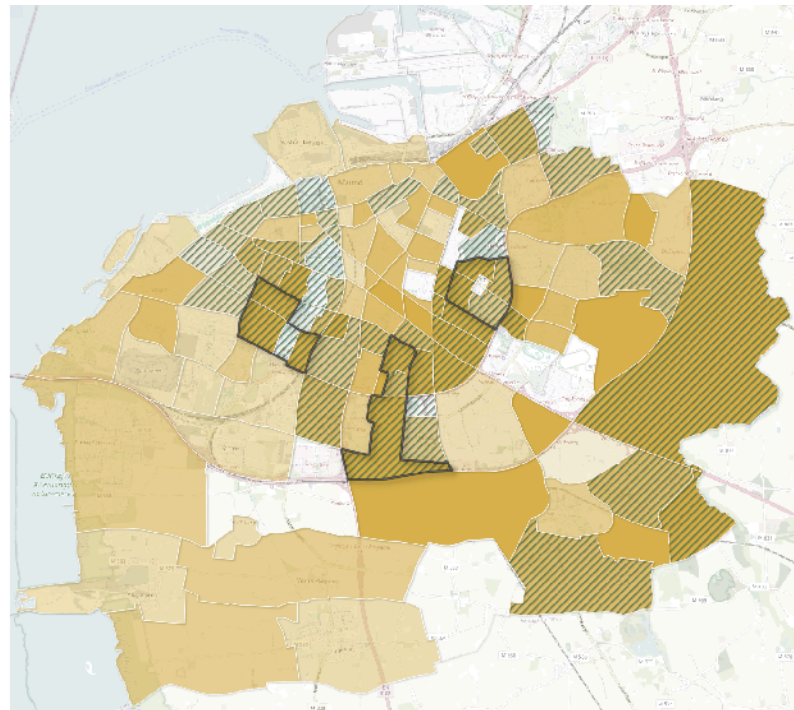
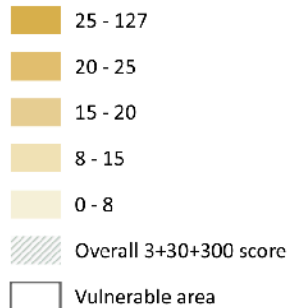


Figure 31. Map showing percentage of first and second generation migrants as well as the threshold for acceptable level of 3+30+300 (i.e. overall score over 6 out of 10). The areas defined by the Swedish police as vulnerable are framed in black.

For ethnicity, here measured by the presence of first or second-generation immigrants, areas with a high percentage of immigrants also reached an acceptable level of 3+30+300 (Figure 31). In Figure 32 below the result has been plotted showing the percentage of first and second generation migrants on the y-axis and the 3+30+300 school note on the x-axis. The results show a tendency that areas with a high share of migrants also have a good fulfilment of the 3+30+300 rule. The calculated r-squared is 0.05. Please note, however, that although linking ethnicity and cultural background to canopy cover and green space provision is common in e.g., North America and the United Kingdom, this is a much more contentious issue in the Nordic Region and should always be handled with great care.

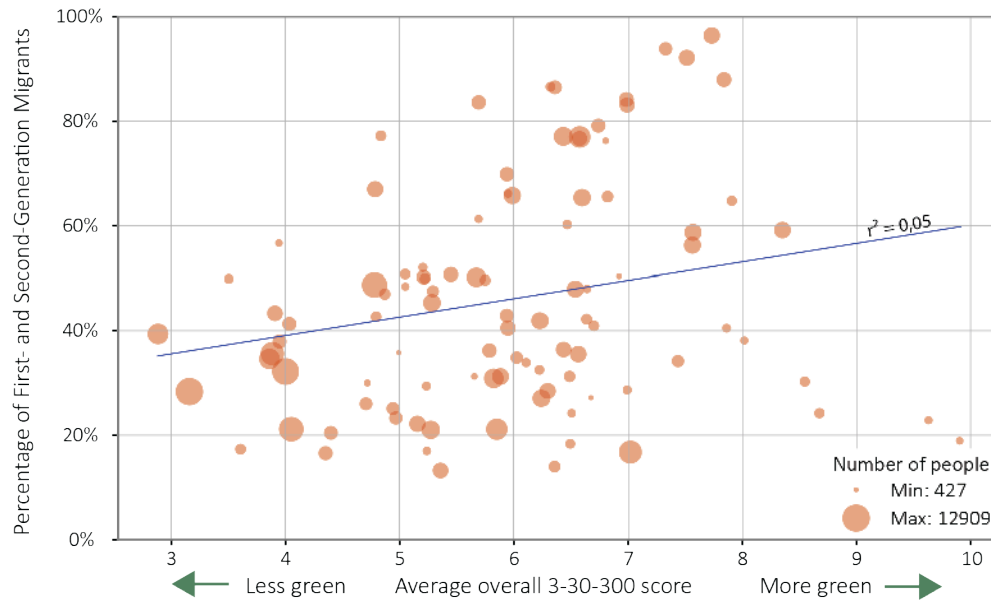


Figure 32. Correlation between share of first and second generation immigrants and the 3+30+300 school note for Malmö, Sweden.

Table 6. The 3+30+300 overall score for Malmö as a whole and the three areas defined by the Swedish police as vulnerable.

	Overall score	Mean number of trees seen from each building	Percentage tree cover	Mean distance to green space (m)
Malmö (city wide)	6.3 (standard deviation 1.62)	15.0	18.7	100.0
<i>Nydala/ Hermosdal/ Lindängen</i>	6.5	16.0	23.3	47.5
<i>Holma/ Kroksbäck/ Bellevuegården</i>	7.1	23.4	26.5	55.4
<i>Rosengård</i>	7.5	40.0	28.9	49.4

Looking at the numbers, Table 6 lists the overall score, mean number of trees seen from each building, the percentage of tree cover, and the mean distance to a public green space for Malmö and the three defined vulnerable areas. The vulnerable areas score better on all parameters than Malmö as a whole. This paints a different picture than the usual negative correlation between tree canopy cover and green space access on the one hand, and higher vulnerability of local communities on the other found in international studies (e.g., Astell-Burt et al., 2014; Cusick, 2022; Konijnendijk, 2022).

As seen in the current adherence to the 3+30+300 rule section above, Nordic cities generally score high, and this is also evident in socioeconomically vulnerable areas as shown here in Malmö. Ongoing research at the Swedish University of Agricultural Sciences (slu.se, 2024) working with developing new methods to assess environmental justice in relation to green space and socioeconomic status shows preliminary results similar to the Yggdrasil analysis. By combining tree cover, square metres of green space per resident, and distance from home to green spaces, and by focusing on the socioeconomic aspects income per household, age dependency ratio (i.e., share of household dependent on the income of family members such as children and elderly), education level, and employment rate, the project shows that the city don't have a major problem with the inequitable distribution of greenery.

In the analysis below, looking at the other 8 cities in the Yggdrasil project, similar results can be found. While there are studies showing more conventional results of environmental justice in Oslo (Venter et al., 2023) the results in the Yggdrasil project indicate that the relationship between socioeconomic vulnerability and green space and urban trees has a Nordic dimension that requires further study and consideration in planning and policy. Further, it is crucial to note that this analysis does not take into account the quality of local green spaces, and their use and appreciation by local communities.

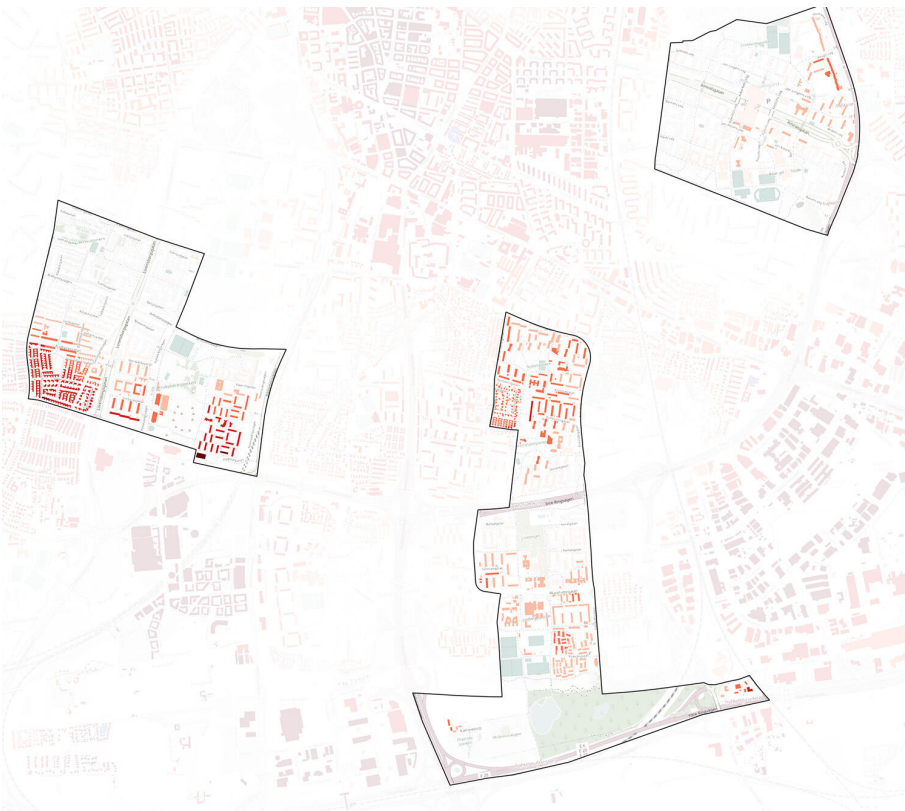
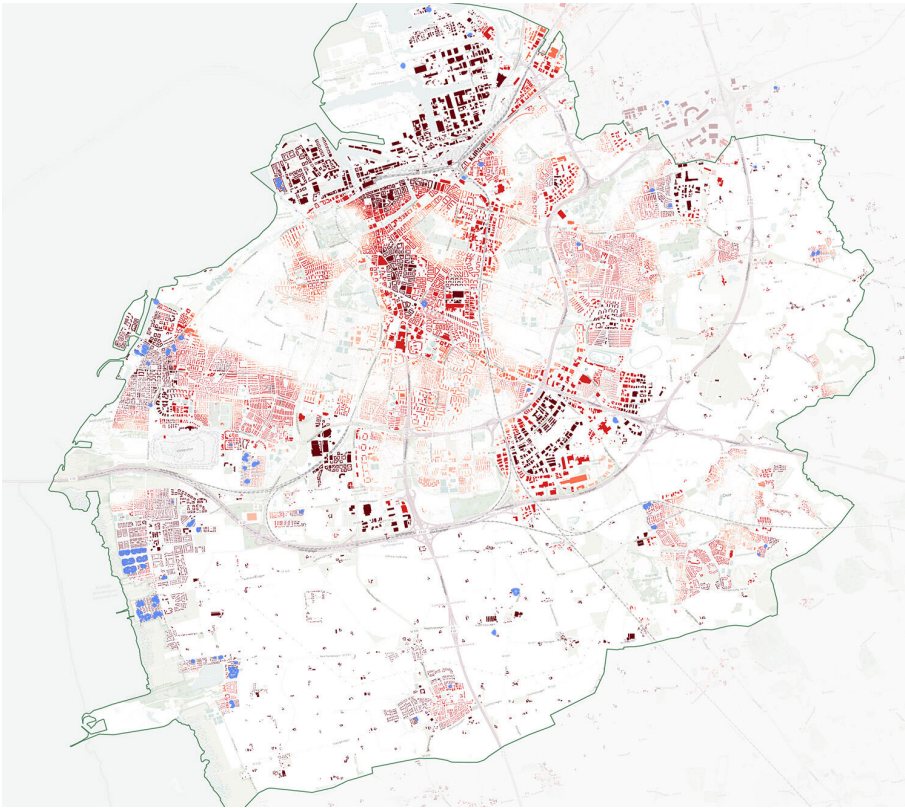


Figure 33. Gap analysis on the 30-rule for Malmö and gap analysis showing the defined vulnerable areas.

The defined vulnerable areas scores are all below 30% tree cover, ranging between 23.3 and 28.9. Although this shows a deficiency of trees, they do not represent the areas where the largest gaps are, and as these are areas with a high share of open space new trees could be planted to reach the 30% score (Figure 33).

Vulnerable areas and green space in the case cities

Table 7 provides an overview of local areas that are defined as vulnerable in the participating municipalities. As can be seen, municipalities use a wide range of definitions and approaches.

Table 7. Overview of local areas in the participating municipalities that are defined as vulnerable.

Vulnerable areas in the participating municipalities	
Bergen	According to the Bergen municipality public health overview residents in Bergen experience a good quality of life, but there are differences related to age, level of education, and place of residence. While living standards in international comparison are high, there is a tendency towards a geographical accumulation of factors that have a negative impact on health. An overall index shows that the challenges in Bergen are greatest in Solheim South, Loddefjord, Solheim North, Ytre Arna, and Gullfjellet North (Bergen Municipality, 2024).
Holbæk	In Holbæk, Agervang/ Grønneparken is identified as a prevention area (BL, undated).
Kolding	In Kolding the area Skovvejen/Skovparken is defined as a vulnerable area as well as a parallel society and transformation area, being the worst category in the Danish classification system. Munkebo is defined as a prevention area, pointing out that the area has socioeconomic challenges (BL, undated).
Reykjavik	Reykjavik, faces certain socioeconomic challenges, despite the country's overall high standard of living. Reykjavik has experienced a housing shortage in recent years, particularly after the 2008 financial crisis. Property prices and rents have surged, leading to a significant strain on low-income families and young adults, especially in central areas. This has pushed many residents to seek housing further away from the city centre, contributing to social segregation. Vulnerable groups often struggle to access affordable housing, which exacerbates socioeconomic issues. Breiðholt is one of Reykjavik's largest and most socioeconomically diverse areas but has a higher concentration of social housing, and a significant immigrant population, which has faced challenges related to unemployment, language barriers, and income disparity. The area has also been the focus of social welfare and community engagement projects by the city to improve living conditions and social inclusion. Within Breiðholt, the Fellahverfi area is particularly noted for its socioeconomic challenges. It has been known for higher unemployment rates and a higher proportion of lower-income households compared to other parts of Reykjavik (Iceland monitor, 2021; Reykjavik.se, undated).
Stavanger	According to Stavanger municipality, the distribution of living conditions in Stavanger is not linked to district boundaries or a clear east/west divide. Stavanger has a patchwork structure with an uneven distribution of living conditions. Areas with challenges have been identified in the eastern and northern parts of Storhaug district, the eastern part of Eiganes and Våland district and the north-eastern part of Hillevåg district. At the same time, the municipality stresses that although some areas are more likely to have concentrations of groups with poor living conditions, these are still dominated by people without living conditions problems, and that the data does not provide a basis for characterising areas as good or bad (Stavanger municipality, 2017).
Tampere	Tampere has some areas with higher than average unemployment, especially among young people and immigrants. The neighbourhood Tesoma has been highlighted for socioeconomic problems, including higher unemployment and lower average incomes compared to other parts of the city. Efforts have been made to improve the living conditions and safety of Tesomas residents. Residents have pointed out issues such as disturbances and a lack of leisure activities, while also praising the natural surroundings, including nearby lakes and forests (Tampere municipality, 2024).

Turku	Turku has struggled for periods with higher unemployment compared to the national average, especially among young people and residents with immigrant backgrounds. Neighbourhoods with high unemployment also tend to have lower incomes and a higher proportion of residents dependent on social benefits, such as social assistance. Segregation in the housing market is a growing problem in Turku, with differences between neighbourhoods based on income and education levels becoming more apparent in recent decades. The area Varissuo, a suburb of Turku, has been particularly highlighted as an area with socioeconomic challenges. It has a high proportion of residents with an immigrant background, relatively high unemployment rates, and a low average income compared to other parts of the city (Laakkonen, 2022).
Umeå	Umeå is the largest city in Sweden that does not have any neighbourhoods defined by the police as vulnerable. At the same time, the municipality, in cooperation with the police, has identified the areas Mariehem, Ålidhem, and Ersboda in northeastern Umeå as areas of concern. According to the social services in Umeå, these areas are socioeconomically vulnerable, with more overcrowding, less disposable income, and greater dependence on income support than Umeå in general (Umeå municipality, 2020).
Malmö	In Malmö, the Swedish police has defined three areas as vulnerable: Nydala/Hermodsdal/Lindängen, Holma/Kroksbäck/Bellevuegården and Rosengård.

Of all the identified vulnerable areas, only two do not reach an acceptable level of the combined 3+30+300 score (Table 8). These are the central part of Stavanger and Fellahverfi. Fellahverfi is a part of the larger area Breidholt that reaches an acceptable score of 6.9 out of 10. All areas reach the 3 trees rule; the lowest number is the central part of Stavanger which still has a mean of 9.9 trees from each building. Tree coverage is the main challenge with 7 of the 17 vulnerable areas not reaching 30%, but the lowest number is still 13.4% in Fellahverfi. All areas have less than 300 metres to a public green space; the longest mean distance is 270 metres in central Stavanger. These findings confirm the earlier statement about the Nordic Region showing different correlations between tree cover, green space access, and the presence of vulnerable populations than many other countries.

Table 8. Results of 3+30+300 for the nine case cities (city-wide) and the identified vulnerable areas. *Note that Fellahverfi is part of the larger Breidholt area.

	Overall score	Mean number of trees seen from each building	Mean percentage tree cover	Mean distance to green space (m)
Sweden				
Umeå (city wide)	9.1 (standard deviation 2.01)	43.5	56.3	33.1
<i>Ersboda</i>	8.9	32.2	47.5	83.1
<i>Mariehem</i>	9.2	40.0	43.8	53.7
<i>Ålidhem</i>	7.9	22.4	38.2	154.2
Malmö (city wide)	6.3 (standard deviation 1.62)	15.0	18.7	100.0
<i>Nydala/Hermosdal/ Lindängen</i>	6.5	16.0	23.3	47.5
<i>Holma/Kroksbäck/ Bellevuegården</i>	7.1	23.4	26.5	55.4
<i>Rosengård</i>	7.5	40.0	28.9	49.4
Norway				
Stavanger (city wide)	8.3 (standard deviation 1.62)	28.8	36.8	74.7
<i>Stavanger vulnerable areas</i>	4.9	9.9	19.0	270.5
Bergen (city wide)	9.5 (standard deviation 1.32)	43.3	63.6	45.1
<i>Ytre Arna</i>	9.9	49.9	77.7	17.3
<i>Loddefjord</i>	9.8	43.7	62.9	39.9
<i>Solheim Sør</i>	8.5	29.4	45.4	106.8
<i>Solheim Nord</i>	7.6	19.4	39.2	206.7

Denmark				
Kolding (city wide)	7.3 (standard deviation 1.97))	22.4	26.2	55.4
<i>Munkebo</i>	6.2	25.0	27.5	168.3
<i>Skovvejen</i>	6.8	25.7	24.5	42.9
Holbaek (city wide)	6.9 (standard deviation 1.95)	22.5	21.1	51.3
<i>Agervang</i>	7.9	26.1	38.0	26.4
Finland				
Turku (city wide)	9.2 (standard deviation 1.55)	47.0	55.2	41.2
<i>Vassisuo</i>	9.7	44.9	62.7	83.3
Tampere (city wide)	9.4 (standard deviation 1.28)	48.0	63.4	55.9
<i>Tesoma</i>	9.8	66.9	65.2	51.2
Iceland				
Reykjavik (city wide)	6.8 (standard deviation 1.83)	22.0	18.3	118.2
<i>Breidholt</i>	6.9	26.8	23.3	40.5
<i>Fellahverfi*</i>	5.7	20.9	13.4	39.2

Nordic dimensions of socioeconomic vulnerability and access to green space and trees

As mentioned, the analysis above shows that, for the Nordic case studies, there is no direct correlation between socioeconomic vulnerability and lack of green space and urban trees. In fact there are indications that this correlation could in fact move in the opposite direction. At the same time, the results do not take into account the actual use of green space, perceived access, safety and quality of the green spaces. Studies from the NORDGREEN – Smart Planning for Healthy and Green Nordic Cities project show that objective distance and perceived nearness to green space do not always correlate (Nordh et al., 2024). The study showed, using Täby outside Stockholm as a case, that the more satisfied people were with their access to green spaces and safety outdoors in the evenings and nights, the more satisfied they were with their living environments.

In one Finnish study, residents in high and low socio-economic status (SES) areas experienced different quality features in their nearest green spaces (Viinikka et al., 2023). Low SES areas were closer to recreational facilities and pathways, while high SES areas benefited from better access to larger green spaces and forests. A Swedish study showed that greater access to total and publicly available urban green spaces is beneficial for groups with lower SES from a health perspective (Mattisson et al., 2022). However, access to high-quality publicly available urban green spaces was lower in these areas, particularly regarding noise levels, indicating a negative impact.

In Estonian cities, with results published as a conference abstract (Orru et al., 2024), the potential for improved population health by reducing "green inequality" was, however, demonstrated when comparing maximum residential greenness exposure (e.g., 0.49 in Tartu) with the average exposure (e.g., 0.29 in Tartu). Health impact assessments indicated that eliminating this inequality could prevent approximately 823 premature deaths and 9,854 years of life lost, leading to a potential life expectancy increase of 0.59 years and savings of €463.1 million in external health costs (Orru et al., 2024). The greatest health benefits were found in larger cities, where life expectancy could increase by up to 1.49 years. Notably, Tartu exhibited profound green inequality, as most residents were exposed to significantly lower levels of greenness despite the city having large green areas that comprise 25% of its total area.

Many of the areas identified as vulnerable in the present analysis were built in the late 1960s and 1970s. All of the defined vulnerable areas in Sweden are part of the so-called "Million program" which was a large public housing program implemented in Sweden between 1965 and 1974 (Photo 14). Also, the areas Breidholdt, Tesoma, and Varissou are from roughly the same time period; construction of Breidholdt

started in 1966, Tesoma was built in the 1960s, and construction of Varissou started 1975. These areas have a similar building typology with large-scale apartment buildings with significant areas of preserved nature around them. In Norway, the defined vulnerable areas are much more diverse in building typology and age, although apartment buildings dominate.



Photo 14. Scene from the Rosengård district in Malmö, Sweden (photo by Wösel Thorensen).

Conclusions

In conclusion, the correlation between socioeconomic status on the one hand and urban green space and trees on the other has a specific Nordic dimension as many vulnerable areas have acceptable levels of green space from purely a geographical perspective. The Malmö case shows a relationship between the share of first- and second-generation migrants and the 3+30+300 score, with areas hosting a higher share of migrants being increasingly greener. This relationship should not necessarily be seen as an actual correlation but can be traced to the building typology dominating socioeconomically vulnerable areas in Malmö, and in several of the other Nordic cities that have been studied. At the same time, both researchers and governmental agencies express concern that vulnerable areas are more likely to experience the negative effects of a warmer climate with a stronger urban heat

island effect. This also can be related to building typologies such as those of high rise apartment buildings with a high share of hard surfaces (such as parking lots) and low-quality urban green space in the form of short cut lawns. Further, as this analysis does not compare more vulnerable areas to more affluent ones, relative environmental justice can still be the case when areas with higher socioeconomic status can have more accessible green space and trees, also with higher quality than the vulnerable areas.

Two recent studies in Sweden have concluded that the green space in Swedish cities has decreased. In a study by Ekot (the Swedish national radio newsroom) green space has decreased in all major cities during the last five years with a total area of more than 1300 hectares (sr.se, 2024). Similar results can be found in a Husqvarna group's Husqvarna Urban Green Space Index (HUGSI in brief, Husqvarna group, 2024) which uses AI to map green space in Sweden's 20 largest cities. According to the index, 65 hectares of green space have disappeared in the cities during 2022–2023. While Ekot's study indicates that socioeconomic areas have been especially affected by loss of green space, research has not had a focus on environmental justice.

As discussed above, there is no common definition of socioeconomic vulnerability in the Nordic Region. Parameters such as employment rate, educational level, income and public health as well as ethnicity are used but not in the same way or to the same extent. From an environmental vulnerability perspective, children, elderly, and chronically sick are often described as vulnerable groups being especially vulnerable to the negative health effects of a warmer climate and environmental factors such as pollution and noise. These are groups that often experience limited mobility which make their home environments more important. For prioritising investments in urban green space and trees vulnerable groups must therefore be taken into account. The vulnerable areas generally have a higher problem with health (as seen in the number of sick days in the Malmö study and argued by the Norwegian municipalities) and younger populations; these areas are therefore still important when allocating funds for urban green space, even though they score high or relatively high on 3+30+300.

As also discussed in the gap analysis, many of the areas that score low on 3+30+300 in the analysis are industrial areas and dense inner city areas. The former is a place where few people live, and the latter places that often are well connected with both public transport and other transportation infrastructure, making it easier to reach green space outside the city centre. Again, vulnerable groups might still not have the possibility to travel, making institutions for these groups, such as preschools, schools, hospitals and other health institutions, as well as elderly facilities, important focus areas when investing in urban green space and trees.



Photo 15. *Having good access to trees and other nature is of particular importance to children (photo by Anna Maria Larson).*

Comparison of tree cover data with climate-related parameters

Research consistently shows that trees and green spaces are vital for reducing noise, improving air quality, and strengthening climate resilience. Numerous scientific studies have emphasised the importance of trees in urban environments, underscoring their role in shaping sustainable city planning and ecological strategies (Nowak et al., 2014; Zhao et al., 2022; Gillerot et al., 2023).

Tree cover is particularly essential in mitigating the urban heat island (UHI) effect, a phenomenon where cities experience higher temperatures than nearby rural areas due to heat-retaining materials like concrete and asphalt. In densely populated regions, the lack of sufficient tree cover intensifies this effect, raising the risk of extreme heat during summer, especially during heatwaves (Sinha et al., 2022; Sheridan et al., 2024).

The global temperature rise of 1.1 °C has already triggered profound, unprecedented changes in the Earth's climate system, including rising sea levels, more frequent and severe weather events, and the accelerated melting of sea ice. As the planet warms further, these disruptions will intensify, with profound implications for natural ecosystems and human societies.

One of the most critical consequences of additional warming is the escalation of extreme heat events. Every 0.5 °C increase in global temperatures leads to more frequent, severe, and prolonged heat waves, accompanied by heavier rainfall and longer droughts in various regions. For instance, with just 1.5 °C of warming, heatwaves that once occurred only once per decade may happen 4.1 times as often. If temperatures continue rising to 2 °C or higher, extreme heat events will become increasingly common and dangerous, pushing ecosystems and communities to the brink (IPCC, 2023).

In the Nordic countries, the growing risk of heatwaves is becoming more evident due to climate change, which is projected to increase both the frequency and intensity of extreme heat events (Figure 34). Regional heat maps based on IPCC's forecast for future climate highlight the stark changes expected in these regions as global temperatures rise.

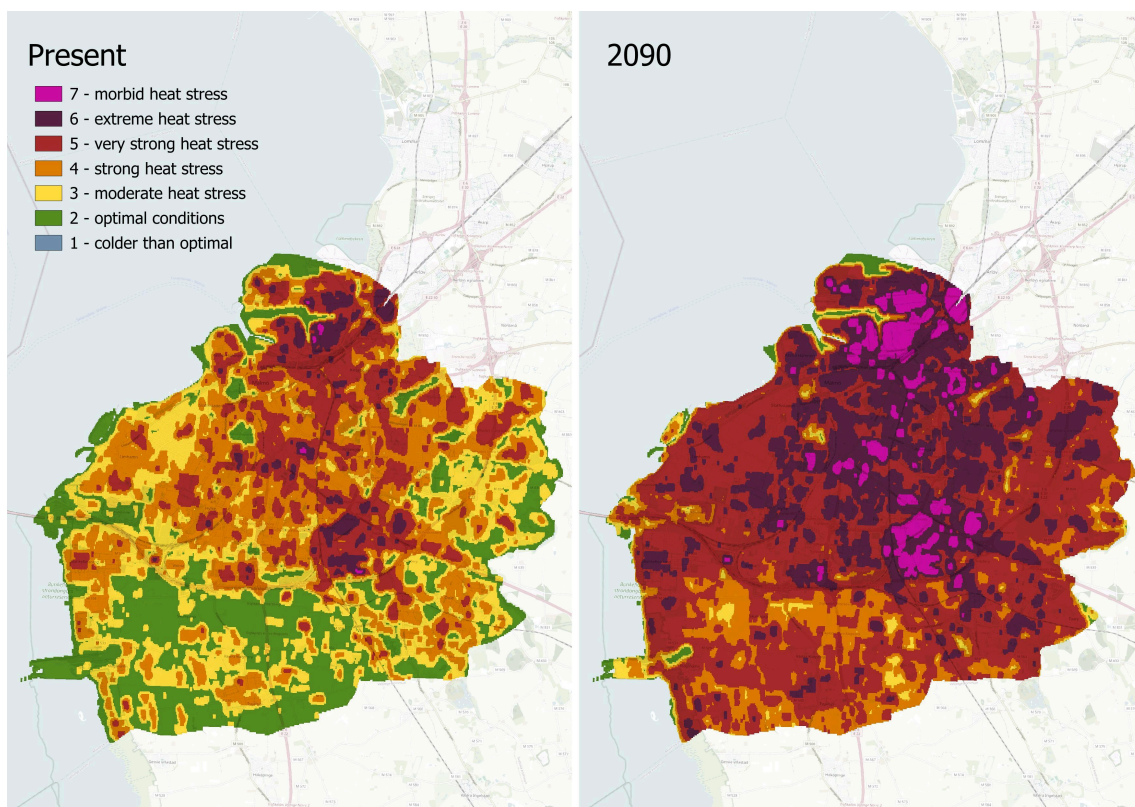


Figure 34. Three-year averaged Summertime Heat maps that illustrate the shifts in climate and their correlation with optimal tree habitats across Malmö's municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, showing a clear deterioration in growing conditions for trees across the municipality.

The importance of tree cover

To combat the rising frequency of heatwaves and a warming climate, increasing tree cover will be a powerful strategy. Research demonstrates that urban areas with extensive tree coverage experience cooler temperatures. Trees provide shade and cool the environment through evapotranspiration – a process where they release water vapour, reducing surrounding air temperatures. Heat mapping studies consistently show a strong correlation between dense vegetation and lower local temperatures, with areas rich in greenery often being several degrees cooler than those with little or no tree cover (Sinha et al., 2022; Sheridan et al., 2024)

In Malmö, districts with tree coverage at or above 30% are better positioned to mitigate future heat risks due to their robust canopy (Figure 35). When comparing heat maps with tree cover data, the connection is clear: urban areas with higher levels of tree cover consistently exhibit lower heat risk, while areas with sparse vegetation face significantly higher surface and air temperatures. As discussed earlier in this report, trees not only provide natural cooling through shade but also enhance evapotranspiration, further lowering temperatures. Conversely, areas with minimal tree cover absorb and retain more heat, contributing to elevated local temperatures. This relationship highlights the essential role trees play in reducing urban heat risk and creating cooler, more livable cities.



Figure 35. Correlation between high tree cover and heat stress in the city of Malmö. The score is based on the heat stress maps in Figure 34, meaning 2 is optimal conditions for tree habitats and 7 is morbid conditions.

When analysing additional case cities, a clear correlation between tree cover percentage and reduced heat stress emerges (Figure 36). However, factors like urban fabric, building materials, and the presence of other green infrastructure also significantly influence these outcomes. While higher tree cover helps alleviate heat stress, its impact is shaped by the broader urban context. For instance, well-planned green spaces, reflective building materials, and permeable surfaces can enhance the cooling effect of trees, whereas dense construction and heat-absorbing materials may limit it. This highlights the importance of integrating tree cover with smart urban design and sustainable infrastructure for optimal climate resilience.

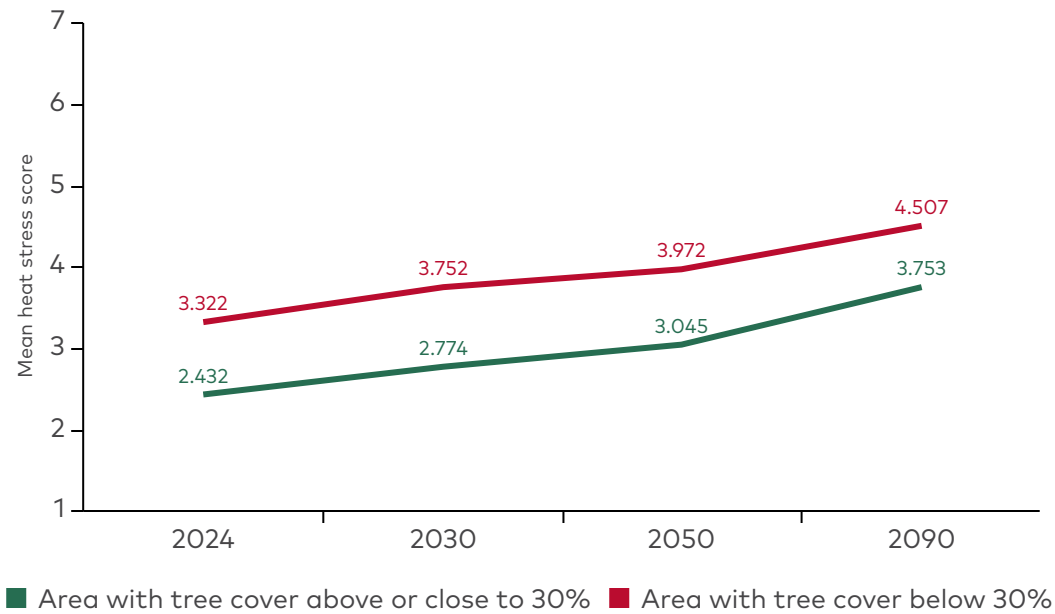


Figure 36. Correlation between high tree cover and heat stress in three of the case study sites (Malmö, Umeå, and Stavanger). The score is based on the heat stress maps meaning 2 is optimal conditions for tree habitats and 7 is morbid conditions.

Malmö and Stavanger showcase distinct characteristics regarding tree cover and heat risk. Stavanger benefits from a greater integration of natural landscapes, featuring higher levels of tree cover in its urban areas. In contrast, Malmö, with its denser urban structure, has comparatively less tree cover, rendering it more vulnerable to heat risks. The differences in their urban planning and environmental conditions significantly influence how each city addresses the challenges of rising temperatures and climate resilience.

Malmö's limited tree cover, combined with its high population density, makes it more susceptible to urban heat island (UHI) effects. This lack of adequate tree

cover exacerbates the UHI effect, heightening Malmö's vulnerability to extreme heat events.

Conversely, Stavanger's higher tree cover provides essential natural cooling benefits (Figure 37). The abundance of trees and parks helps moderate temperatures, effectively reducing the UHI effect and offering a buffer against heat-related risks. This contrast highlights the critical role of green spaces in urban planning as a strategy for enhancing climate resilience and improving the overall liveability of cities in the future.

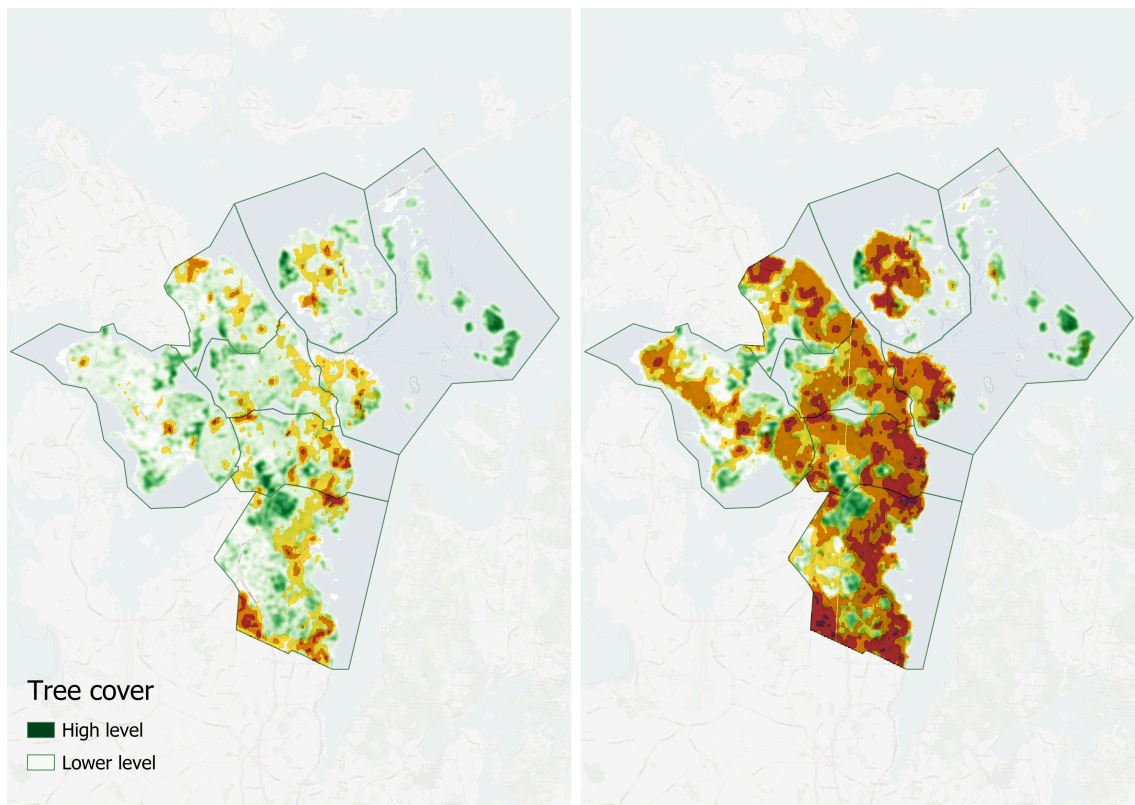


Figure 37. The tree cover in Stavanger is examined alongside heatmap data, emphasising the relationship between vegetation and temperature distribution. The left image reflects current conditions, while the right image represents climate predictions for the year 2090, with existing canopy cover.

Noise pollution

To assess the relationship between tree cover and environmental factors such as noise levels, we analyse various environmental parameters in relation to specific threshold values set by authoritative organisations like the World Health Organization (WHO), the European Union (EU), and national environmental

authorities. These benchmarks are essential for evaluating compliance with public health and environmental standards.

Noise pollution is measured in decibels (dB), and evaluating noise exposure relies on established guideline values aimed at protecting public health. The Day-Evening-Night Level (Lden) metric averages noise levels over a 24-hour period, placing greater emphasis on evening and nighttime noise, as these periods have a more significant impact on human health. According to World Health Organization (WHO) guidelines, the recommended Lden threshold for road traffic noise is < 53 dB, and for railway noise, it is < 54 dB. These thresholds are essential for assessing whether long-term noise exposure exceeds levels that could negatively affect public health, potentially leading to issues such as stress and cardiovascular problems. Additionally, the recommended annual average exposure limit for noise from all combined sources is ≤ 70 dB LAeq, 24h (WHO and UN, 2022).

These values provide reference points for assessing noise levels. By comparing the measured noise levels to these established guidelines, this analysis identifies specific zones where noise pollution is the highest in the city of Malmö (Figure 38). Additionally, the analysis explores the potential relationship between tree cover and noise pollution.

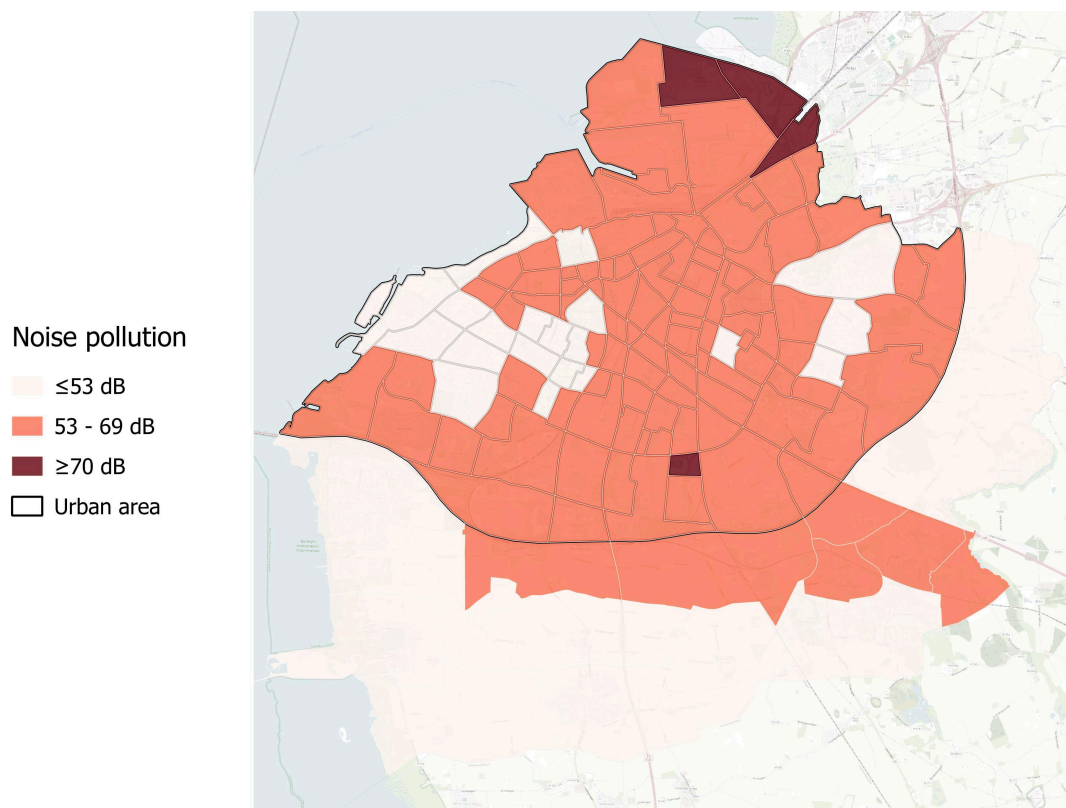


Figure 38. Noise pollution map for Malmö, showing the combined mean score of all noise sources from road traffic, trains, and industrial activities.

The map reveals significant discrepancies in noise levels between urban and rural areas in Malmö. Urban environments, characterised by high population density and heavy traffic, typically experience elevated noise levels compared to their rural counterparts. For instance, densely populated districts with substantial traffic flow may register noise levels exceeding 70 dB, primarily due to road traffic and other urban activities. In contrast, rural areas, often marked by lower traffic volumes and fewer leisure activities, tend to have quieter soundscapes, with average noise levels around 40–50 dB but also a lower level of tree cover.

Despite the challenges posed by urban noise, there is a notable correlation between tree cover and lower noise pollution levels. Areas with substantial tree cover exhibit lower noise levels, demonstrating that trees play a crucial role in mitigating the impact of urban noise (Figure 39). The natural sound-absorbing qualities of trees, along with their ability to create a buffer against noise, make them an essential component of urban planning aimed at improving overall community well-being.

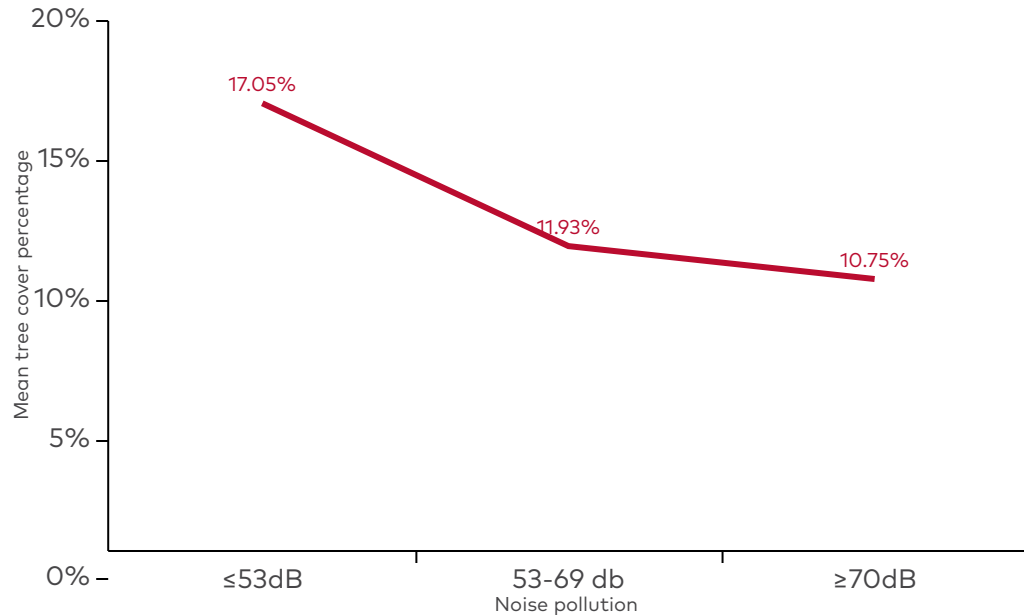


Figure 39. Noise pollution in relation to tree cover in Malmö's urban districts: the graph shows the average tree cover percentage specifically for districts within Malmö's urban areas, see figure 38, categorised by mean noise levels at or below 53 dB, between 53 and 69 dB, and at or above 70 dB.

Moreover, regions with high tree cover often feature fewer roads and lower traffic volumes. This is not merely a coincidence; areas rich in greenery tend to be planned with more consideration for natural landscapes, which often leads to the development of less dense, low-traffic environments. The reduced number of roads means fewer vehicles, contributing to lower overall noise levels.

Conclusion

In conclusion, increasing tree cover emerges as a powerful strategy to combat the rising frequency of heatwaves and the warming climate. Research consistently demonstrates that urban areas with extensive tree coverage experience cooler temperatures, thanks to the shade provided by trees and their ability to cool the environment through evapotranspiration. This natural process not only reduces surrounding air temperatures but also creates a buffer against heat stress, underscoring the vital role trees play in enhancing urban liveability.

Case studies from cities like Malmö and Stavanger illustrate the importance of tree cover in mitigating urban heat risks. Malmö's denser urban structure and limited tree cover make it more vulnerable to urban heat island effects, leading to higher surface and air temperatures, particularly during extreme heat events. In contrast, Stavanger's higher tree cover and integration of natural landscapes result in more moderate temperatures, demonstrating the protective benefits of urban greenery.

Furthermore, the analysis of noise pollution levels in relation to tree cover reveals a significant correlation between dense vegetation and reduced noise levels. Urban areas characterised by high tree cover typically experience lower noise pollution, contributing to a healthier sound environment. This is particularly important in light of established noise exposure guidelines from authoritative organisations like the World Health Organization, which indicate that prolonged exposure to high noise levels can lead to serious health issues.

Integrating tree cover with thoughtful urban planning is crucial for creating more resilient and liveable cities. By reducing the number of roads and traffic volumes in areas with abundant greenery, cities can not only lower noise pollution but also enhance community well-being. The synergy between increased tree cover, reduced heat stress, and lower noise levels highlights the multifaceted benefits of urban greenery, positioning it as an essential component of sustainable urban design.

Trees under future climate change scenarios – an analysis

As projections for the future of urban environments unfold in the context of climate change, predictive climate modelling from the Intergovernmental Panel on Climate Change (IPCC) provides a foundational resource. The analysis of projected climate impacts for the future reveals insights into urban areas facing increased risks of heat stress and regions that may transform from inhospitable environments into "tree-friendly" habitats.

These scenarios also reveal critical information regarding effective desert zones – areas where rising temperatures and declining vegetation make conditions increasingly uninhabitable for both trees and, in turn, people. Although such zones

are relatively rare in the Nordic Region compared to other global areas, their potential emergence poses significant challenges for urban planners and environmental policymakers. Visualisation of these scenarios allows for the identification of vulnerable urban areas that may require targeted interventions to mitigate heat stress and enhance climate resilience.

Furthermore, the analysis extends beyond merely identifying at-risk locations; it incorporates advanced computational models that calculate expected changes in temperature and vegetation suitability across diverse urban landscapes. Examining the relationship between urban heat stress and vegetation suitability provides a clearer understanding of how various neighbourhoods may adapt – or struggle to adapt – to these climatic shifts.

The case cities are evaluated on a scale of 1 to 7, providing a nuanced assessment of their suitability for tree growth (Figure 40). A score of 1 signifies areas that are colder than the optimal conditions for trees, indicating potential challenges for vegetation health and growth. In contrast, a score of 7 denotes regions experiencing severe heat stress, which can hinder tree vitality and biodiversity.

This scoring system facilitates the identification of areas that may require intervention or adaptation strategies to enhance urban forestry initiatives. Scores in the middle range (2 to 6) reflect varying degrees of climate suitability, highlighting regions that may be on the cusp of transitioning from less favourable to more optimal conditions for tree growth. This detailed evaluation not only informs urban planners and policymakers about current habitat suitability but also guides future actions to promote sustainable and resilient urban forests in the face of changing climate conditions.

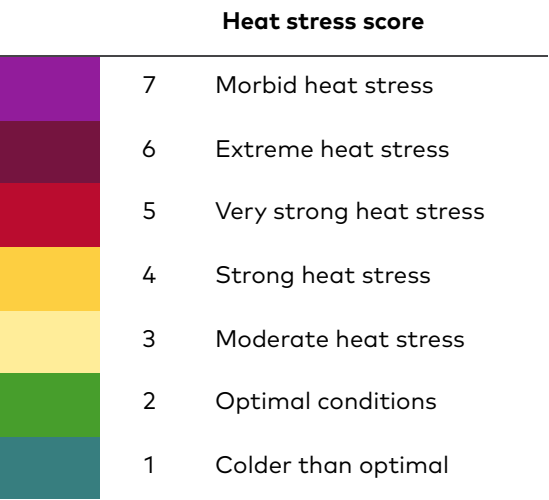


Figure 40. Overview of heat stress scores.

Scenarios for the participating cities

In Figures 41–56, climate change-related scenarios are presented for most of the participating municipalities. The figures show the shifts in climate and their correlation with optimal tree habitats for the municipalities from the present through the year 2090. The tables show the projected development of heat risk for each municipality, once again, from today through the year 2090.

The scenarios reveal significant variability between municipalities, highlighting that the urban fabric significantly influences the urban heat island effect, which exacerbates the impacts of climate change. Areas with substantial tree cover and vegetation within cities can help mitigate these effects, resulting in more favourable scores. However, the heat island effect will increasingly impact urban areas, necessitating a re-evaluation of which tree species can thrive under these changing conditions. This underscores the importance of adaptive urban forestry strategies to enhance ecological resilience and ensure the sustainability of urban green spaces in the face of climate change.

In contrast, rural areas generally benefit from cooler temperatures and more natural vegetation, making them less susceptible to the heat island effect. This natural advantage emphasises the need for urban planners to prioritise tree canopy and urban greenery in cities to create more balanced microclimates. By integrating accessible green spaces and adequate tree cover into urban planning, municipalities can develop thoughtful environments that not only enhance the aesthetic appeal of cities but also contribute to environmental health and community well-being.

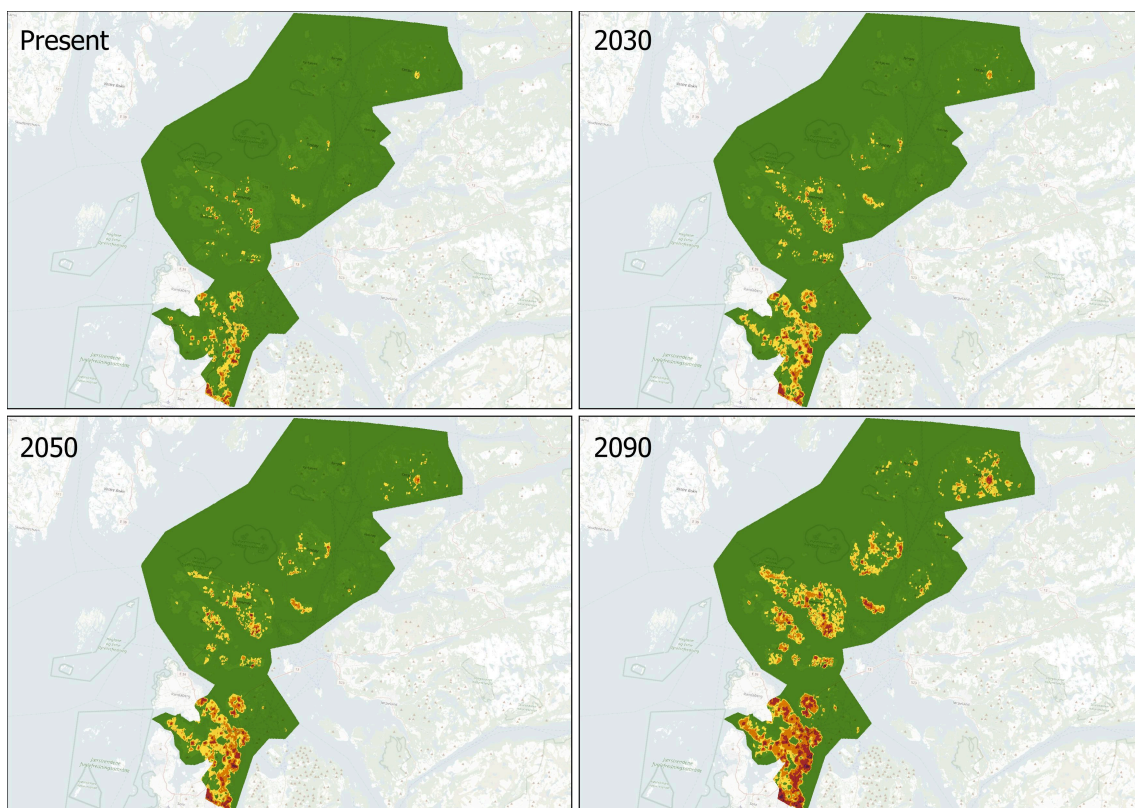


Figure 41. Scenario illustrating the shifts in climate and their correlation with optimal tree habitats across Stavanger municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, providing insights into the sustainability and adaptability of urban forestry in the region.

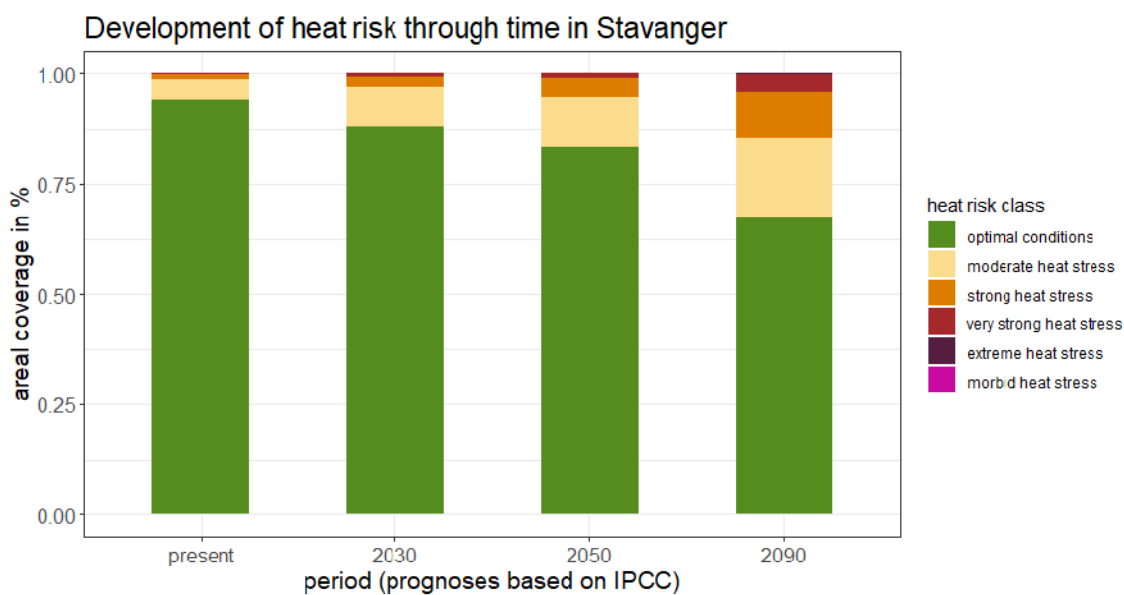


Figure 42. Percentage of Stavanger municipality classified within each category and its changes over time.

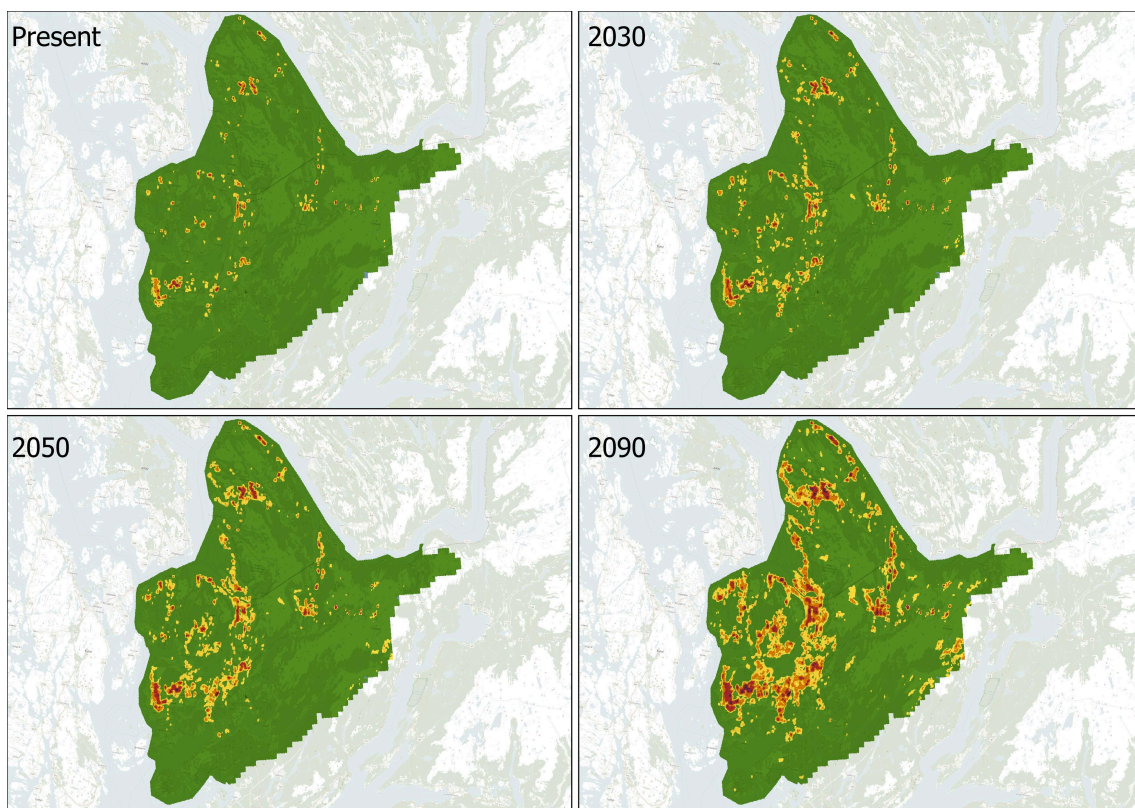


Figure 43. Scenario illustrating the shifts in climate and their correlation with optimal tree habitats across Bergen municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, providing insights into the sustainability and adaptability of urban forestry in the region.

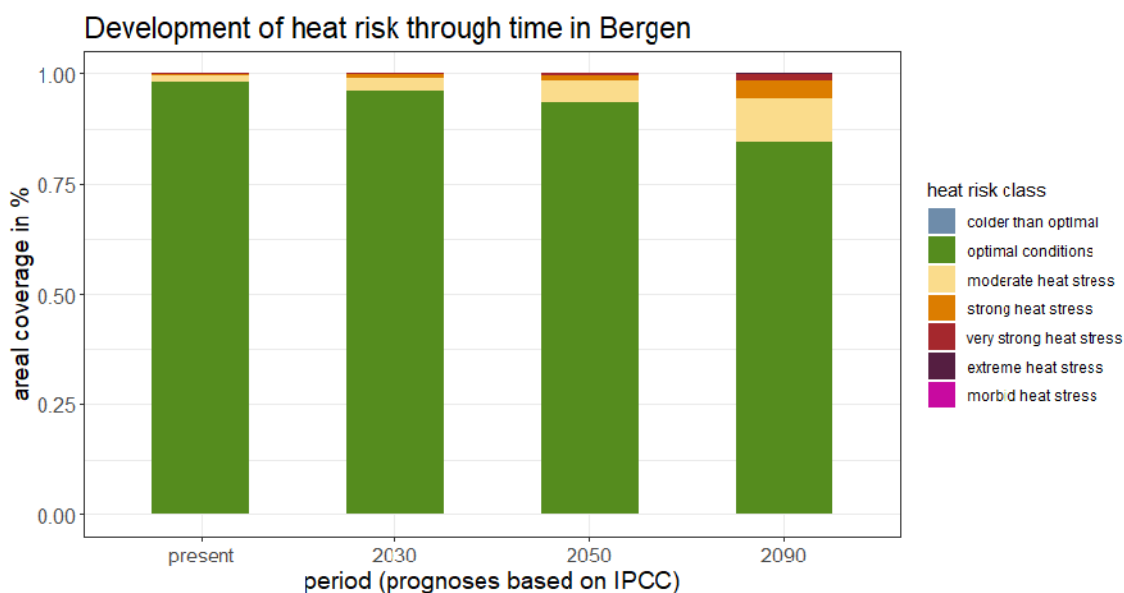


Figure 44. Percentage of Bergen municipality classified within each category and its changes over time.

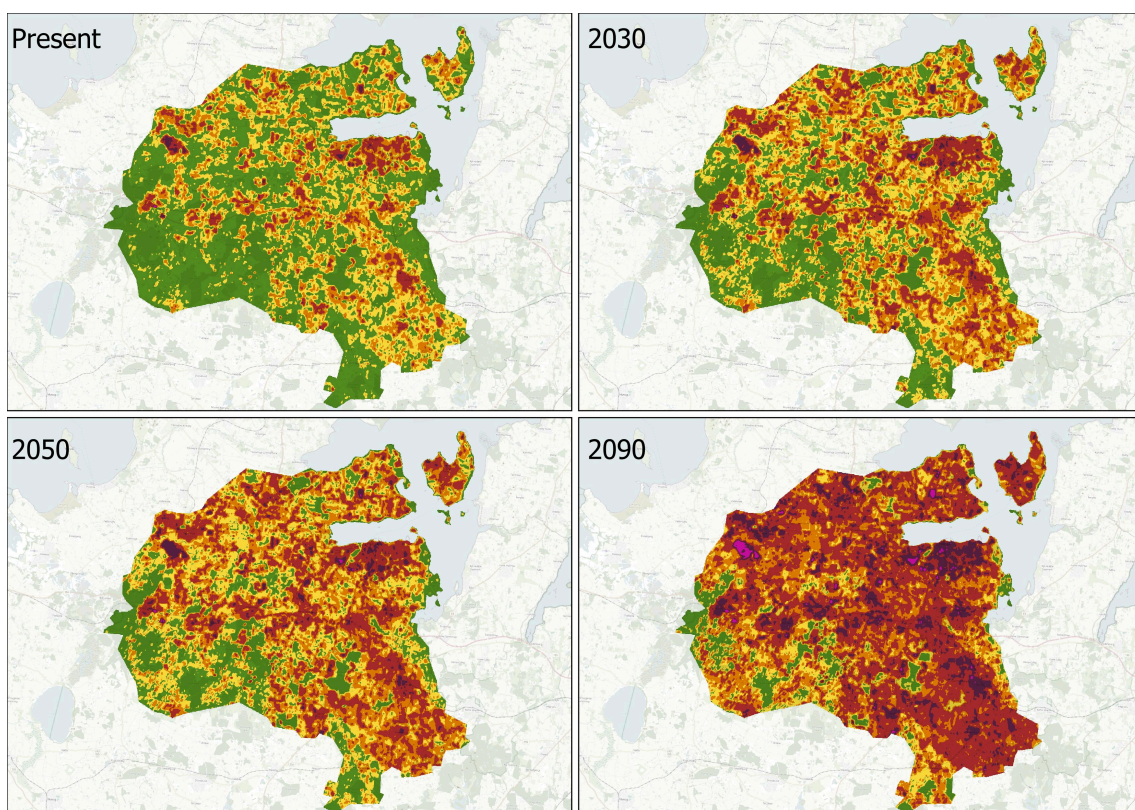


Figure 45. Scenario illustrating the shifts in climate and their correlation with optimal tree habitats across Holbæk municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, providing insights into the sustainability and adaptability of urban forestry in the region.

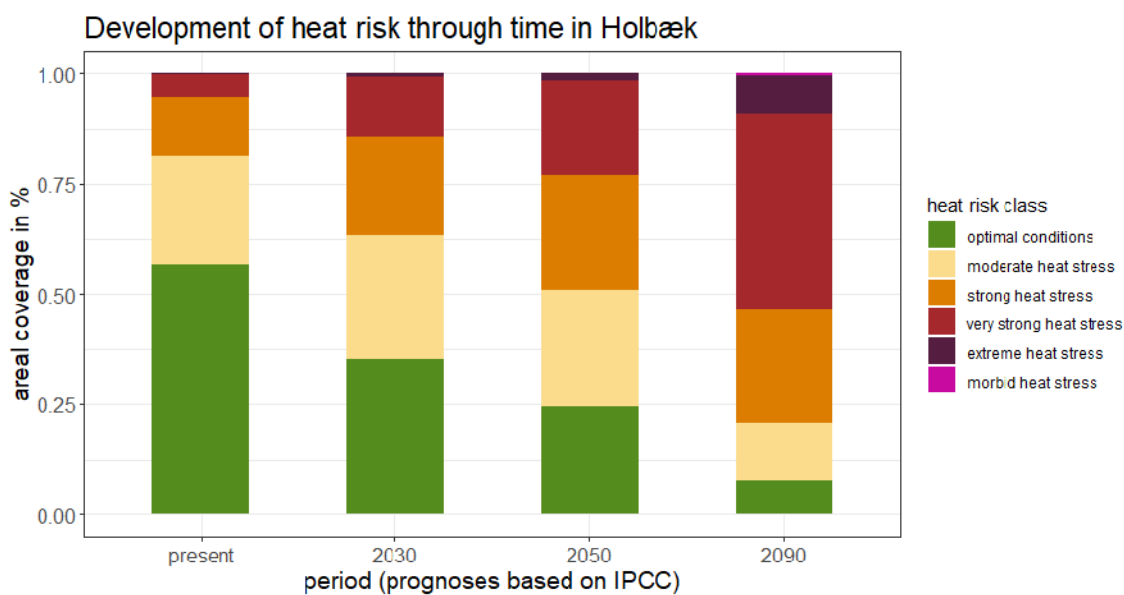


Figure 46. Percentage of Holbæk municipality classified within each category and its changes over time.

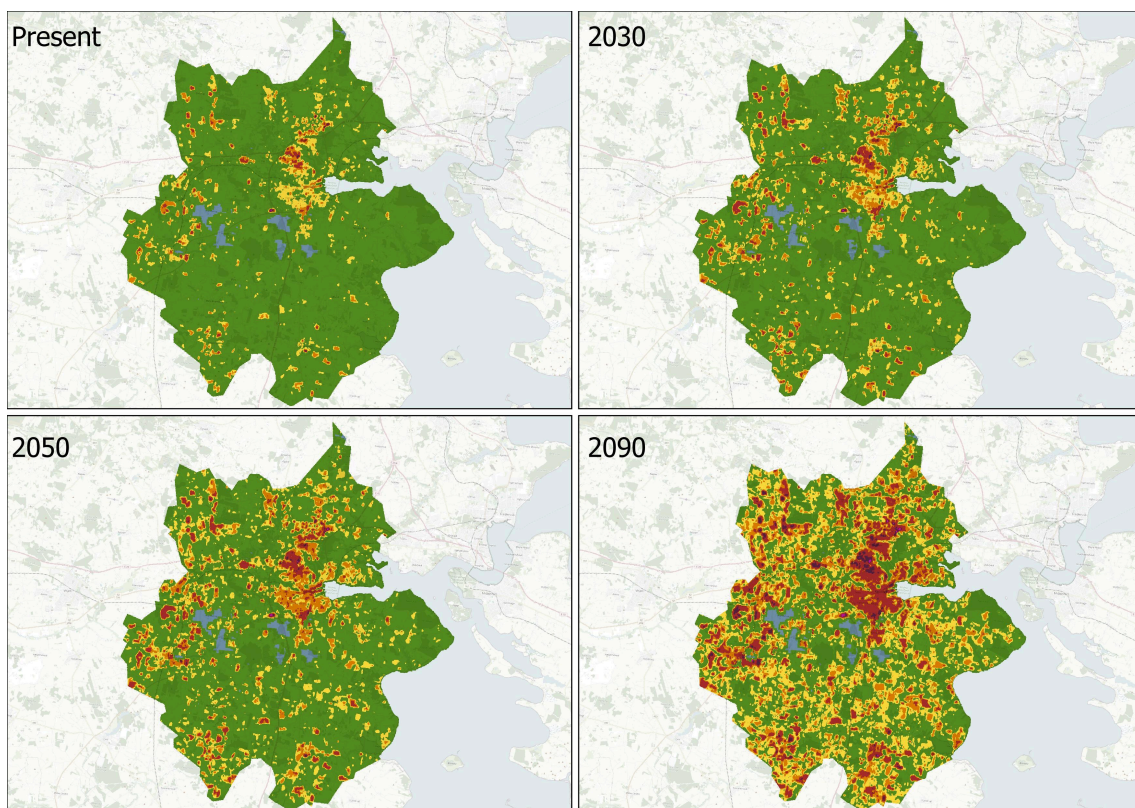


Figure 47. Scenario illustrating the shifts in climate and their correlation with optimal tree habitats across Kolding municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, providing insights into the sustainability and adaptability of urban forestry in the region.

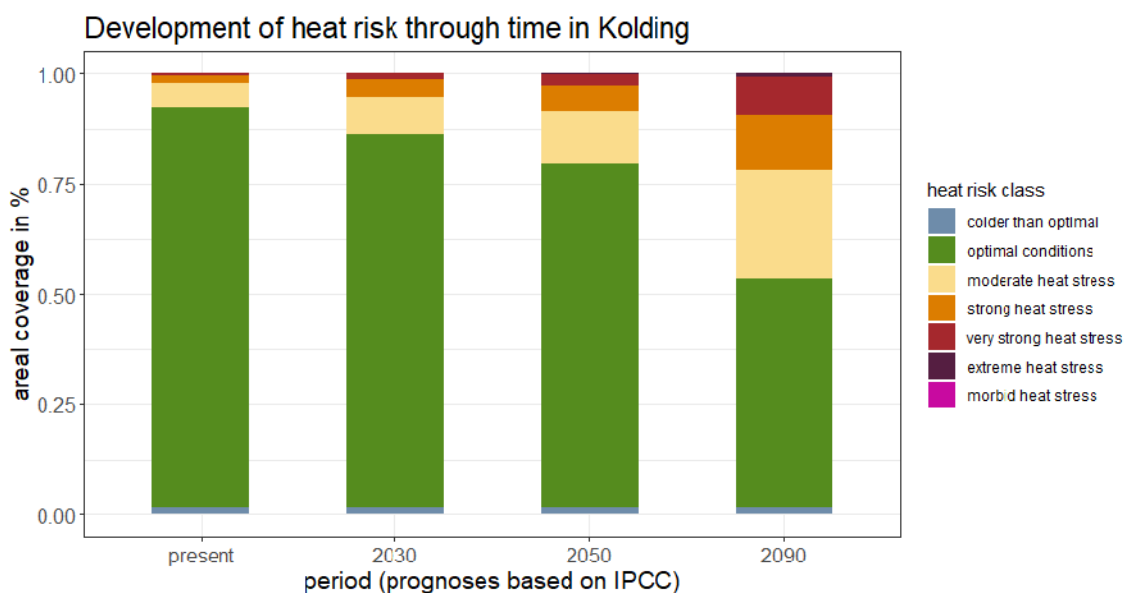


Figure 48. Percentage of the municipality classified within each category and its changes over time

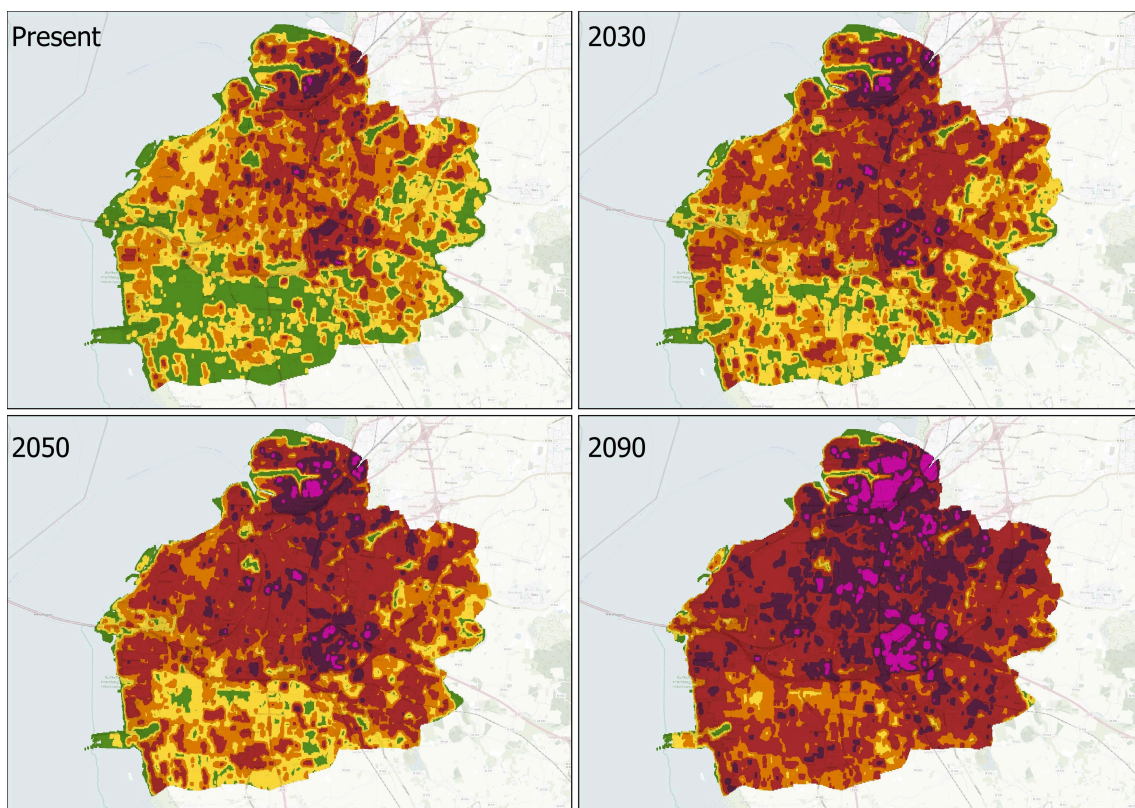


Figure 49. Scenario illustrating the shifts in climate and their correlation with optimal tree habitats across Malmö municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, providing insights into the sustainability and adaptability of urban forestry in the region.

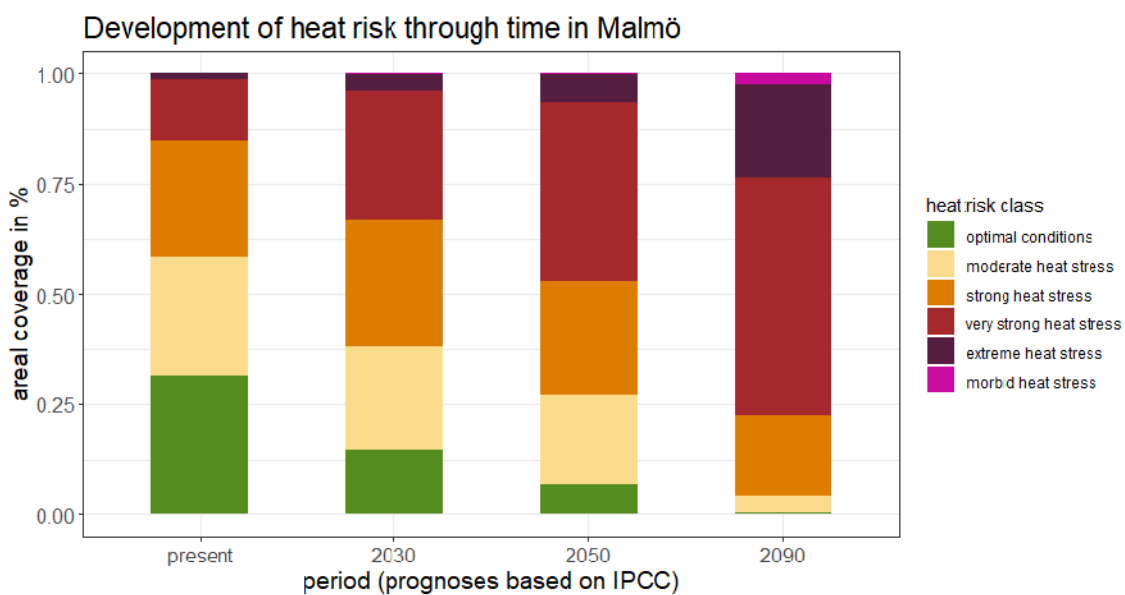


Figure 50. Percentage of Malmö municipality classified within each category and its changes over time.

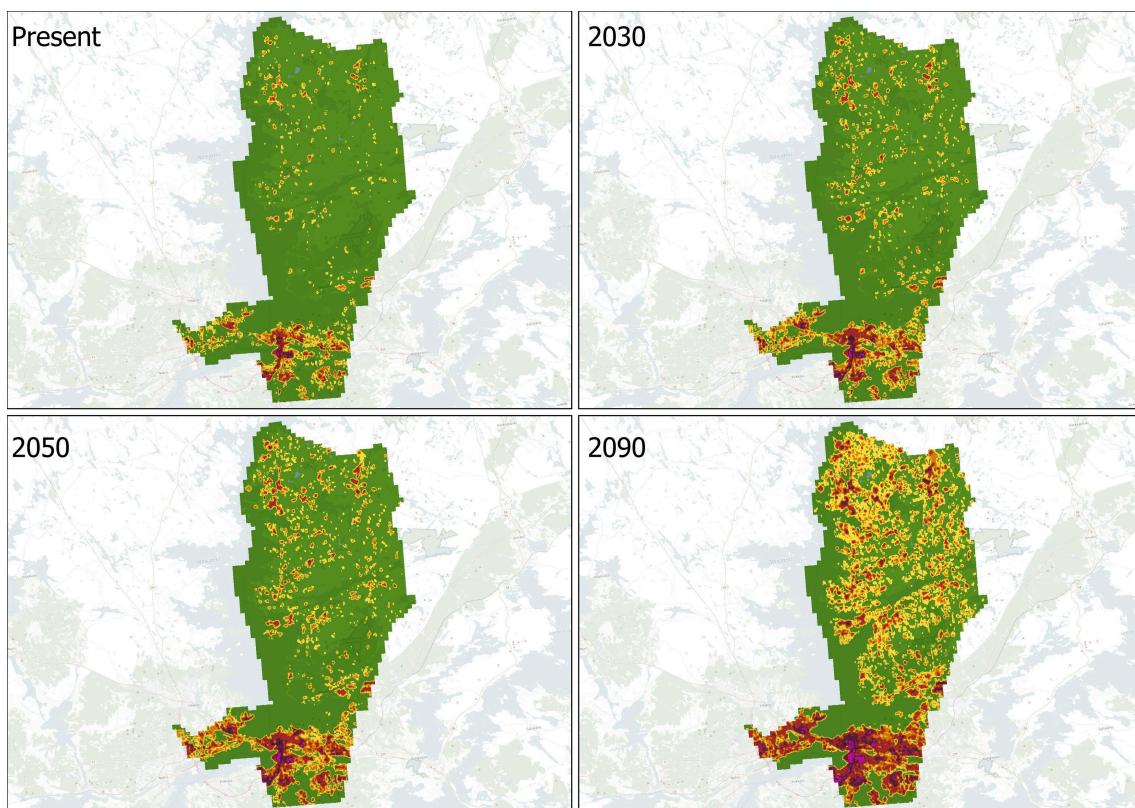


Figure 51. Scenario illustrating the shifts in climate and their correlation with optimal tree habitats across Tampere municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, providing insights into the sustainability and adaptability of urban forestry in the region.

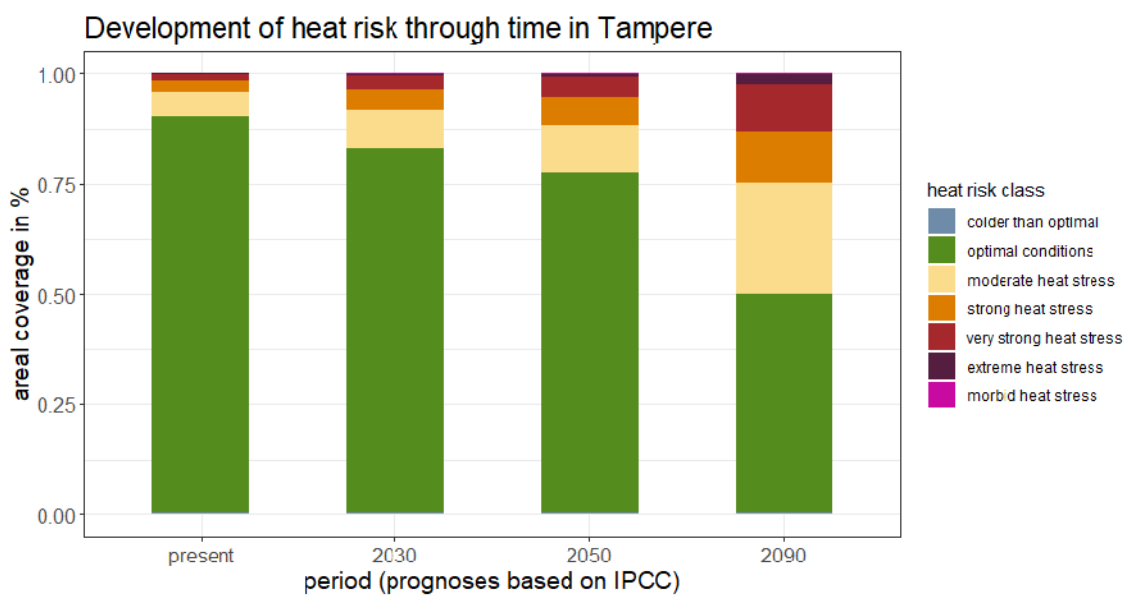


Figure 52. Percentage of Tampere municipality classified within each category and its changes over time.

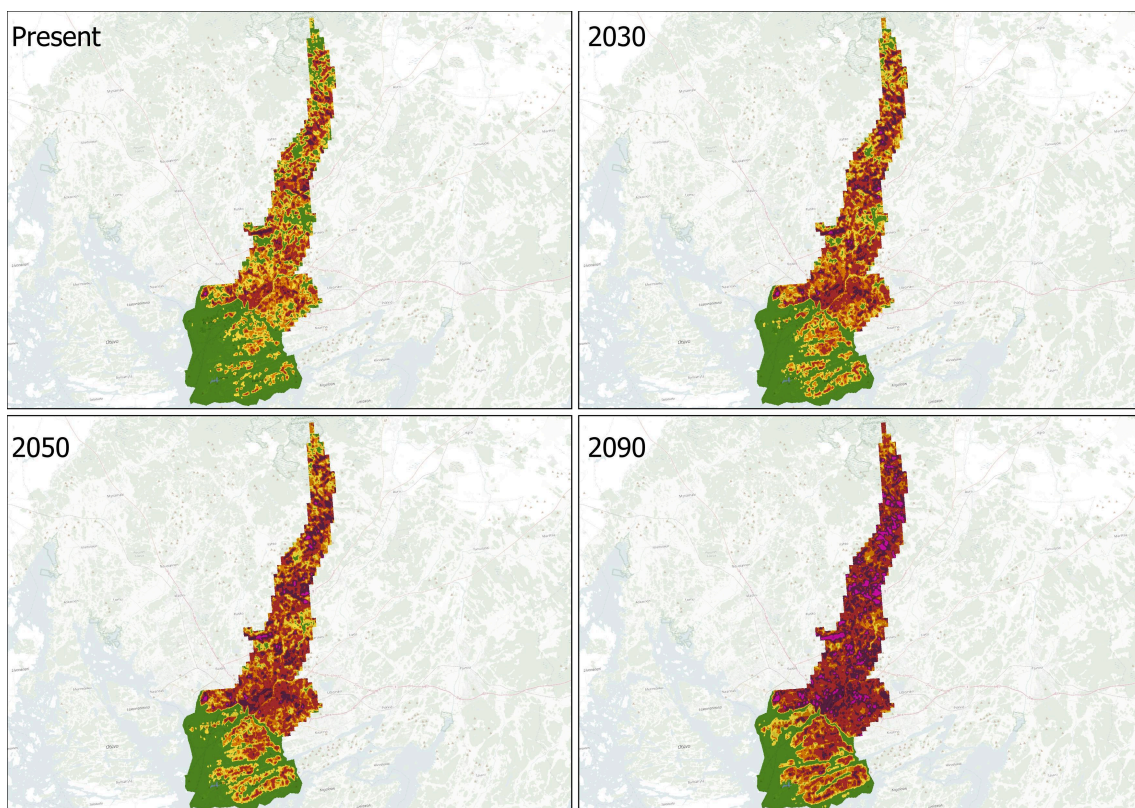


Figure 53. Scenario illustrating the shifts in climate and their correlation with optimal tree habitats across Turku municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, providing insights into the sustainability and adaptability of urban forestry in the region.

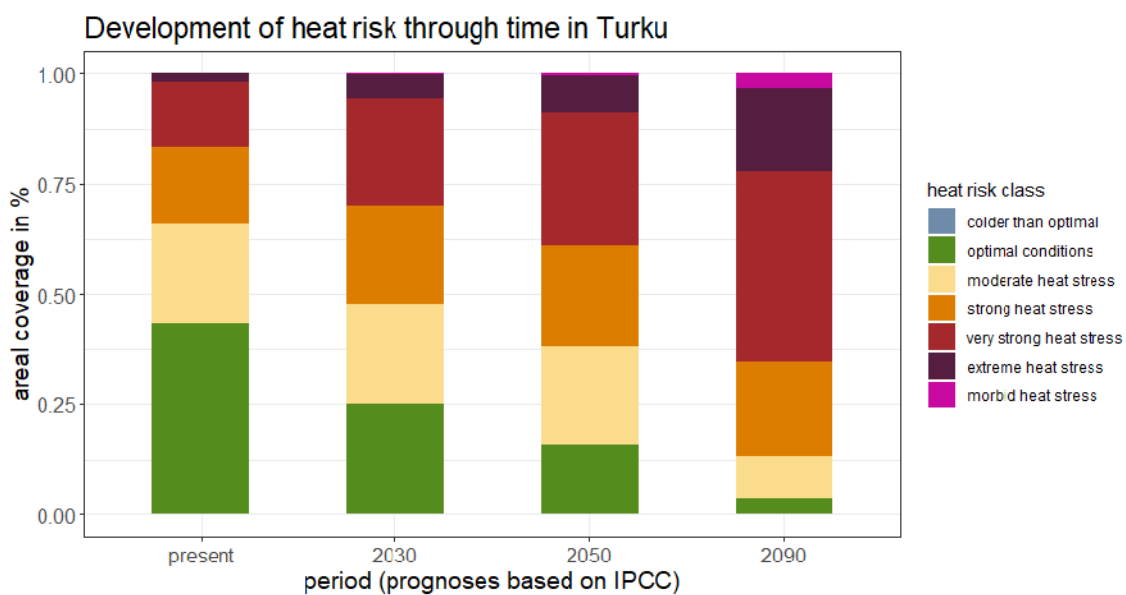


Figure 54. Percentage of Turku municipality classified within each category and its changes over time.

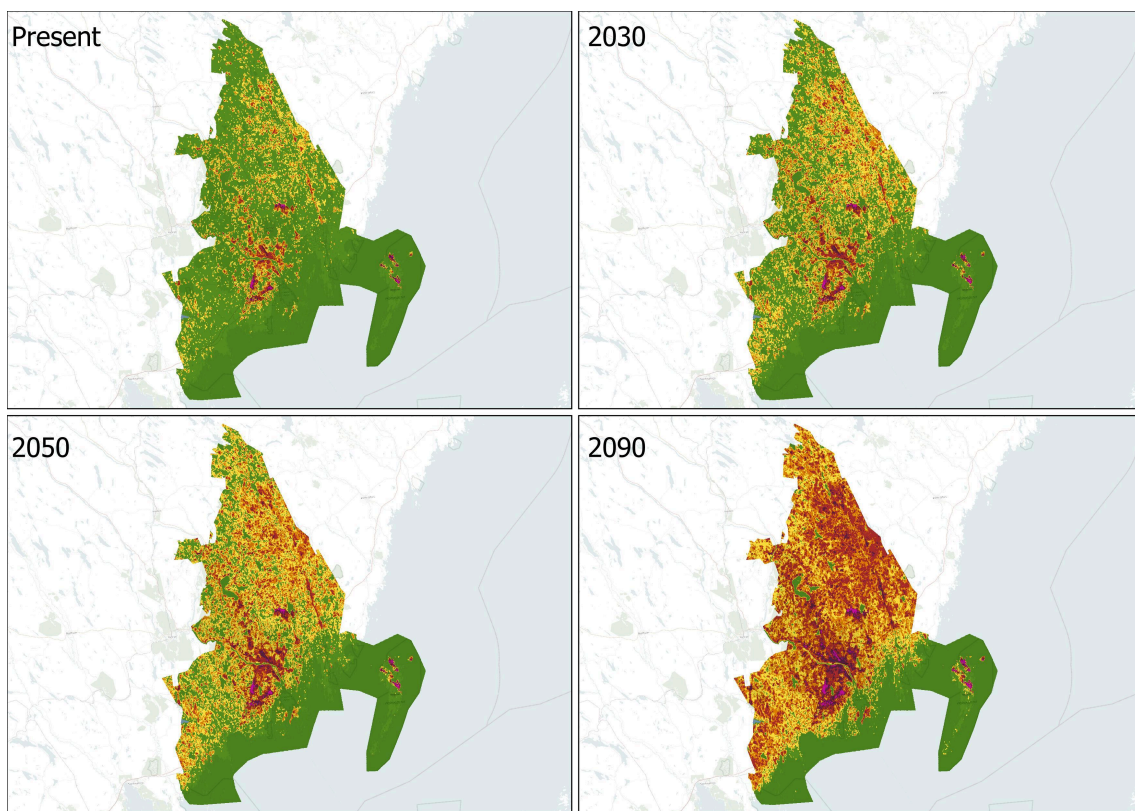


Figure 55. Scenario illustrating the shifts in climate and their correlation with optimal tree habitats across Umeå municipality. This visualisation emphasises how changing climate conditions affect areas best suited for tree growth, providing insights into the sustainability and adaptability of urban forestry in the region.

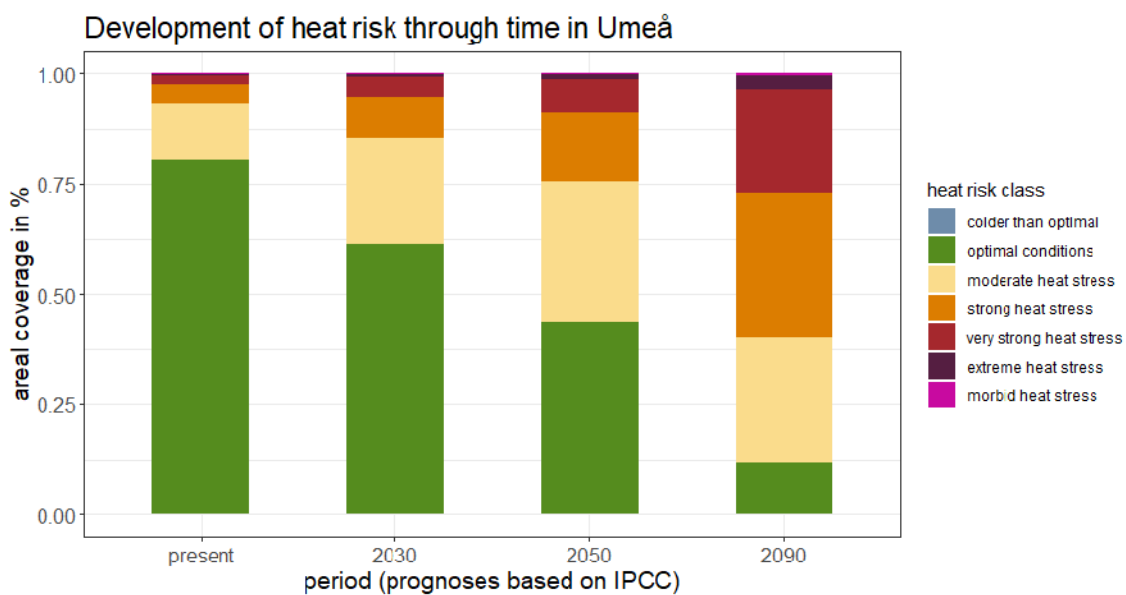


Figure 56. Percentage of Umeå municipality classified within each category and its changes over time.



Photo 16. Vigelandsparken, Oslo, Norway (photo by Nick Night/Unsplash).

4. Mapping of tree species diversity in Nordic cities

Species diversity in Nordic cities

The distribution and diversity of tree species is a crucial issue for our cities, particularly in creating healthy urban environments that not only provide ecosystem services today but are also robust enough to withstand future challenges such as climate change and (often associated) emerging plant diseases. As tree diversity is also closely linked to the implementation of the 3+30+300 principle, for example, in terms of developing a diverse and resilient urban forest and ensuring tree canopy cover in the longer term, the aspect of tree diversity in the Nordic cities was given specific attention in the Yggdrasil project.

The study was divided into three main parts. The first part focused on mapping the distribution of tree species in five Nordic cities, based on their existing tree databases, to understand the current state. The second part examined, as a case study, which tree species are being planted in Sweden today and at what ratio, using sales data from four of the largest Swedish tree nurseries. By analysing both the current state and contemporary planting trends, we have gained insights into how the future urban tree population may develop. The third and last part focused on exploring the impacts on climate adaptation, including biodiversity, by making climate impact predictions for a number of different species. This work also links closely to the climate analyses presented in Chapter 3.

Tree species distribution in the partnering cities

Five of the partnering cities supplied data from their tree database showing the distribution of tree species on public land in the cities (Table 9). The analysis is only done for the data provided, and the quality and density of the data is widely differing between the cities, therefore the findings should be seen only as preliminary.

The results reveal significant variation in the distribution of tree species across the different cities. Malmö, for example, has a very broad species distribution, with a total of 1,036 different taxa (species and varieties) of trees. This is a notably high diversity, even on a global scale. One reason for Malmö's broad distribution of species is the city's experience with Dutch elm disease, which caused the loss of a

substantial part of Malmö's urban tree population due to the elm's dominance. Between the 1980s and the 2000s, around 45,000 elms were felled on both public and private land in the city. To put this in perspective, Malmö today has 91,079 trees in its database. If Dutch elm disease were to hit Malmö today, and the elm was as common as it once was, almost half of the city's trees would be lost. This crisis has led Malmö to establish clear goals for maintaining a broad species distribution.

The importance of a good species distribution to reduce the risk of mass losses due to disease outbreaks is something that has been discussed for a long time. Barker (1975) was one of the first to suggest the use of a broad range of species. He recommended that no given species should account for more than 5% of the total tree population. Smiley et al. (1986) and Miller and Miller (1991) suggested that the maximum share of any species should be less than 10% of the population. Grey and Deneke (1986) presented a similar view, stating that one species should not amount to more than 10–15% of the total population. In a refined model, Moll (1989) recommended that no species should exceed 5% of a city's tree population and that no genus should exceed 10%. Santamour (1990) extended the recommendations even further to include a recommended maximum use of species and genera from the same family, suggesting that no species should represent more than 10%, no genus more than 20%, and no family more than 30% of the population. Such strategic recommendations for species choice are important guidelines for more diverse use of tree species in the urban environment. Even though the Santamour rule of thumb has been in use for over 30 years, it is still the most widely recognised and used recommendations for species distributions within urban forestry.

When we look at Malmö's species distribution according to the Santamour model we see that the city is outside the danger zone, with figures of 6-10-26 (compared to Santamour's thresholds of 10-20-30). This means that the most common species, Swedish whitebeam (*Sorbus intermedia*), accounts for only 6% of the population, while the most common genus, maple (*Acer*), represents 10%, and the most common family, the rose family (*Rosaceae*), makes up 26%. However, none of the other analysed cities meet the Santamour model's recommendations.

Table 9. Tree species distribution in the partnering cities, scores marked in red surpass the threshold.

City	Santamour-ratio (10-20-30)	Most common species (%)	Most common genus (%)	Most common family (%)	Number of trees in database	Ratio native/exotic trees	Population*	Trees in database per capita
Malmö	6-10-26	Swedish whitebeam (<i>Sorbus intermedia</i>) 6%	maple (<i>Acer</i>) 10%	Rose family (<i>Rosaceae</i>) 27%	91,079	51/49%	362,133	0.25
Bergen	55-55-55	linden (<i>Tilia sp.</i>) 55%	linden (<i>Tilia sp.</i>) 55%	Mallows (<i>Malvaceae</i>) 55%	1,779	56/44%	291,940	0.006
Umeå	56-60-62	silver birch (<i>Betula pendula</i>) 56%	birch (<i>Betula</i>) 60%	Birch family (<i>Betulaceae</i>) 62%	30,915	92/8%	130,224	0.24
Stavanger	16-23-24	sycamore maple (<i>Acer pseudo-platanus</i>) 16%	maple (<i>Acer</i>) 23 %	Soapberry family (<i>Sapindaceae</i>) 24%	6,563	60/40%	237,369	0.027
Kolding	12-23-23	Norway maple (<i>Acer platanooides</i>) 12%	linden (<i>Tilia</i>) 23%	Mallows (<i>Malvaceae</i>) 23%	11,873	75/25%	62,444	0.19

* From Wikipedia "City" or "Urban"

In fact, the only participating city that does not exceed the recommended thresholds of the Santamour model (10-20-30) is Malmö. All other participating cities exceed at least one of the maximum thresholds for share of species, genus, and/or family. Bergen exceeds this by far, but the amount of trees in their database, 1,779, shows that there is a lot unknown. When it comes to Umeå we see that their database includes a lot of trees, therefore their data could be seen as more reliable than the one from Bergen. Umeå with their result of 56-60-62 regarding the Santamour model has a high risk in its urban forest. If a new disease that affects birch enters the city the impact would be catastrophic, even worse than when the Dutch elm disease entered Malmö in the early 1980s.

When looking at the distribution of native and exotic trees we see that Malmö has a large amount of exotic trees with a distribution of 51% native and 49% exotic trees. Others of the participating cities that have a fairly large distribution of exotic trees are Bergen with 44% exotic trees and Stavanger with 40% exotic trees. Umeå had the largest distribution of native trees with only 8% exotic trees.

In addition, it's worth noting that the number of inventoried trees per capita / inhabitant varies significantly between cities. For instance, Malmö has 0.25 and Umeå 0.24 surveyed trees per capita, while Bergen has only 0.006. This could be an indication of how much resources each city invests in analysing its urban trees per capita.

Conclusion

Many Nordic cities are struggling with tree diversity, making them more vulnerable to climate change and emerging plant diseases - something which also impacts the implementation of the 3+30+300 principle. This, in particular, is clear when it comes to cities in the northern part of the Nordics, where the current climate is inhibiting the use of many species that cannot handle the cold winters. With a changing climate come new challenges, and it is important for the cities in the northern parts of the Nordics to start adapting to the coming climate in a proactive way.

By developing policies and learning from cities that already have been affected by plant diseases and climate change, with Malmö as a clear example, Nordic municipalities should start planting more diverse in an effort to reach the recommendations of the Santamour model or better as soon as possible. The use of exotic trees is a part of the solution, however, it is crucial to use exotic species with care and assess the risk of invasiveness before planting the species in large numbers. Therefore, it is important to follow the respective country's recommendations to avoid use of invasive species. There is also a need for using a broader variety of native trees. A city like Umeå for instance, has a lot of native trees to choose from that aren't already overused, such as linden (*Tilia sp.*), Norway maple (*Acer platanoides*), English oak (*Quercus robur*), and many more.

In conclusion, many cities are on the right track, but there remains a substantial need to work more strategically, both in mapping their existing tree populations and in ensuring greater species diversity in future plantings.



Photo 17. Den Grønne Sti, Copenhagen, Denmark (photo by Supercykelstisamarbejdet, hovedstadsregionen).

Distribution of tree species planted in Sweden in 2023

The second part of the study investigated current planting practices, giving us a glimpse into the future tree population. For this project, only Swedish nursery data from 2023 was collected and analysed. A total of 29,707 single stem trees were sold during the period in question, with a native-to-exotic species ratio of 53% native and 39% exotic (Table 10), the remaining 8% are trees that could not be defined as native or exotic due to lack of data. The most common species, silver birch (*Betula pendula*), with 2,819 sold, is accounting for just over 9% of the total. The most common genus was cherries (*Prunus*), with 4,816 sold trees (16% of the total), and the most common family was the rose family (*Rosaceae*), comprising 41% of the sold trees. According to the Santamour model, this would result in percentages of 9-16-41, indicating that current tree planting practices are relatively diverse at the species and genus levels, but too uniform at the family level.

Table 10. *The species composition of the Swedish nurseries sales of trees during 2023.*

Summary	Amount	Percentage
Total amount of trees sold	29,707	100%
Number of exotic trees sold	11,653	39%
Number of native trees sold	15,658	53%
Number of "unknown"* trees sold	2,396	8%
Number of "unknown" and native trees sold together	18,054	61%

*Trees that could not be categorised as native nor exotic due to insufficient data, for example "oaks" (*Quercus* sp.) that could be any oak, both native or exotic species of oaks.

The rate between native and exotic tree species being sold (and therefore planted) in Sweden during 2023 differs from the trees that were within the tree databases of the participating cities. When looking at Malmö as an example, we can see that Malmö has a larger rate of exotic trees (51%) than is planted today in Sweden (39%). Therefore, if Malmö planted like the average Swedish city currently does (based on the sales data), the rate of exotic trees in the city would decrease. On the other hand, if a city like Umeå planted similarly to the average Swedish city, the rate of exotic trees in this city would increase. Their tree diversity would also increase significantly compared to what it is today.

When analysing the data, we also saw a trend that around 42% of the trees that are planted are of species that would rarely reach a height over 15 metres (Table 11). These tree species are in this report referred to as "ornamental trees" whereas the trees that, under normal conditions, would reach a height over 15 metres are referred to as "shade trees". Ornamental trees are important to create interesting and aesthetically pleasing areas, but by increasing the amount of shade trees being planted in the Nordic cities, we could reach the goal of 3+30+300 much faster due to the fact that large canopy trees are providing more shade and other regulating ecosystem services than ornamental trees. Regardless of the growth rate of a tree species, a shade tree will probably within not more than 20 years after planting significantly outperform an ornamental tree in contributing to the 3+30+300-rule.

Table 11. The expected maximum height of trees sold by nurseries in Sweden in 2023.

Size	Number of trees	Percentage of total
Expected max. height <7 m	4,036	14%
Expected max. height 8–14 m	8,301	28%
Expected max. height >15 m	17,370	58%

When looking at the most commonly sold trees in Sweden in the year 2023 (Table 12), we find sargent cherry (*Prunus sargentii*) in third place. This is interesting because even though some literature states that the sargent cherry could potentially reach a height of >15 m, when looking at the tree in an urban context, they rarely reach heights over 10 m. At the same time the species is often planted in large open areas where we could fit much larger trees (Photo 18).

Table 12. The five most commonly sold species in Sweden in 2023 based on the result from the study.

Place	Species	Number of sold trees	Percentage of total
1	Silver birch (<i>Betula pendula</i>)	2,819	9.4%
2	Norway maple (<i>Acer platanoides</i>)	2,334	7.8%
3	Sargent cherry (<i>Prunus sargentii</i>)	1,520	5.1%
4	Small-leaved linden (<i>Tilia cordata</i>)	1,239	4.1%
5	English oak (<i>Quercus robur</i>)	1,076	3.6%



Photo 18. *Sargent cherry trees planted in a large open space in Malmö, Sweden. Much larger and taller growing trees could have been planted to provide more shade and other ecosystem services (photo by Gustav Nässlander).*

Conclusion

When looking at the distribution of exotic and native trees being sold, we see that it differs from the current distribution within the participating cities. This leads to the prognosis that the amount of exotic trees in our Nordic cities is slowly increasing.

The reason as to why the amount of exotic trees is increasing is not fully known. One could argue that it is merely a trend concerning aesthetics and the qualities of exotic species in this respect, but there is also a chance that the use of native trees is decreasing due to their higher sensitivity to climate change in urban areas than some of the exotic more drought and heat tolerant species. Moreover, the use of exotic trees is increasing due to the fact that some of the more drought- and heat-tolerant species are non-natives to the Nordic countries. The increased use of exotic trees could be seen as an increased will to adapt our urban forests to a changing climate.

It would be important to place more focus on choosing species for their functions rather than their aesthetic values, thus leading to more large canopy trees being planted in areas that are in great need of shade trees.

Exploration of impacts on climate adaptation, including biodiversity

As stated earlier in this report, the future climate in the Nordic Region will lead to an increase in both annual temperature, annual precipitation, prolonged periods of drought, and uneven precipitation patterns (IPCC, 2021; VKM et al., 2022). The impact these climatological changes have on urban tree populations is crucial in understanding how to better adapt urban tree selection, urban tree planting, as well as the management of these trees for future climate conditions.

The concept of combining climate data with species distribution was used for Stockholm city, where over 60 tree species were evaluated for the future climate of 2071–2100, combining species observations with high-resolution climate data from GFDL (Geophysical Fluid Dynamics Laboratory) (Karger et al., 2021). The resulting analysis was combined with a literature review on urban conditions for trees to create a forecast for urban forest development in the coming decades.

Impacts on biodiversity

Results from the climate forecast made for Stockholm (Trädkontoret, 2024) indicate that many tree species more commonly found in Central and Southern Europe may spread to more northern latitudes due to increased annual temperatures (Figure 57). Species native to Nordic countries are also expected to move their ecological boundaries further north. This is likely to increase both risks of new invasive species, pests and diseases, as well as a deterioration in tree species that lack adaptation mechanisms for a warmer climate. In the Nordic Region, warmer summers with uneven distribution of rain are therefore likely to prove a challenge for urban forests in the coming decades.

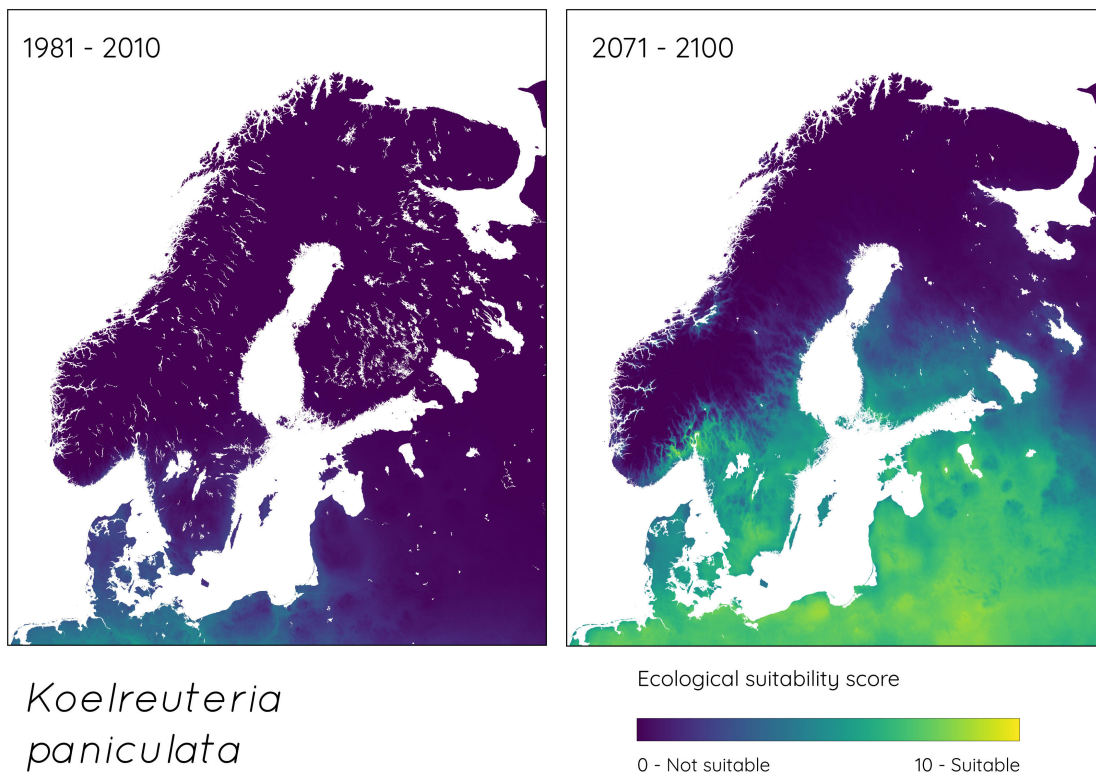


Figure 57. Prognosis of the golden rain tree (*Koelreuteria paniculata*) for 1981–2010 and 2071–2100. A big improvement in ecological conditions is seen on the 2071–2100 map.

In the Stockholm area, the ecological conditions for species such as London plane (*Platanus x hispanica*), black locust (*Robinia pseudoacacia*), honey locust (*Gleditsia triacanthos*), golden rain tree (*Koelreuteria paniculata*), Austrian pine (*Pinus nigra*), and dawn redwood (*Metasequoia glyptostroboides*) improved in the period of year 2071–2100 (see Table 13). Many of these species are already established as urban trees due to their abilities to cope with / thrive during harsh growing conditions. These traits are also shared by pear (*Pyrus communis*), field maple (*Acer campestre*), Turkish hazel (*Corylus colurna*), and manna ash (*Fraxinus ornus*).

Table 13. Table showing the species with the best predicted development for the Stockholm region in 2071–2100 compared to 1981–2010. Higher scores indicate better ecological conditions, and lower scores indicate less suitable conditions for each species. The score is derived from the suitability score (see Figure 57 and 58) for each species from the climate forecast, with Stockholm as the reference point. Species native to Sweden are marked with an asterisk (*).

Species	1981–2010 score	2071–2100 score
<i>Pterocarya fraxinifolia</i>	1	8
<i>Acer saccharinum</i>	2	8
<i>Corylus colurna</i>	1	7
<i>Quercus palustris</i>	1	7
<i>Acer campestre</i> *	2	7
<i>Fraxinus ornus</i>	1	6
<i>Platanus x hispanica</i>	0	4
<i>Robinia pseudoacacia</i>	3	7
<i>Ulmus minor</i> *	2	6
<i>Gleditsia triacanthos</i>	1	4
<i>Koelreuteria paniculata</i>	2	5
<i>Metasequoia glyptostroboides</i>	2	5
<i>Pinus nigra</i>	3	6
<i>Pyrus communis</i>	6	9
<i>Quercus rubra</i>	5	8
<i>Tilia x euchlora</i>	4	7

Species whose ecological conditions declined in 2071–2100 were Amur cherry (*Prunus maackii*) (Figure 58), Swedish whitebeam (*Sorbus intermedia*), balsam poplar (*Populus balsamifera*), Norway spruce (*Picea abies*), Chinese poplar (*Populus simonii*), European aspen (*Populus tremula*) and rowan (*Sorbus aucuparia*) (see Table 14). Four of the seven species are classified as native by the Swedish Species Information Centre (SLU Artdatabanken), while the remaining are exotic. What characterises these species, besides their origin, is that they are known for their tolerance to low temperatures, but at the same time, they are sensitive to drought and high temperatures.

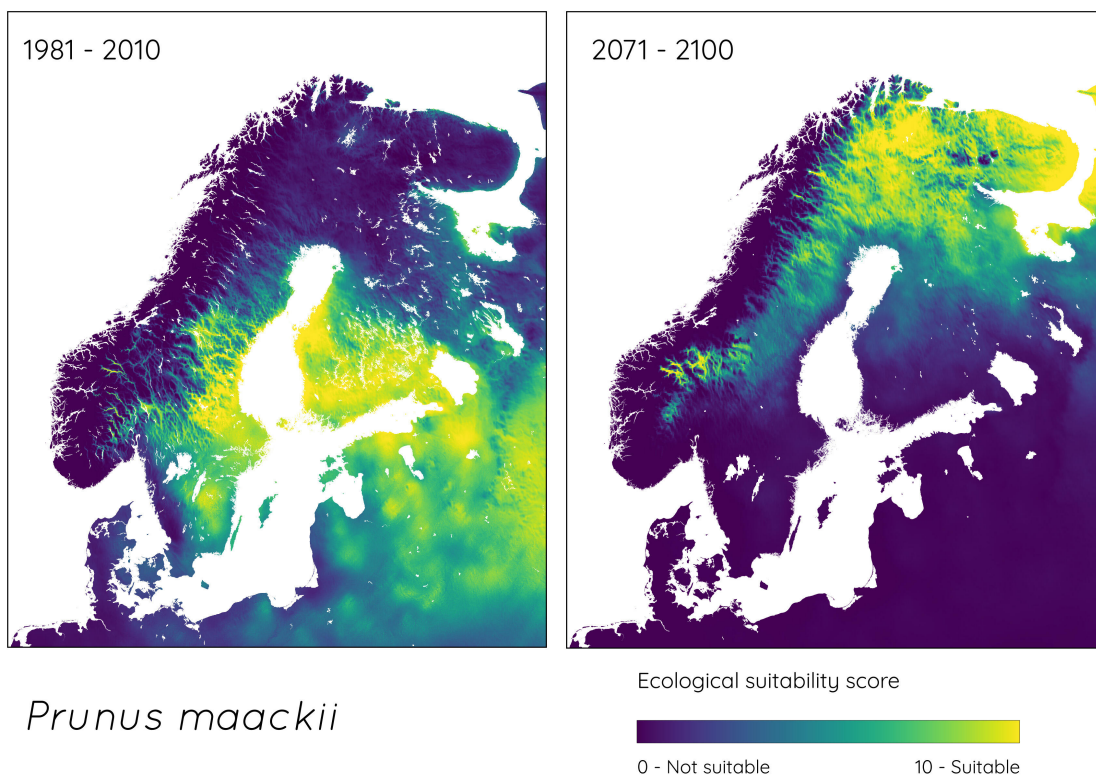


Figure 58. Prognosis of the Amur cherry (*Prunus maackii*) tree for 1981–2010 and 2071–2100.

Species	1981–2010 score	2071–2100 score
<i>Prunus maackii</i>	9	2
<i>Sorbus intermedia</i> *	8	1
<i>Populus balsamifera</i>	9	6
<i>Picea abies</i> *	6	4
<i>Populus simonii</i>	8	7
<i>Populus tremula</i> *	6	5
<i>Sorbus aucuparia</i> *	7	6

Table 14. Table showing the species with the most negative predicted development for the Stockholm region in 2071–2100 compared to 1981–2010. The score is based on the raster values for each species from the climate forecast with Stockholm as a geographical reference point. Species native to Sweden are marked with an asterisk (*)

Ecological developments for 2071–2100 in a Nordic context

In the Nordic Region, an annual increase in both temperature and precipitation is likely to benefit many plants, both native and exotic (e.g., Cowles et al., 2018). The increased temperature sum throughout the year will likely result in a prolonged growing season, warmer summers and higher temperatures throughout the year. This increase in temperature is likely to be a driving factor for many species in their ecological expansion in the Nordic Region. Species with an already high risk of invasiveness (for example, black locust, *Robinia pseudoacacia*) (Figure 59) will benefit from the increase in temperature, and thus, become a greater concern in areas where it is introduced as well as spreading further north. Apart from elevated risks from invasive species, the introduction of new plant material suited for warmer and drier conditions will be possible.

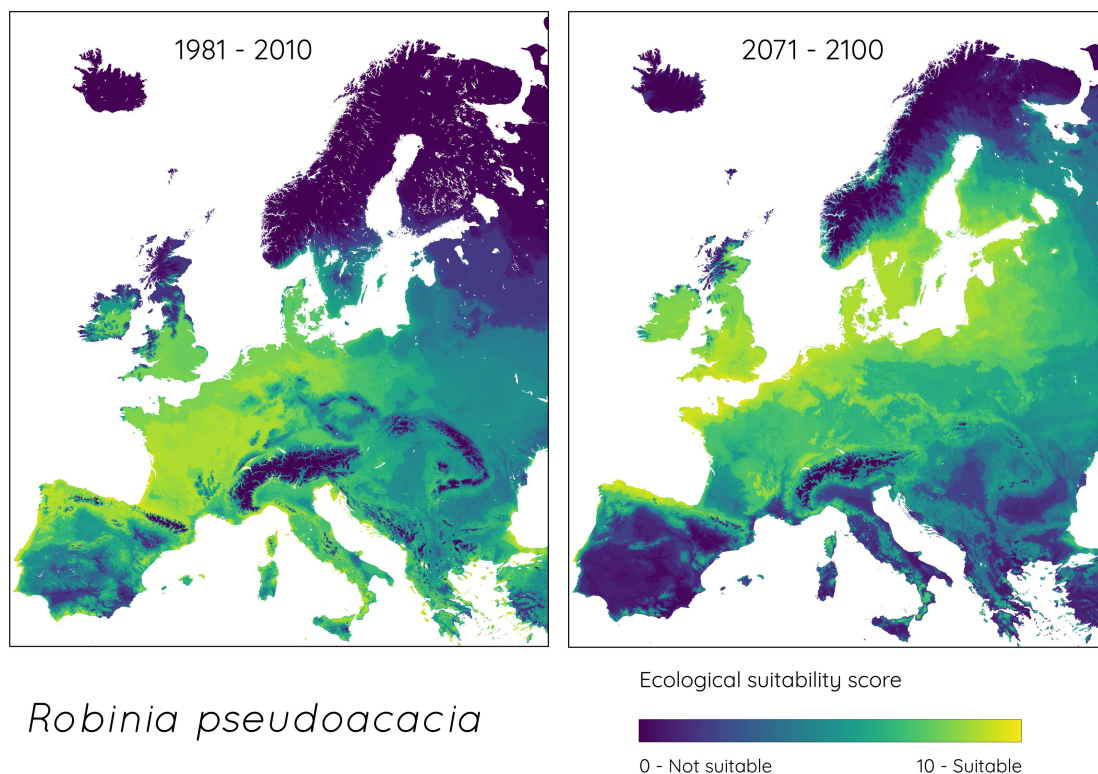


Figure 59. The ecological niche for black locust (*Robinia pseudoacacia*) in Europe in the years 1981–2010 and 2071–2100. The yellow areas indicate areas where the species ecological conditions regarding heat and precipitation are met. Noticeable changes can be observed in both southern Sweden and Finland.

Trees native to the Nordic Region will also expand their ecological niches further north, as in the case of sessile oak (*Quercus petraea*) (Figure 60). This oak species is predicted to expand from southern Scandinavia to further up along Sweden on the eastern coast along both the Norwegian and Swedish coastline as well as southern Finland.

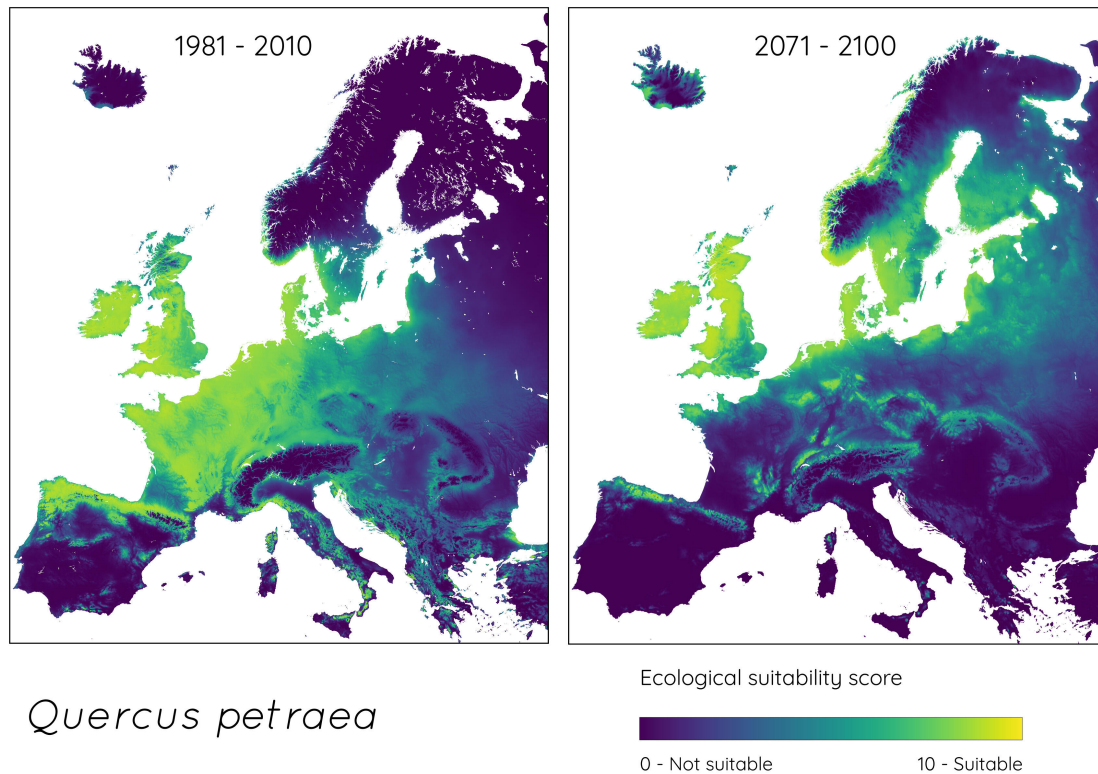


Figure 60. The ecological niche for Sessile oak (*Quercus petraea*) in Europe in the periods 1981–2010 (left) and 2071–2100 (right). The yellow areas indicate areas where the species ecological conditions regarding heat and precipitation are met. Noticeable changes can be observed in Sweden, Finland, and the Norwegian coastline.

The increase in annual precipitation will also play a vital role in the development of ecological niches for tree species. However, for precipitation to be beneficial to trees, it needs to occur during the growing season. Rainfall that occurs in the autumn and before bud burst, will have little advantages for the tree. This will also be amplified in urban conditions where growing conditions are characterised by limited root space, lack of nutrients, compacted soil, pollution and limited water supply due to impervious surfaces. The increased annual temperature will enable more tree species to expand further north, but the ones that have developed strategies for withstanding uneven water supply will have an advantage.

The elevated risks of invasive species due to annual temperatures will also come with the possibility of new and more drought-tolerant tree species. Species capable of managing prolonged periods of drought will have a greater chance of successful establishment and development in a future climate. This will especially be true in urban areas whereas mentioned above, growing conditions for city trees will be harsher than in rural areas.

Implications for climate adaptation regarding implementation of the 3+30+300 principle

When considering other factors, such as the exposed and harsh environment that urban trees inhabit, the effects of climate change are amplified. Street trees are often subjected to a range of stressors, including limited root space, compacted soil, a lack of nutrients and water, as well as pollution from traffic and construction (Jim, 1993; Bassuk and Day, 1994; Gilman et al., 2014; Ghosh et al., 2014). These conditions make the trees more vulnerable to the negative impacts of climate change. For instance, the already limited access to water can worsen due to changing rainfall patterns (IPCC, 2021), leading to water stress and reduced vitality. Increased temperatures can result in more frequent and severe heat damage, especially for trees located on hard surfaces like asphalt and concrete, which absorb and radiate heat. Pollution from traffic can further weaken the trees by damaging their leaves and bark, and by altering the soil's chemical composition. Overall, this means that street trees, already struggling in a tough environment, become even more vulnerable as the effects of climate change unfold. Tree species adapted to warmer and drier conditions are more likely to adapt and grow in the urban climate than species adapted to more stable and cooler conditions.

A tree that is capable of handling these circumstances will be able to better contribute to ecosystem services as well as canopy coverage in an urban environment, a crucial part of the 30-component in 3+30+300.

Conclusions

Climate change poses a significant challenge for urban trees, affecting both native and exotic species. By analysing climate forecasts and the trees' local environments, we have gained a comprehensive understanding of the future conditions for trees and the measures needed to ensure their survival and functionality in the urban landscape.

One of the most prominent trends is that many tree species are expected to shift their distribution boundaries further north, as a direct consequence of rising temperatures. This indicates that climate change will change the ecological prerequisites for almost all tree species in northern Europe. Species lacking the adaptability to cope with drought and higher temperatures will encounter major

difficulties. This is particularly relevant for native species that have evolved in a more temperate climate and are thus less equipped for the extreme conditions expected in the future. If we are to plant trees that will remain vital and provide ecosystem services for over a century, we need to carefully consider the choice of species to ensure that the trees are prepared for the coming climate.

These choices will impact rules and guidelines such as the 3+30+300 principle, where trees not suited for the future climate will struggle with water management as well as increased transpiration, leading to a mortality spiral. This impacts all aspects of the 3+30+300 principle. Trees unsuitable for urban conditions will develop less biomass, leading to smaller crown sizes, and the ones already in decline will have higher mortality. Hence, proactive measures in securing the urban forest are needed in order to secure it for future generations. Planting tree species well suited for limited water supply and warmer temperatures is one way forward, another is improving the conditions for existing trees through root zone renovations, where appropriate.

A more nuanced approach to the use of native and exotic tree species in urban planning is needed. A diversified tree population, including both native and exotic species, is necessary to create a resilient and sustainable urban environment. By using a mix of species, we can take advantage of the different strengths each species offers and create a tree population better suited to handle future climate challenges.



Photo 19. Tree in front of house facade (photo by Benjamin Suomela).

5. Conclusions and recommendations

Overall project results

The Yggdrasil – The Living Nordic city had as its aims to:

- Evaluate the 3+30+300 principle's effectiveness in enhancing public health, climate change, and biological diversity, with a specific focus on native tree species.
- Guide the Nordic Countries in their implementation of the Kunming-Montreal Global Biodiversity Framework Target 12 on green cities (Target 12 (cbd.int)) and support their work on Target 8 and 11 on climate change, nature-based solutions and ecosystem services (Target 8 and 11 (cbd.int)).
- Establish a collaborative network among Nordic cities, fostering the preservation and expansion of local tree populations.
- In countries where the 3+30+300 principle might not be relevant to implement (e.g. Faroe Islands, Iceland, and Greenland) due to the lack of native tree species and the difficulty in reaching high tree canopy levels, the aim is to assess realistic steps towards 3+30+300 and recommend alternative ways of urban greening based e.g., on native vegetation.

As this report has documented, comprehensive information and analysis has been provided on the current implementation of the 3+30+300-principle in the Nordic Region. Findings include, among others, an overview of the overall status of urban forests and green spaces according to this principle in all Nordic countries, showing that most countries and municipalities score well when it comes to 3+30+300 compliance. However, in particular, the gap analysis for the participating municipalities has shown there are opportunities for further improvement. The results presented in this report also highlight the links of 3+30+300 with public health, climate change, and biodiversity considerations.

The work carried out by the Yggdrasil team provides an important contribution to the wider fulfilment of green space, biodiversity, and nature-based solutions policies and targets at different levels, including the Kunming-Montreal Global Biodiversity Framework Target 11. Concrete ways of integration 3+30+300 in policies and plans are provided in this report, based on experiences from Nordic countries and cities, as well as those elsewhere. One example of a relevant policy framework is that of urban forestry master plans but as the example of several Swedish cities shows, 3+30+300 can even be included in municipal comprehensive

plans. The principle has the potential to be an important delivery mechanism and metric for the wider implementation of nature-based solutions, also in a more equitable way.

The Yggdrasil project has created a network of organisations and municipalities that can help advance 3+30+300 implementation and the efforts to enhance biodiversity, public health, and climate action, e.g., through wider implementation of nature-based solutions in Nordic municipalities. Important knowledge and experience sharing has taken place within this network.

Although most Nordic countries and municipalities are well placed to implement 3+30+300, it is important to work context-specific and recognise that starting conditions and needs will differ. Trees and green spaces are important for climate adaptation and health promotion, and even countries and regions with lower tree and forest covers like the Faroe Islands and Iceland show that 3+30+300 can be a useful tool to enhance urban and other built-up areas. But obviously the local landscape and biodiversity concerns need to be considered. This report also shows the role of biodiversity and native trees in meeting policy objectives related to liveable and resilient cities, while highlighting the importance of diverse and resilient urban forests that also include non-natives.

Recommendations

Based on the work within Yggdrasil, several recommendations can be provided, both for the wider greening of Nordic municipalities and the implementation of nature-based solutions and specifically for implementing the 3+30+300 principle.

Overall recommendations

Policies and planning

- Nordic cities and other municipalities have a long tradition of urban greening. In the face of urban densification, climate change, and biodiversity loss, this tradition is under threat, however, as there is a risk that urban areas can become less green and with that also more vulnerable and less liveable and healthy. Awareness about this risk needs to be raised and actions have to be taken to counteract it.
- Linked to the above, it is important to ensure that green space and trees are not removed in urban regeneration programs or densification strategies that are implemented to create higher urban attractiveness and to support security in socio-economic vulnerable areas.
- Sufficient canopy cover and green spaces need to be provided in new developments to avoid creating the vulnerable neighbourhoods of the future. Climate change and predicted warmer, dryer and wetter climate, and a

higher extreme weather will affect our Nordic cities and areas without trees and green space will be more exposed and vulnerable.

- To maximise their socio-economic benefits, trees need to be integrated into broader urban planning and development policies. Tree-planting initiatives should be aligned with housing, transportation, and public health strategies for greater impact.
- Children, the elderly, the sick, or otherwise vulnerable are particularly in need of green infrastructure and proximity to high-quality public green spaces, partly because they are more sensitive to the effects of air pollution and heat, and partly because they often spend a large proportion of their time close to their homes or various institutional settings. It has to be noted, however, that Nordic cities often do not show the usual link between higher level of neighbourhood vulnerability and lower levels of greenness.
- Implementation of the 3+30+300 principle should be seen within the wider international and national policy context. The new Nature Restoration Law of the European Union, for example, sets minimum requirements for urban tree canopy cover and share of public green space.

Funding and investment

- Public investment in urban forestry, as well as incentives for private landowners to plant and maintain trees, are crucial. Cities may implement tax breaks or grants for greening efforts. Although funding and investment were not specifically addressed by the project, there is no doubt that sound urban forestry and urban greening programs require sufficient funds, including for longer-term management.

Tree protection and management

- We need to retain and care for existing trees in the urban landscape, rather than putting too much emphasis on planting new trees. This is especially important for older trees since they provide more ecosystem services than smaller trees.
- Protective measures should be taken for street and city trees near construction, both above and below ground, so that trees can get older and provide more ecosystem services. Important trees that are in need of, and suitable for, root zone renovation in order to improve growing conditions for existing city trees should be identified and properly cared for.
- Nordic municipalities should allocate more resources into surveying and monitoring their tree populations. The more data collected the better policies regarding tree diversity they could produce and implicate.

Tree selection and planting

- Just planting as many trees as possible, no matter where, no matter what species, should be avoided. It is important to consider, for example, future climate conditions and biodiversity concerns.
- You are in this for the long run, plant trees with ample space to become a large tree. Better a few good trees that have a real chance to grow older and larger than many smaller ones.
- Make sure you plant a variety of species for a sustainable and resilient urban forest cover.

Tree diversity, including the use of native and exotic species

- Striving for a more diverse tree population is important for climate change mitigation and adaptation. Not all Nordic municipalities currently have a sufficiently diverse urban forest and thus become vulnerable to climate change, current and emergent pests and diseases, and the like. Tree diversity can be increased by planting new species instead of the more common species within the city, for example based on species suitability under future climate scenarios. Further, within tree species, diversity makes the populations less vulnerable to changes in the environment and increases their adaptive potential. Diversity also relates to a good age distribution in the urban forest, so that a healthy canopy can be maintained. In parks and woodland, the presence of dead wood can also support biodiversity. age of trees, a diverse population of younger and older trees, including dead trees supports biodiversity.
- Diversity is also important to mitigate ecosystem disservices like pollen allergens and tree diversity is positive for the diversity of flora, fauna, and fungi dependent on different species. Moreover, tree selection should include both the positive and more challenging characteristics of trees, also in the longer term.
- It should be ensured that new trees are chosen not only for the existing climate, but for the future climate as well.
- The number of trees planted solely for ornamental purposes should, in many cases, be reduced in favour of trees intended to provide shade, as temperature regulation and other climate-related benefits of trees have become a priority
- The use of exotic trees should be conducted with much care. There is a great need for being cautious regarding the risk of invasive species being introduced where they can spread and compete with local flora and habitats. Using non-native plants can also affect pollinator communities. Therefore, it is important to follow the respective country's recommendations to avoid the use of invasive species.

Community engagement

- Engaging local communities in urban tree initiatives fosters a sense of ownership and ensures that tree-planting projects are aligned with community needs. Participation in local greening projects can empower residents and ensure long-term success.

3+30+300-specific recommendations

Overall, 3+30+300 approach and implementation

- It is essential to formulate a clear, long-term vision for the trees and green spaces in the municipality (or at a different scale) and then see how 3+30+300 can help you deliver this vision.
- This principle is a great starting point, as it has a decent evidence base, is increasingly tested and implemented, and serves as an international benchmark. Moreover, it provides a simple metric or guideline that combines the importance of visible green, surrounding green, and recreational green.
- One needs to always integrate the 3+30+300 principle in a wider policy and planning context, with other guidelines, metrics, etc. 3+30+300 is not only for tree and green space plans and policies. Try to integrate into plans and policies for health, climate action, biodiversity, social justice, education, etc. However, work context-specific and see what is realistic and desirable.
- Consider how appropriate 3+30+300 implementation is to local contexts. In some cases, adding more trees to areas can be seen as less appropriate and conflicting e.g., with local habitats.
- Don't forget local communities and their wishes. Find ways to engage them in 3+30+300 implementation.
- Do not request a new development to be 3+30+300-compliant from the start, as this is impossible. Do not request a new development to be 3+30+300-compliant from the start, as this is impossible (unless the development is in an area where substantial existing vegetation can be maintained). Trees take time to grow. An alternative might be that you request it to be 3+30+300-compliant in 20 years for instance.
- Learn from others, as more and more municipalities - also in the Nordic region - are gaining experience with implementing the principle.
- Undertake gap analyses and set priorities for 3+30+300 implementation where needs are highest, for example in the vicinity of kindergartens, schools, care facilities, and other types of social institutions, as well as in areas with a high proportion of children and elderly people.

Assessment and monitoring

- It is important to carry out an initial 3+30+300 assessment of your municipality, neighbourhood, or other area.
- You can overlay 3+30+300 maps with other relevant maps, such as the socio-demographic neighbourhood characteristics and climate maps shown in this report, but also for example, mobility maps, presence of underground infrastructure, and the like.
- A gap analysis tells you where to prioritise and start first, given limited budgets. A gap analysis can take different forms and can focus on the municipality as a whole but also on specific neighbourhoods as well as land-use or building types (for example, schools, hospitals, and elderly homes).
- The individual 3, 30 and 300 components allow you to know if your effort should go into creating a park, creating more street trees or creating better support/policy for trees on private territory.
- As a follow-up: through time you could monitor if your efforts have been effective. Moreover, you can link the monitoring of your 3+30+300 scores to (changes in) different ecosystem services, such as cooling and public health gains. Various assessment tools, including i-Tree, can assist with this and sometimes also provide insights into economic costs and benefits.
- Important to note is that 3+30+300 should be seen as a minimum level. This is especially important in the Nordic context as the cities here in general score high on one or several of the parts of the rule. Our good conditions and long history of preserving and safeguarding urban green space is a strength and should not be taken for granted.
- Don't get discouraged by a drop in one of the three components. There could be good reasons for that, for example a replacement of certain tree species by others that are more climate-resilient or functional (and which can lead to e.g., a temporary drop in canopy cover).

Key messages

Four key messages result from the project and crystalise its main findings and recommendations. These messages can be used when implementing the 3+30+300 rule and developing greener municipalities throughout the Nordic region, in collaboration with different stakeholders.

Let's keep our Nordic cities green as they grow and transform.

- Although Nordic cities are small and green, rapid transformations are at risk of changing that due to lack of tools and policies to preserve and develop new green space as cities are growing and densifying.
- The Nordic cities generally score high on the 3+30+300 principle, but the further north we get the fewer trees can grow (although climate change could lead to an expansion of the tree palette). We have nature around the corner, but we cannot take our trees and green spaces for granted. As new neighbourhoods need to be planned and developed, and existing neighbourhoods have to be transformed, trees and green space should be an integral component so that these areas can be healthy, resilient, and biodiverse.
- Human-caused climate change poses challenging conditions for both humans and trees. Trees, shrubs, and other green spaces are crucial in adapting to climate change and mitigating the effects of a wetter, dryer, and warmer climate.

Use 3+30+300 to assess, promote, and celebrate the possibilities of urban trees.

- The narrative on trees and urban green space needs to be shifted from a two-dimensional, abstract, and placeless understanding of greenery, to that of a narrative of trees and other vegetation that are living, physical, and multi-dimensional.
- Trees need to be viewed both as individuals and as important components of green networks for humans and non-humans. Due to the specific Nordic context, shrubs and ground vegetation also need to be included in a holistic understanding of the urban green space.
- The 3+30+300 principle is a powerful communication tool for decision-makers, civil servants, different professions, and residents to rally around.

The city is an unnatural habitat for trees - and thus specific actions are needed to still make trees thrive and contribute to better cities.

- Understanding the properties, needs, and characteristics of both native and introduced (exotic) species is crucial in a changing Nordic climate. Climate change is pushing climate zones and changing conditions for both existing urban trees and those that are being planted today.

- The use of native species influences legibility, place attachment, and sense of place as well as contributing to local gene pools. Thus, native species are important, but it is important to realise that they are not native to the city.
- Urban conditions for trees are often challenging, affecting the lifespan and viability of trees highlighting the complexity of species choice and selection.

Relationships between socio-economic vulnerability, trees, and green space have a specific Nordic dimension.

- The relationship between tree canopy cover, green space access, and socio-economic status in Nordic cities differs from what the literature from North America and elsewhere suggests, as neighbourhoods with more vulnerable communities are not necessarily less green. The definition of socio-economic vulnerability also differs widely between the Nordic cities.
- Access to green space and the presence of trees in connection to vulnerable groups such as children, the elderly, and the health-challenged remains an important planning challenge.
- While green space is often available, safety and seasonal challenges need to be addressed in areas of socio-economic vulnerability.

Executive summary

This report presents findings from the project 'Yggdrasil – The Living Nordic City', part of the larger Nordic Cities Nature-Based Solutions Programme which aims to contribute to achieving Vision 2030 – making the Nordic Region the most sustainable and integrated region in the world. Focused on promoting nature-based solutions in cities and municipalities across the Nordic region, the project centres on the 3+30+300 principle, which is a rather new rule of thumb for urban trees and greening, emphasising biodiversity, climate adaptation, and public health. The 3+30+300 principle provides clear criteria for the minimum provision of urban trees in our urban communities: all citizens shall be able to see 3 large trees from their home, school, workplace, or place of care; there should be at least 30 percent tree canopy cover in every neighbourhood; and nobody should live more than 300 metres from the nearest publicly accessible (and high-quality) green space.

Yggdrasil – The Living Nordic City has had as its aims to:

- Evaluate the 3+30+300 principle's effectiveness in enhancing public health, climate change, and biological diversity, with a specific focus on native tree species.
- Guide the Nordic countries in their implementation of the Kunming-Montreal Global Biodiversity Framework Target 12 on green cities (Target 12 (cbd.int)) and support their work on Target 8 and 11 on climate change, nature-based solutions and ecosystem services (Target 8 and 11 (cbd.int)).
- Establish a collaborative network among Nordic cities, fostering the preservation and expansion of local tree populations.
- In countries and areas where the 3+30+300 principle might not be relevant to implement due to lack of native tree species and the difficulty to reach high tree canopy levels, the aim is to assess realistic steps towards 3+30+300 and recommend alternative ways of urban greening based e.g., on native vegetation.

As this report has documented, comprehensive information and analysis has been provided on current implementation of the 3+30+300-principle in the Nordic countries and cities. Findings include, among other, an overview of overall status of urban forests and green spaces according to this principle in all Nordic countries, showing that most countries and municipalities score well

when it comes to 3+30+300 compliance, although there are some differences between countries as Table ES1 shows. Finland and Norway have the highest 3+30+300 compliance, with the large majority of all buildings scoring high on all three components, while Iceland and Greenland (not surprisingly, given their generally low tree cover) show the lowest scores.

More important than the national assessments, however, is analysis at municipal level. Here in particular the gap analysis for the participating municipalities has shown, there are opportunities for further improvement of 3+30+300-compliance. The results presented in this report also highlight the links of 3+30+300 with public health, climate change, and biodiversity considerations.

Table ES1. Overview of 3+30+300-principle scores for the Nordic countries. The percentages and averages refer to all buildings in every respective country. Scores are for all buildings in the respective countries, including cities and rural areas. With a 'green space' is meant a publicly accessible green space of at least 1 ha, in line with definitions used for assessing the 300-component of the 3+30+300 principle.

Country	Adherence of buildings reaching					Averages per building		
	3-rule (%)	30-rule (%)	300-rule (%)	Positive overall score (%)	All 3 rules at once (%)	n° of trees	Canopy cover (%)	Distance to green space (m)
Norway	85.63	84.06	95.88	92.29	74.48	40.39	54.83	42.0
Denmark	71.70	32.83	93.45	66.96	26.73	24.31	26.25	60.6
Sweden	83.11	79.94	97.23	89.74	70.74	38.24	53.99	27.1
Åland	86.48	92.48	51.40	88.02	43.89	40.96	60.25	329.9
Finland	97.55	92.54	97.70	97.12	87.39	56.69	56.24	22.6
Faeroes	73.67	18.56	80.75	51.74	17.17	28.47	16.23	140.2
Iceland	39.26	4.08	51.52	23.50	3.57	11.00	7.93	327.7
Greenland	1.46	0.02	2.73	0.10	0.01	0.18	0.43	632.2

The work carried out by the Yggdrasil project team provides an important contribution to the wider fulfilment of green space, biodiversity, and nature-based solutions policies and targets at different levels, including the Kunming-Montreal Global Biodiversity Framework Target 11. Concrete ways of integration 3+30+300 in policies and plans are provided in this report, based on experiences from Nordic countries and cities, as well as those elsewhere. One example of a relevant policy framework is that of urban forestry master plans but as the example of several Swedish cities shows, 3+30+300 can even be included in municipal comprehensive plans. The principle has the potential to be an important delivery mechanism and metric for the wider implementation of nature-based solutions, also in a more equitable way.

The Yggdrasil project has created a network of organisations and municipalities that can help advance 3+30+300 implementation and the efforts to enhance biodiversity, public health, and climate action, e.g., through wider implementation of nature-based solutions in Nordic municipalities. Important knowledge and experience sharing has taken place within this network.

Although most Nordic countries and municipalities are well placed to implement 3+30+300, it is important to work context-specific and recognise that starting conditions and needs will differ. Trees and green spaces are important for climate adaptation and health promotion and even countries and regions with lower tree and forest covers like the Faroe Islands and Iceland show that 3+30+300 can be a useful tool to enhance urban and other built-up areas. But obviously the local landscape and biodiversity concerns need to be considered. This report also shows the role of biodiversity and native trees in meeting policy objectives related to liveable and resilient cities, while highlighting the importance of diverse and resilient urban forests that also include non-natives.

Based on the work within Yggdrasil, several recommendations can be provided, both for the wider greening of Nordic municipalities and the implementation of nature-based solutions and specifically for implementing the 3+30+300 principle.

Table ES2 provides an overview of project recommendations for the overall greening and implementation of nature-based solutions and specifically for 3+30+300 principle implementation.

Table ES2. Recommendations resulting from the Yggdrasil - The Living Nordic City project. (For more details, sources and the like we refer to the full report.)

Area of recommendations	Specific recommendations
<i>Overall recommendations</i>	
Policies and planning	• Nordic cities and other municipalities have a long tradition of urban greening. In the face of urban densification, climate change, and biodiversity loss, this tradition is under threat, however, as there is a risk that urban areas can become less green and with that also more vulnerable and less liveable and healthy. Awareness about this risk needs to be raised and actions have to be taken to counteract it. • Linked to the above, it is important to secure that green space and trees are not removed in urban regeneration programs or densification strategies implemented to create higher urban attractivity and to support security in socio-economic vulnerable areas. • Sufficient canopy cover and green spaces need to be provided in new developments to avoid creating the vulnerable neighbourhoods of the future. Climate change and predicted warmer, dryer and wetter climate, and more frequent extreme weather events will affect our Nordic cities and areas without trees and green space will be more exposed and vulnerable. • To maximise their socioeconomic benefits, trees need to be integrated into broader urban planning and development policies. Tree-planting initiatives should be aligned with housing, transportation, and public health strategies for greater impact. • Children, the elderly, the sick, or otherwise vulnerable are particularly in need of green infrastructure and proximity to high-quality public green spaces, partly because they are more sensitive to the effects of air pollution and heat, and partly because they often spend a large proportion of their time close to their homes or various institutional settings. • Implementation of the 3+30+300 principle should be seen within the wider international and national policy context. The new Nature Restoration Law of the European Union, for example, sets minimum requirements for urban tree canopy cover and share of public green space.
Funding and investment	• Public investment in urban forestry, as well as incentives for private landowners to plant and maintain trees, are crucial. Cities may implement tax breaks or grants for greening efforts. Although funding and investment were not specifically addressed by the project, there is no doubt that sound urban forestry and urban greening programs require sufficient funds, including for longer-term management.
Tree protection and management	• We need to retain and care for existing trees in the urban landscape. This is especially important for older trees since these provide more ecosystem services than smaller trees. • Protective measures should be taken for street and city trees near construction, both above and below ground, so that trees can get older and provide more ecosystem services. • Important trees that are in need of, and suitable for, root zone renovation in order to improve growing conditions for existing city trees should be identified and properly cared for. • Nordic municipalities should allocate more resources into surveying and monitoring their tree populations. The more data collected the better policies regarding tree diversity they could produce and implicate.
Tree selection and planting	• Just planting as many trees as possible, no matter where, no matter what species, should be avoided. It is important to consider, for example, future climate conditions and biodiversity concerns. • You are in this for the long run, plant trees with ample space to become a large tree. Better a few good trees that have a real chance to grow older and larger than many smaller ones. • Make sure you plant a variety of species for a sustainable and resilient urban forest cover.

Tree diversity, including the use of native and exotic species	● Striving for a more diverse tree population is important for climate change mitigation and adaptation. Not all Nordic municipalities currently have a sufficiently diverse urban forest and thus become vulnerable to climate change, current and emergent pests and diseases, and the like. Tree diversity can be increased by planting new species instead of the more common species within the city, for example based on species suitability under future climate scenarios. Further, within tree species, diversity makes the populations less vulnerable to changes in the environment and increases their adaptive potential. Diversity also relates to a good age distribution in the urban forest, so that a healthy canopy can be maintained. In parks and woodland, the presence of dead wood can also support biodiversity. ● Diversity is also important to mitigate ecosystem disservices like pollen allergens and tree diversity is positive for the diversity of flora, fauna, and fungi dependent on different species. Moreover, tree selection should include both the positive and more challenging characteristics of trees, also in the longer term. ● It should be ensured that new trees are chosen not only for the existing climate, but for the future climate as well. ● The number of trees planted solely for ornamental purposes should, in many cases, be reduced in favour of trees intended to provide shade, as temperature regulation and other climate-related benefits of trees have become a priority. ● The use of exotic trees should be conducted with much care. There is a great need for being cautious regarding the risk of invasive species being introduced where they can spread and compete with local flora and habitats. Using non-native plants can also affect pollinator communities.
Community engagement	● Engaging local communities in urban tree initiatives fosters a sense of ownership and ensures that tree-planting projects are aligned with community needs. Participation in local greening projects can empower residents and ensure long-term success.
<i>3+30+300-specific recommendations</i>	
Overall 3+30+300 approach and implementation	● It is essential to formulate a clear, long-term vision for the trees and green spaces in the municipality (or at a different scale) and then see how 3+30+300 can help you deliver this vision. ● This principle is a great starting point, as it has a decent evidence base, is increasingly tested and implemented, and serves as an international benchmark. Moreover, it provides a simple metric or guideline that combines the importance of visible green, surrounding green, and recreational green. ● One needs to always integrate 3+30+300 in a wider policy and planning context, with other guidelines, metrics, etc. 3+30+300 is not only for tree and green space plans and policies. Try to integrate into plans and policies for health, climate action, biodiversity, social justice, education, etc. However, work context-specific and see what is realistic and desirable. ● Consider how appropriate 3+30+300 implementation is to local contexts. In some cases, adding more trees to areas can be seen as less appropriate and conflicting e.g., with local habitats. ● Don't forget local communities and their wishes. Find ways to engage them in 3+30+300 implementation. ● Do not request a new development to be 3+30+300-compliant from the start, as this is impossible (unless the development is in an area where substantial existing vegetation can be maintained). Trees take time to grow. An alternative might be that you request it to be 3+30+300-compliant in 20 years for instance. ● Learn from others, as more municipalities – including those in the Nordic Region – are gaining experience with implementing the principle. ● Undertake gap analyses and set priorities for 3+30+300 implementation where needs are highest, for example in the vicinity of kindergartens, schools, care facilities, and other types of social institutions, as well as in areas with a high proportion of children and elderly people.

Assessment and monitoring	• It is important to carry out an initial 3+30+300 assessment of your municipality, neighbourhood, or other area. • You can overlay 3+30+300 maps with other relevant maps, such as the socio-demographic neighbourhood characteristics and climate maps shown in this report, but also for example, mobility maps, presence of underground infrastructure, and the like. • A gap analysis tells you where to prioritise and start first, given limited budgets. A gap analysis can take different forms and can focus on the municipality as a whole but also on specific neighbourhoods as well as land-use or building types (for example, schools, hospitals, and elderly homes). • The individual 3, 30, and 300-components allow you to know if your effort should go into creating a park, creating more street trees or creating better support/policy for trees on private territory. • As a follow-up: through time you could monitor if your efforts have been effective. Moreover, you can link the monitoring of your 3+30+300 scores to (changes in) different ecosystem services, such as cooling and public health gains. Various assessment tools, including i-Tree, can assist with this and sometimes also provide insights into economic costs and benefits. • Important to note is that 3+30+300 should be seen as a minimum level. This is especially important in the Nordic context as the cities here in general score high on one or several of the parts of the rule. Our good conditions and long history of preserving and safeguarding urban green space is a strength and should not be taken for granted. • Don't get discouraged by a drop in one of the three components. There could be good reasons for that, for example a replacement of certain tree species by others that are more climate-resilient or functional (and which can lead to e.g., a temporary drop in canopy cover).
---------------------------	---

These recommendations also link to the four key messages resulting from the project:

- Let's keep our Nordic cities green as they grow and transform.
- Use 3+30+300 to assess, promote, and celebrate the possibilities of urban trees.
- The city is an unnatural habitat for trees, and thus, specific actions are needed to ensure that trees thrive and contribute to better cities.
- Relationships between socio-economic vulnerability, trees, and green space have a specific Nordic dimension.

Sammanfattning på svenska

I den här rapporten presenteras resultat från projektet "Yggdrasil – The Living Nordic City", som är en del av det större programmet Nordic Cities Nature-Based Solutions som syftar till att bidra till att uppnå Vision 2030 – att göra Norden till världens mest hållbara och integrerade region. Projektet fokuserar på att främja naturbaserade lösningar i städer och kommuner i hela Norden och fokuserar på 3+30+300-principen, som är en relativt ny princip för stadsträd och grönska, med betoning på biologisk mångfald, klimatanpassning och folkhälsa. 3+30+300-principen ger tydliga kriterier för miniminivå av träd som bör finnas i våra städer: alla medborgare ska kunna se 3 stora träd från sitt hem, sin skola, sin arbetsplats eller sin vårdplats; Det bör finnas minst 30 procent trädkröntäckning i varje kvarter; och ingen bör bo mer än 300 meter från närmaste offentligt tillgängliga (och högkvalitativa) grönområde.

Yggdrasil – The Living Nordic City har haft som mål att:

- Utvärdera 3+30+300-principens effektivitet när det gäller att förbättra folkhälsan, klimatförändringarna och den biologiska mångfalden, med särskilt fokus på inhemska trädarter.
- Vägleda de nordiska länderna i deras implementering av Kunming-Montreal Global Biodiversity Framework Target 12 om gröna städer (Target 12 (cbd.int)) och stödja deras arbete med Target 8 och 11 om klimatförändringar, naturbaserade lösningar och ekosystemtjänster (Target 8 och 11(cbd.int)).
- Etablera ett samarbetsnätverk mellan nordiska städer för att främja bevarandet och expansionen av lokala trädbestånd.
- I länder och områden där 3+30+300-principen kanske inte är relevant att genomföra på grund av bristen på inhemska trädarter och svårigheten att nå hög trädkröntäckningsgrad, är syftet att bedöma realistiska steg mot 3+30+300 och rekommendera alternativa sätt att öka den urbana grönskan utifrån t.ex. inhemsk vegetation.

Som denna rapport har dokumenterat har omfattande information och analys tillhandahållits om den nuvarande implementeringen av 3+30+300-principen i de nordiska länderna och städerna. Resultaten inkluderar bland annat en översikt av statusen för urbana trädbestånd och grönytor enligt denna princip i alla nordiska länder. Denna visar att de flesta länder och kommuner har höga resultat vad gäller överensstämmelse med 3+30+300, även om det finns vissa skillnader mellan länderna, vilket Tabell ES1 visar. Finland och Norge har den

högsta överensstämmelsen med 3+30+300, där majoriteten av byggnaderna har höga poäng på alla tre komponenterna, medan Island och Grönland (inte förvånande, med tanke på deras generellt låga trädnivåer) har de lägsta resultaten.

Mer betydelsefullt än de nationella bedömningarna är dock analyser på kommunal nivå. Särskilt gap-analysen för de deltagande kommunerna har visat att det finns möjligheter att ytterligare förbättra överensstämmelsen med 3+30+300. Resultaten som presenteras i denna rapport belyser också kopplingarna mellan 3+30+300 och folkhälsa, klimatförändringar och biologisk mångfald.

Tabell ES1. Översikt av poäng enligt 3+30+300-principen för nordiska länder. Procentsatserna och genomsnittsvärden avser samtliga byggnader i respektive land, inklusive stads- och landsbygdsområden. Grönområde definieras i detta sammanhang som ett allmänt tillgängligt grönområde på minst 1 hektar, i linje med de definitioner som används för att bedöma 300-komponenten i 3+30+300-principen.

Land	Överensstämmelse hos byggnader					Genomsnitt per byggnad		
	3- (%)	30-regeln (%)	300-regeln (%)	Positivt totalbetyg (%)	Alla 3 regler på en gång (%)	Antal träd	Trädkronstäckning (%)	Avstånd till grönområde (m)
Norge	85.63	84.06	95.88	92.29	74.48	40.39	54.83	42.0
Danmark	71.70	32.83	93.45	66.96	26.73	24.31	26.25	60.6
Sverige	83.11	79.94	97.23	89.74	70.74	38.24	53.99	27.1
Åland	86.48	92.48	51.40	88.02	43.89	40.96	60.25	329.9
Finland	97.55	92.54	97.70	97.12	87.39	56.69	56.24	22.6
Färöarna	73.67	18.56	80.75	51.74	17.17	28.47	16.23	140.2
Island	39.26	4.08	51.52	23.50	3.57	11.00	7.93	327.7
Grönland	1.46	0.02	2.73	0.10	0.01	0.18	0.43	632.2

Arbetet som Yggdrasils projektgrupp har utfört ger ett viktigt bidrag till uppfyllandet av mål och policyer relaterade till grönytor, biologisk mångfald och naturbaserade lösningar på olika nivåer, inklusive Kunming-Montreal Global Biodiversity Framework Target 11. I denna rapport presenteras konkreta sätt att integrera 3+30+300 i politik och planer, baserat på erfarenheter från nordiska länder och städer samt från andra länder. Ett exempel på ett relevant policyramverk är översiktsplaner, men som flera svenska städer visar kan 3+30+300 även inkluderas i kommunala grönplaner. Principen har potential att bli en viktig genomförandemekanism och måttstock för den bredare implementeringen av naturbaserade lösningar, och kan dessutom bidra till en mer rättvis fördelning av dessa lösningar.

Yggdrasil-projektet har skapat ett nätverk av organisationer och kommuner som kan hjälpa till att driva implementeringen av 3+30+300 framåt och stärka insatser för att förbättra biologiska mångfalden, folkhälsan och klimatåtgärderna, till exempel genom en bredare användning av naturbaserade lösningar i nordiska kommuner. Viktigt kunskaps- och erfarenhetsutbyte har skett inom detta nätverk.

Även om de flesta nordiska länder och kommuner är väl lämpade att genomföra 3+30+300 är det viktigt att arbeta kontextspecifikt och inse att förutsättningar och behov kommer att skilja sig åt.

Träd och grönytor är viktiga för klimatanpassning och hälsofrämjande, och även länder och regioner med lägre trädäckning, som Färöarna och Island, visar att 3+30+300 kan vara ett användbart verktyg för att förbättra urbana och andra bebyggda områden. Det är dock uppenbart att lokala landskaps- och biodiversitetsfrågor behöver beaktas. Rapporten visar också den roll som biologisk mångfald och inhemska träd spelar för att uppfylla politiska mål för beboeliga och motståndskraftiga städer, samtidigt som den belyser vikten av mångsidiga och motståndskraftiga trädbestånd som även inkluderar icke-inhemska arter.

Baserat på arbetet inom Yggdrasil kan flera rekommendationer ges, både för en bredare miljöanpassning av nordiska kommuner och implementering av naturbaserade lösningar och specifikt för implementering av 3+30+300-principen.

Tabell ES2 ger en översikt över projektrekommendationer för övergripande genomförande av naturbaserade lösningar, samt specifikt för implementering av 3+30+300-principen.

Tabell ES2. Rekommendationer från projektet Yggdrasil – The Living Nordic City. (För mer detaljer, källor och liknande hänvisar vi till hela rapporten.)

Område för rekommendation	Särskilda rekommendationer
Övergripande rekommendationer	
Policy och planering	- Nordiska städer och kommuner har en lång tradition av att skapa gröna städer. I takt med förtätning, klimatförändringar och förlust av biologisk mångfald hotas dock denna tradition. Det finns en risk att urbana områden blir mindre gröna, vilket också gör dem mer sårbara och mindre levande och hälsosamma. Medvetenheten om denna risk måste öka, och åtgärder måste vidtas för att motverka den. - Kopplat till ovanstående är det viktigt att säkerställa att grönområden och träd inte tas bort i förtätning och exploatering som syftar till att öka attraktiviteten och tryggheten i socioekonomiskt utsatta områden. - Tillräcklig trädskräddning och grönområden behöver tillhandahållas i nya utvecklingsområden för att undvika skapandet av framtida utsatta stadsdelar. Ett varmare, torrare och våtare klimat med flera extrema väderhändelser kommer att påverka våra nordiska städer, och områden utan träd och grönska blir då mer utsatta och sårbara. - För att maximera de socioekonomiska fördelarna med träd måste de integreras i den bredare stadsplanerings- och utvecklingspolicy. Trädplaneringsinitiativ bör samordnas med bostads-, transport- och folkhälsostrategier för större effekt. - Barn, äldre, sjuka eller på annat sätt utsatta är särskilt i behov av grön infrastruktur och närhet till offentliga grönområden av hög kvalitet, dels för att de är mer känsliga för effekterna av luftföroreningar och värme, dels för att de ofta tillbringar en stor del av sin tid nära sina hem eller olika institutionella miljöer. - Implementeringen av 3+30+300-principen bör ses i ett bredare internationellt och nationellt politiskt sammanhang. Till exempel sätter EU:s nya lag om naturrestaurering minimikrav på trädskräddning och andelen offentliga grönområden i våra städer.
Finansiering och investering	Offentliga investeringar i urban grönska och incitament för privata markägare att plantera och underhålla träd är av avgörande betydelse. Städerna kan införa skattelättnader eller bidrag för miljöanpassningsinsatser. Även om finansiering och investeringar inte specifikt omfattades av Yggdrasil-projektet, är det tydligt att långsiktiga program för bibehållandet av gröna utemiljöer kräver tillräckliga resurser, inte minst för att säkerställa en långsiktig förvaltning.
Skydd och förvaltning av träd	- Existerande träd i stadsmiljö måste bevaras och vårdas. Detta är särskilt viktigt för äldre träd eftersom dessa ger fler ekosystemtjänster än mindre träd. - Skyddsåtgärder bör vidtas för gatu- och stadsträd i närheten av bebyggelse, både ovan och under mark, så att träden kan bli äldre och tillhandahålla fler ekosystemtjänster. - Viktiga träd som är i behov av växtbäddsrenovering för att förbättra växtförhållandena bör identifieras och tas om hand på lämpligt sätt. - De nordiska kommunerna bör satsa mer resurser på att kartlägga och övervaka sina trädbestånd. Ju mer data som samlas in, desto bättre politik för trädens mångfald kan de leda till och medföra.
Trädartsval och placering	- Att plantera träd utan hänsyn till artval och placering bör undvikas. Det är viktigt att ta hänsyn till framtida klimat och biologisk mångfald. - Plantera för långsiktighet: välj träd som har plats att växa sig stora. Färre, men välplanerade träd är bättre än många små som inte får möjlighet att utvecklas. - Använd en varierad artblandning för att skapa ett hållbart och motståndskraftigt trädbestånd.

Träddiversitet, inklusive användning av inhemska och exotiska arter	● Att sträva efter en mer diversifierad trädpopulation är viktigt för att begränsa och anpassa sig till klimatförändringen. Alla nordiska kommuner har för närvarande inte ett tillräckligt diversifierat trädbestånd och blir därför sårbara för klimatförändringar, befintliga och nya skadedjur samt sjukdomar. Mångfalden av trädarter kan ökas genom att plantera nya arter istället för de vanligare arterna inom staden, till exempel baserat på arternas lämplighet i framtida klimatscenarier. Vidare gör diversitet inom trädarter populationerna mindre sårbara för förändringar i miljön och ökar deras anpassningsförmåga. Mångfald handlar också om en god åldersfördelning för att kunna bibehålla en trädkronstäckning över tid. I parker och skogar kan förekomsten av död ved också gynna den biologiska mångfalden. ● Diversitet är också viktigt för att minska ekosystemtjänsternas negativa effekter, som pollenallergener, och träddiversitet är positivt för mångfalden av flora, fauna och svampar som är beroende av olika arter. Dessutom bör val av träd inkludera både positiva och mer utmanande egenskaper hos träd, även på lång sikt. ● Det bör säkerställas att nya träd väljs inte bara för det befintliga klimatet, utan även för det framtida klimatet. ● Antalet träd som planteras enbart för prydnad bör i många fall minska till förmån för träd som är avsedda att ge skugga, eftersom temperaturreglering och andra klimatrelaterade fördelar med träd har blivit en prioritet. ● Användningen av exotiska trädarter bör ske med stor försiktighet. Det är viktigt att vara noggrann med att undvika att invasiva arter introduceras, då dessa kan sprida sig och konkurrera med den lokala floran och habitat. Användning av icke-inhemska växter kan också påverka pollineringspopulationer negativt. Därför är det viktigt att följa respektive lands rekommendationer för att undvika användning av invasiva arter.
Samhällsengagemang	● Att engagera lokalsamhällen i urbana trädinitiativ främjar en känsla av ägarskap och säkerställer att trädplanteringsprojekt är i linje med samhällets behov. Deltagande i lokala projekt kan också stärka invånarna och säkerställa långsiktig framgång.
<i>3+30+300-specifika rekommendationer</i>	
Övergripande strategi och implementering av 3+30+300	● Det är viktigt att formulera en tydlig, långsiktig vision för träden och grönområdena i kommunen (eller i en annan skala) och därefter se hur 3+30+300 kan hjälpa till att leverera denna vision. ● Principen är en bra utgångspunkt eftersom den har en gedigen evidensbas, testas och implementeras alltmer och fungerar som ett internationellt riktmärke. Principen fastställer ett enkelt mål eller riktlinje som kombinerar vikten av grönområden som är synliga, jämnt fördelade och tillgängliga för rekreation. ● Man måste alltid integrera 3+30+300 i ett bredare policy- och planeringssammanhang, med andra riktlinjer, måttvärden etc. Principen är inte bara för träd- och grönområdesplaner och policyer. Försök även integrera i planer och policyer för hälsa, klimatåtgärder, biologisk mångfald, social rättvisa, utbildning med mera. Arbeta dock kontextspecifikt och se vad som är realistiskt och önskvärt. ● Överväg hur lämplig 3+30+300-implementering är för lokala sammanhang. I vissa fall kan det anses vara mindre lämpligt att plantera fler träd i specifika områden, t.ex. med hänsyn till lokala livsmiljöer. ● Glöm inte lokalsamhällena och deras önskemål. Hitta sätt att engagera dem i implementeringen av 3+30+300. ● Begär inte att en ny bebyggelse ska vara 3+30+300-kompatibel från början, eftersom detta är omöjligt (såvida inte området har en betydande befintlig vegetation som kan bevaras). Träd tar tid att växa. Ett alternativ kan till exempel vara att du begär att den ska vara 3+30+300-kompatibel om 20 år. ● Lär av andra, eftersom fler kommuner – även i Norden – skaffar sig erfarenhet av att implementera principen. ● Genomföra gap-analyser och sätt prioriteringar för implementeringen av 3+30+300 där behoven är som störst, till exempel i närheten av förskolor, skolor, vårdinrättningar och andra typer av sociala institutioner, samt i områden med en hög andel barn och äldre.

Bedömning och uppföljning	• Det är viktigt att göra en första 3+30+300-bedömning av din kommun, stadsdel eller annat område. • Du kan kombinera 3+30+300-analyser med andra relevanta kartor, som till exempel socio-demografiska analyser och klimatkartor som visas i denna rapport. Det går även att inkludera exempelvis mobilitetskartor, kartor över underjordisk infrastruktur och liknande. • En gapanalys hjälper dig avgöra var du bör prioritera och börja först och kan se olika ut beroende på om fokus är på kommunen som helhet eller specifika stadsdelar, markanvändning eller byggnadstyper (till exempel skolor, sjukhus och äldreboenden). • De individuella komponenterna 3, 30 och 300 hjälper dig avgöra om dina insatser ska riktas mot att skapa en park, fler gatuträd eller bättre stöd och policyer för träd på privat mark. • Som en uppföljning kan du över tid övervaka om dina insatser har varit effektiva. Dessutom kan du koppla övervakningen av dina 3+30+300-resultat till (förändringar i) olika ekosystemtjänster, som avkylning och folkhälsoförbättringar. Olika bedömningsverktyg, till exempel i-Tree, kan hjälpa till med detta och ibland också ge insikter i ekonomiska kostnader och fördelar. • Viktigt att notera är att 3+30+300 bör ses som en miniminivå. Detta är särskilt viktigt i den nordiska kontexten då städerna här generellt har höga poäng på en eller flera av principens komponenter. Våra goda förutsättningar och långa historia av att bevara och värna urbana grönområden är en styrka som inte bör tas för givet. • Låt dig inte nedslås av en minskning i en av de tre komponenterna. Det kan finnas goda skäl till det, till exempel ett byte av vissa trädarter till andra som är mer klimattåliga eller funktionella (vilket kan leda till en tillfällig minskning av trädkronstäckningen).
---------------------------	--

Dessa rekommendationer kopplas också till fyra viktiga budskap som resulterar från projektet:

- Låt oss hålla våra nordiska städer gröna när de växer och förändras.
- Använd 3+30+300 för att bedöma, främja och fira möjligheterna med stadsträd.
- Staden är en onaturlig livsmiljö för träd, och därför behövs särskilda åtgärder för att se till att träden trivs och bidrar till bättre städer.
- Relationen mellan socioekonomisk utsatthet, träd och grönområden har en specifik nordisk dimension.

Sammendrag på norsk

Denne rapporten presenterer funn fra prosjektet «Yggdrasil – The Living Nordic City», som er en del av det større programmet Nordic Cities Nature-Based Solutions. Programmet har som mål å bidra til å nå Visjon 2030 – å gjøre Norden til den mest bærekraftige og integrerte regionen i verden. Yggdrasil-prosjektet søker å fremme naturbaserte løsninger i byer og kommuner i hele Norden. Det tar utgangspunkt i 3+30+300-prinsippet, som er en ganske ny tommelfingerregel for urbane trær og grøntområder, og som legger vekt på biologisk mangfold, klimatilpasning og folkehelse. 3+30+300-prinsippet gir klare kriterier for minimumsbehovet for trær i våre urbane nabolag: alle innbyggere skal kunne se 3 store trær fra sitt hjem, sin skole, arbeidsplass eller omsorgssted; det bør være minst 30 prosent trekronedekning i hvert nabolag; og ingen bør bo mer enn 300 meter fra nærmeste offentlig tilgjengelige grøntområde av høy kvalitet.

Yggdrasil – The Living Nordic City har hatt som mål å:

- Evaluere 3+30+300-prinsippetets effektivitet når det gjelder å forbedre folkehelse, klimatilpasningsevne og biologisk mangfold, med spesielt fokus på hjemmehørende treslag.
- Veilede de nordiske landene i deres implementering av Kunming-Montreal Global Biodiversity Framework Mål 12 om grønne byer (Target 12 (cbd.int)) og støtte deres arbeid med Mål 8 og 11 om klimaendringer, naturbaserte løsninger og økosystemtjenester (Target 8 og 11 (cbd.int)).
- Etablere et samarbeidsnettverk mellom nordiske byer, og fremme bevaring og utvidelse av lokale trebestander.
- I land og områder der gjennomføring av 3+30+300-prinsippet kanskje ikke er relevant på grunn av mangel på hjemmehørende treslag og vanskeligheter med å nå høy grad av trekronedekning, er målet å vurdere realistiske steg mot 3+30+300 og anbefale alternative måter å gjøre byer grønnere, med utgangspunkt i for eksempel hjemmehørende vegetasjon.

Som denne rapporten har dokumentert, er omfattende informasjon og analyser av dagens implementering av 3+30+300-prinsippet i de nordiske landene og byene gjort tilgjengelig. Funnene inkluderer blant annet en oversikt over statusen til urbane trebestander og grøntområder i alle nordiske land, i

henhold til dette prinsippet. Oversikten viser at de fleste land og kommuner oppnår gode resultater når det gjelder etterlevelse av 3+30+300., selv om det er noen forskjeller mellom land, som vist i Tabell S1. Finland og Norge har høyest oppnåelse etter 3+30+300, der mesteparten av all bebyggelse scorer høyt på alle tre komponentene. Island og Grønland viser (ikke overraskende, gitt deres generelt lave tredekke) de laveste poengsummene.

Analyser på kommunenivå er imidlertid viktigere enn de nasjonale vurderingene. Her har spesielt gap-analysen for de deltakende kommunene vist at det er muligheter for å forbedre oppnåelsen av 3+30+300 ytterligere. Resultatene som presenteres i denne rapporten fremhever også koblingene mellom 3+30+300 og hensynet til folkehelse, klimaendringer og biologisk mangfold.

Tabell S1. Oversikt over poeng etter 3+30+300-prinsippet for de nordiske landene. Prosentene og gjennomsnittsverdiene refererer til alle bygninger i hvert enkelt land, inkludert byer- og rurale områder. I denne sammenheng defineres et grøntområde som en park eller et grøntområde som er minst 1 hektar stort og offentlig tilgjengelig.

Land	Prosentvis overenstemmelse av bygninger som oppnår					Gjennomsnitt per bygning		
	3-trær (%)	30-prosent dekning (%)	300-meter avstand (%)	Positiv samlet poengsum (%)	Alle 3+30+300 samtidig (%)	Antall trær	Trekrone-dekning%	Avstand til grøntområde (m)
Norge	85.63	84.06	95.88	92.29	74.48	40.39	54.83	42.0
Danmark	71.70	32.83	93.45	66.96	26.73	24.31	26.25	60.6
Sverige	83.11	79.94	97.23	89.74	70.74	38.24	53.99	27.1
Åland	86.48	92.48	51.40	88.02	43.89	40.96	60.25	329.9
Finland	97.55	92.54	97.70	97.12	87.39	56.69	56.24	22.6
Færøyene	73.67	18.56	80.75	51.74	17.17	28.47	16.23	140.2
Island	39.26	4.08	51.52	23.50	3.57	11.00	7.93	327.7
Grønland	1.46	0.02	2.73	0.10	0.01	0.18	0.43	632.2

Arbeidet som er utført av Yggdrasil-prosjektgruppen gir et viktig bidrag til den videre oppfyllelsen av policyer og mål for grøntområder, biologisk mangfold og naturbaserte løsninger på ulike nivåer, inkludert Mål 11 i Kunming-Montreal Global Biodiversity Framework. Konkrete måter å innlemme 3+30+300 i retningslinjer og planer er gitt i denne rapporten, basert på erfaringer fra nordiske land og byer, så vel som andre steder. Et eksempel på et relevant politisk rammeverk er områdeplaner, men som flere svenske byer viser, kan 3+30+300 også inngå i kommuneplanarbeid. Prinsippet har potensial til å være en viktig gjennomføringsmekanisme og målestokk for implementering av naturbaserte løsninger i en større utstrekning, og kan bidra til en mer rettferdig fordeling av disse løsningene.

Yggdrasil-prosjektet har etablert et nettverk av organisasjoner og kommuner som kan bidra til å fremme implementeringen av 3+30+300 og arbeidet med å styrke biologisk mangfold, folkehelse og klimatiltak, for eksempel gjennom implementering av naturbaserte løsninger i nordiske kommuner. Innenfor dette nettverket har det foregått viktig kunnskaps- og erfaringsdeling.

Selv om de fleste nordiske land og kommuner har gode forutsetninger for å gjennomføre 3+30+300, er det viktig å jobbe kontekstspesifikt og erkjenne at forutsetninger og behov vil variere. Trær og grøntområder er viktige for klimatilpasning og helsefremmende arbeid, og selv land og regioner med lavere tre- og skogdekning, slik som Færøyene og Island, viser at 3+30+300 kan være et nyttig verktøy for å forbedre byområder og andre bebygde områder. Det er åpenbart at lokale landskaps- og biodiversitetsspørsmål må tas i betraktning. Denne rapporten viser også rollen som biologisk mangfold og hjemmehørende trær spiller for å oppfylle politiske mål om levelige og motstandsdyktige byer. Samtidig fremhever rapporten betydningen av en variert og robust urban trebestand som også inkluderer ikke-hjemmehørende arter.

Basert på arbeidet i Yggdrasil-prosjektet gis flere anbefalinger, både overordnet for planlegging av grønnstrukturen i nordiske kommuner og implementering av naturbaserte løsninger, og spesifikt for implementering av 3+30+300-prinsippet.

Tabell S2 gir en oversikt over prosjektanbefalinger for overordnet grønnstrukturplanlegging og implementering av naturbaserte løsninger, og spesifikt for implementering av 3+30+300-prinsippet.

Tabell S2. Anbefalinger som følger av Yggdrasil - The Living Nordic City-prosjektet (For mer detaljer, kilder og lignende viser vi til den fullstendige rapporten).

Virkeområde for anbefalinger	Spesifikke anbefalinger
<i>Overordnede anbefalinger</i>	
Policy og planlegging	- Nordiske byer og kommuner har en lang tradisjon for grøntstrukturplanlegging. I møte med fortetting, klimaendringer og tap av biologisk mangfold er imidlertid denne tradisjonen truet. Det er en risiko for at byområder blir mindre grønne, og dermed også mer sårbare og mindre levelige og helsefremmende. Bevisstheten om denne risikoen må heves og det må iverksettes tiltak for å motvirke den. - Knyttet til punktet over er det viktig å sikre at grøntområder og trær ikke fjernes i byutviklingsprosjekter eller fortettingsstrategier som har mål om å øke attraktiviteten og tryggheten i sosioøkonomisk utsatte områder. - Det må sikres tilstrekkelig trekronedekning og grøntområder i nye utbyggingsprosjekter for å unngå å skape fremtidig utsatte nabolag. Et varmere, tørrere og våtere klima, med flere ekstreme værhendelser, vil påvirke våre nordiske byer, og områder uten trær og grøntområder vil bli mer utsatt og sårbare. - For å maksimere de sosioøkonomiske fordelene ved trær, må de integreres i overordnet byplanlegging og strategier for byutvikling. Treplantingsinitiativer bør samordnes med bolig-, transport- og folkehelsestrategier for å oppnå større effekt. - Barn, eldre, syke eller på annen måte sårbare personer er spesielt avhengige av grønn infrastruktur og nærhet til offentlige grøntområder av høy kvalitet. Dels fordi de er mer følsomme for effektene av luftforurensning og varme, og dels fordi de ofte tilbringer en stor del av tiden i nærheten av hjemmet eller ulike institusjoner. - Implementering av 3+30+300-prinsippet bør ses i en større internasjonal og nasjonal politisk kontekst. EUs Forordning om naturrestaurering setter for eksempel minimumskrav til trekronedekning og andel offentlig grøntareal i byene (Kommisjonen har markert regelverket som EØS-relevant. Dette er ved tidspunktet for denne rapportens publisering til vurdering på norsk side).
Finansiering og investering	Offentlige investeringer i forvaltning av den urbane skogen, samt insentiver for private grunneiere til å plante og vedlikeholde trær, er avgjørende. Bykommuner kan implementere skattelettelser eller tilskudd til grønne initiativer. Selv om finansiering og investeringer ikke ble spesifikt adressert av Yggdrasil-prosjektet, er det ingen tvil om at forsvarlige program for urbane trær og grøntområder krever tilstrekkelige midler, ikke minst for å sikre langsiktig forvaltning.
Forvaltning og beskyttelse av trær	- Vi må bevare og skjøtte eksisterende trær i bylandskapet. Dette er spesielt viktig for eldre trær siden disse gir flere økosystemtjenester enn unge trær. - Det bør iverksettes beskyttelsestiltak for gate- og bytrær i nærheten av byggeprosjekter, både over og under bakken, slik at trærne kan bli eldre og gi flere økosystemtjenester. - Viktige trær, som har behov for, og egner seg for renovering av rotsonen bør identifiseres og ivaretas på riktig måte. - Nordiske kommuner bør sette av mer ressurser til å kartlegge og overvåke sine trebestander. Jo mere data som samles inn, desto bedre retningslinjer kan utformes og implementeres for å sikre et mangfold av trær
Valg av treslag og planting	- Å plante trær uten hensyn til artsvalg og plassering bør unngås. Det er viktig å ta hensyn til fremtidige klimaforhold og biologisk mangfold. - Treplanting er langsiktig. Plant trær som har plass til å vokse seg store. Det er bedre med færre og godt planlagte trær som har en reell sjanse til å vokse seg eldre og større, enn til mange mindre som ikke får mulighet til å utvikle seg. - Sørg for at det plantes en variasjon av arter for en bærekraftig og motstandsdyktig urban trebestand.

Artsfordeling, inkludert bruk av hjemmehørende og eksotiske arter	● Å tilstrebe større artsmangfold i trebestanden er viktig for å tilpasse seg og dempe risiko ved klimaendringer. Ikke alle nordiske kommuner har i dag tilstrekkelig diversitet i sin urbane trebestand. De blir dermed sårbare for klimaendringer og for nåværende og fremtidige skadedyr og sykdommer. Diversiteten kan økes ved å plante nye treslag i stedet for de mer vanlige artene i byen. Dette kan for eksempel baseres på artenes tilpasningsevne for fremtidige klimascenarier. Diversitet innen samme treslag, bidrar til å gjøre populasjonene mindre sårbare for endringer i miljøet og øker deres potensial for tilpasning. Diversitet er også knyttet til en god aldersfordeling, slik at en tilstrekkelig trekronedekning kan opprettholdes over tid. I parker og skogsområder kan forekomsten av død ved også fremme biodiversitet. ● Diversitet er viktig for dempe ulemper ved noen trær, slik som pollenallergener. Variasjon i valg av treslag er også positivt for mangfoldet av flora, fauna og sopp som er avhengig av ulike arter. Valg av ulike trær bør gi rom for både positive og mer utfordrende egenskaper ved trær, også på lang sikt. ● Det bør sikres at nye trær ikke bare velges for det nåværende klimaet, men også tilpasses fremtidig klima. ● Andelen trær som plantes for pryd alene, bør i mange tilfelle reduseres til fordel for trær som kan bli større og gi skygge, ettersom temperaturregulering og andre klimamessige fordeler ved trær prioriteres. ● Bruk av eksotiske trær bør skje med stor forsiktighet. Det er nødvendig å være forsiktig når det gjelder risikoen for at invasive arter introduseres der de kan spre seg og konkurrere med lokal flora og habitater. Bruk av eksotiske planter kan også påvirke pollinator populasjoner negativt. Det er derfor viktig å følge det enkelte lands anbefalinger for å unngå bruk av invasive arter.
<i>Involvering av lokalsamfunnet</i>	● Å engasjere lokalsamfunnet i urbane initiativ for trær, fremmer en følelse av eierskap og sikrer at treplantingsprosjekter er i tråd med behov i lokalmiljøet. Deltakelse i lokale grønne prosjekter kan gi beboere kunnskap og mestring og derigjennom sikre langsiktig suksess.
<i>Spesifikke anbefalinger for 3+30+300</i>	
Overordnet tilnærming og implementering av 3+30+300	● Det er viktig å formulere en klar, langsiktig visjon for trærne og grøntområdene i kommunen (eller på et annet nivå) og deretter vurdere hvordan 3+30+300 kan anvendes som et verktøy for å realisere denne visjonen. ● 3+30+300-prinsippet er et godt utgangspunkt, siden det har et godt evidensgrunnlag. Det blir stadig mer testet og iverksatt, og det fungerer som et internasjonalt referansepunkt. Prinsippet fastsetter et enkelt måltall eller rettesnor som kombinerer viktigheten av grøntområder som er synlige, jevnt fordelt og tilgjengelige for rekreasjon. ● 3+30+300 må alltid integreres i en større policy- og planleggingskontekst, sammen med andre retningslinjer, måltall osv. 3+30+300 gjelder ikke bare for planer eller policyer for trær og grøntstruktur, men bør integreres i planer og strategier for folkehelse, klimatiltak, biologisk mangfold, sosial rettferdighet, utdanning, osv. Tilpass arbeidet til den lokale konteksten og hva som er realistisk og ønskelig. ● Vurder hvor hensiktsmessig det er å implementere 3+30+300 i den lokale konteksten. I noen tilfeller kan det å plante flere trær i området være mindre hensiktsmessig og i strid med for eksempel hensynet til lokale habitater. ● Ikke glem lokalmiljøene og deres ønsker. Finn måter å engasjere dem i implementeringen av 3+30+300. ● Ikke forvent at et nytt utbyggingsområde eller prosjekt skal være 3+30+300-kompatibel fra starten. Dette er umulig, med mindre utbyggingen er i et område der betydelig eksisterende vegetasjon kan bevares. Trær trenger tid for å vokse. Et alternativ kan være å be om at området skal være i tråd med 3+30+300-prinsippet om for eksempel 20 år. ● Lær av andre, etter hvert som flere kommuner – også i Norden – gjør seg erfaringer med å implementere prinsippet. ● Gjennomfør gap-analyser og prioriter implementering av 3+30+300 der behovene er størst, for eksempel i nærheten av barnehager, skoler, omsorgsinstitusjoner og andre typer sosiale institusjoner, samt i områder med høy andel barn og eldre.

Vurdering og oppfølging	• Det er viktig å foreta en innledende 3+30+300-vurdering av kommunen, bydelen eller en annen aktuell områdeavgrensning. • 3+30+300-analyser kan sammenstilles med andre relevante kart, for eksempel sosiodemografiske analyser og klimakart som vises i denne rapporten. Det er også mulig å inkludere for eksempel mobilitetskart, kart over infrastruktur i bakken og lignende. • En gap-analyse forteller hvor tiltak bør prioriteres og påbegynnes først. Denne kan se ulik ut avhengig av om fokus er kommunen som helhet, eller spesifikke nabolag, type arealbruk eller bygningstyper (for eksempel skoler, sykehus og eldreboliger). • De individuelle 3-, 30- og 300-komponentene avslører om innsatsen bør rettes mot å etablere parkområder, plante flere gatetrær eller utforme bedre støtte eller policyer for trær på privat eiendom. • Som oppfølging kan innsatsens effekt overvåkes over tid. Overvåkingen av 3+30+300-status kan videre knyttes til (endringer i) forskjellige økosystemtjenester, som temperaturregulering og folkehelsegevinster. Ulike vurderingsverktøy, inkludert i-Tree, kan hjelpe med dette og noen ganger gi innsikt i økonomiske kostnader og fordeler. • Det er viktig å merke seg at 3+30+300 bør sees på som et minimumsnivå. Dette er spesielt viktig i nordisk sammenheng ettersom byene her generelt skårer høyt på en eller flere av komponentene. De gode forutsetningene og den lange historien med å bevare og ivareta urbane grøntområder er en styrke som ikke må tas for gitt. • Ikke bli motløs av en nedgang i en av de tre komponentene. Det kan være gode grunner til det, for eksempel utskifting av enkelte treslag med andre som er mer klimatilpassede eller funksjonelle (og som kan føre til for eksempel et midlertidig fall i trekronedekningen).
--------------------------------	--

Disse anbefalingene knytter seg også til de fire hovedbudskapene som følger av prosjektet:

- La oss beholde våre nordiske byer grønne mens de vokser og utvikles.
- Bruk 3+30+300 til å vurdere, fremme og feire mulighetene med trær i byen.
- Byen er et unaturlig habitat for trær, og derfor er det nødvendig med spesifikke tiltak for at trær skal trives og bidra til bedre byer.
- Sammenhenger mellom sosioøkonomisk sårbarhet, trær og grøntområder har en egen nordisk dimensjon.

Yhteenvedo suomeksi

Tässä raportissa esitellään tuloksia Yggdrasil - The Living Nordic City -hankkeesta, joka on osa laajempaa Nordic Cities Nature-Based Solutions -hanketta, joka pyrkii tekemään Pohjoismaista maailman kestävimmän ja integroituneimman alueen vuoteen 2030 mennessä. Luontopohjaisten ratkaisujen edistämiseen kaupungeissa ja kunnissa kaikkialla Pohjoismaissa keskittyvä hanke perustuu 3+30+300-periaatteeseen, joka on melko uusi nyrkkisääntö kaupunkipuille ja viherryttämislle ja korostaa luonnon monimuotoisuutta, ilmastomuutokseen sopeutumista ja kansanterveyttä. 3+30+300-periaate tarjoaa selkeät kriteerit kaupunkipuiden vähimmäistarjonnalle kaupunkiyhteisöissämme: Kaikkien kansalaisten on voitava nähdä 3 isoa puuta kotoaan, koulustaan, työpaikaltaan tai hoitopaikaltaan. Jokaisella asuinalueella tulisi olla vähintään 30 prosentin puiden latvuspeittävyys. Kenenkään ei pitäisi asua yli 300 metrin päässä lähimmästä julkisesta (ja laadukkaasta) viheralueesta.

Yggdrasil – The Living Nordic City -hankkeen tavoitteena on:

- Arvioida 3+30+300-periaatteen tehokkuutta kansanterveyden, ilmastomuutoksen ja biologisen monimuotoisuuden edistämässä keskittyen erityisesti kotoperäisiin puulajeihin.
- Ohjata Pohjoismaita Kunming-Montrealin maailmanlaajuisen luonnon monimuotoisuuskehyksen vihreitä kaupunkeja koskevan tavoitteen 12 toteuttamisessa ja tukea niiden työtä ilmastomuutosta, luontopohjaisia ratkaisuja ja ekosysteemipalveluja koskevien tavoitteiden 8 ja 11 toteuttamisessa.
- Luoda pohjoismaisten kaupunkien välille yhteistyöverkosto, joka edistää paikallisten puukantojen säilymistä ja laajentumista.
- Maissa, joissa 3+30+300-periaatteen täytäntöönpano ei ehkä ole asianmukaista (esim. Färsaaret, Islanti ja Grönlandi) kotoperäisten puulajien puuttumisen ja korkeiden latvustasojen saavuttamisen vaikeuden vuoksi, tavoitteena on arvioida realistisia askeleita kohti 3+30+300-periaatetta ja suositella vaihtoehtoisia tapoja kaupunkien viherryttämiseen esimerkiksi alkuperäiseen kasvillisuuteen perustuen.

Kuten tässä raportissa on dokumentoitu, 3+30+300-periaatteen nykyisestä täytäntöönpanosta Pohjoismaissa ja kaupungeissa on saatu kattavaa tietoa ja analyyskejä. Tuloksiin kuuluu muun muassa yleiskatsaus kaupunkimetsien ja

viheralueiden yleisestä tilasta tämän periaatteen mukaisesti kaikissa Pohjoismaissa, mikä osoittaa, että useimmat maat ja kunnat saavat hyvät pisteet 3+30+300-vaatimusten noudattamisessa, vaikka maiden välillä on joitakin eroja, kuten ES1-taulukko osoittaa. Suomessa ja Norjassa 3+30+300-vaatimukset täyttyvät parhaiten, ja suurin osa kaikista rakennuksista saa korkeat pisteet kaikista kolmesta osa-alueesta, kun taas Islannissa ja Grönlannissa (mikä ei ole yllättävää, koska puusto on yleensä vähäistä) pisteet ovat alhaisimmat.

Kansallisia arviointeja tärkeämpää on kuitenkin kuntatason analyysi. Erityisesti osallistuvien kuntien puuteanalyysi on osoittanut, että 3+30+300-vaatimusten noudattamista on mahdollista parantaa edelleen. Tässä raportissa esitetyt tulokset korostavat myös 3+30+300-periaatteen yhteyksiä kansanterveyteen, ilmastonmuutokseen ja biologiseen monimuotoisuuteen.

Taulukko ES1. Katsaus Pohjoismaiden 3+30+300-periaatteen pisteisiin. Prosenttiosuudet ja keskiarvot koskevat kaikkia rakennuksia kussakin maassa. Pisteet koskevat kaikkia rakennuksia kyseisissä maissa, mukaan lukien kaupungit ja maaseutualueet. Viheralueella tarkoitetaan yleisölle avointa viheraluetta, jonka pinta-ala on vähintään 1 hehtaari 3+30+300-periaatteen 300 osatekijän arvioinnissa käytettyjen määritelmien mukaisesti.

Maa	Rakennusten etäisyyden noudattaminen					Keskiarvot taloa kohti		
	3-sääntö (%)	30-sääntö (%)	300-sääntö (%)	Positiivinen kokonais-piste-määrä (%)	Kaikki 3 sääntöä kerralla (%)	Puiden määrä	Latvus-peittävyys (%)	Etäisyys viher-alueeseen (m)
Norja	85.63	84.06	95.88	92.29	74.48	40.39	54.83	42.0
Tanska	71.70	32.83	93.45	66.96	26.73	24.31	26.25	60.6
Ruotsi	83.11	79.94	97.23	89.74	70.74	38.24	53.99	27.1
Ahvenan-maa	86.48	92.48	51.40	88.02	43.89	40.96	60.25	329.9
Suomi	97.55	92.54	97.70	97.12	87.39	56.69	56.24	22.6
Färsaaret	73.67	18.56	80.75	51.74	17.17	28.47	16.23	140.2
Islanti	39.26	4.08	51.52	23.50	3.57	11.00	7.93	327.7
Grönlanti	1.46	0.02	2.73	0.10	0.01	0.18	0.43	632.2

Yggdrasil-projektiryhmän tekemä työ tarjoaa tärkeän panoksen viheralueiden, biologisen monimuotoisuuden ja luontopohjaisten ratkaisujen politiikkojen ja tavoitteiden laajempaan toteuttamiseen eri tasoilla, mukaan lukien Kunming-Montrealin maailmanlaajuisen luonnon monimuotoisuuskehityksen tavoitteen 11. Tässä raportissa esitetään konkreettisia tapoja integroida 3+30+300-periaatteen käytäntöihin ja suunnitelmiin Pohjoismaista ja pohjoismaisista kaupungeista sekä muualta saatujen kokemusten perusteella. Yksi esimerkki asiaankuuluvasta poliittisesta kehyksestä on kaupunkimetsätalouden yleissuunnitelmat, mutta kuten esimerkki useasta ruotsalaisesta kaupungista osoittaa, 3+30+300 voidaan sisällyttää jopa kuntien kattaviin suunnitelmiin. Periaatteella on mahdollisuuksia toimia tärkeänä toimitusmekanismina ja mittarina luontopohjaisten ratkaisujen laajemmalle toteuttamisella, myös oikeudenmukaisemmalla tavalla.

Yggdrasil-hankkeessa on luotu organisaatioiden ja kuntien verkosto, joka voi edistää 3+30+300-periaatteen toteutusta sekä luonnon monimuotoisuuden, kansanterveyden ja ilmastotoimien edistämistä esimerkiksi laajentamalla luontopohjaisten ratkaisujen käyttöönottoa pohjoismaisissa kunnissa. Tässä verkostossa on jaettu tärkeää tietoa ja kokemuksia.

Vaikka useimmilla Pohjoismailla ja kunnilla on hyvät edellytykset toteuttaa 3+30+300-periaatetta, on tärkeää työskennellä kontekstisidonnaisesti ja tunnistaa, että lähtökohdat ja tarpeet vaihtelevat. Puut ja viheralueet ovat tärkeitä ilmastonmuutokseen sopeutumisen ja terveyden edistämisen kannalta, ja jopa maat ja alueet, joissa on vähemmän puita ja metsiä, kuten Färsaaret ja Islanti, osoittavat, että 3+30+300-periaate voi olla hyödyllinen työkalu kaupunkialueiden ja muiden rakennettujen alueiden parantamiseksi. On kuitenkin selvää, että paikalliset maisemaan ja biologiseen monimuotoisuuteen liittyvät huolenaiheet on otettava huomioon. Tässä raportissa osoitetaan myös biologisen monimuotoisuuden ja kotoperäisten puiden roolia elinkelpoisiin ja selviytymiskykyisiin kaupunkeihin liittyvien poliittisten tavoitteiden saavuttamisessa ja korostetaan samalla monimuotoisten ja selviytymiskykyisten kaupunkimetsien merkitystä, joihin kuuluu myös muita kuin alkuperäislajeja.

Yggdrasil-hankkeessa tehdyn työn perusteella voidaan antaa useita suosituksia sekä pohjoismaisten kuntien viherryttämiseksi ja luontopohjaisten ratkaisujen toteuttamiseksi että erityisesti 3+30+300-periaatteen toteuttamiseksi.

ES2-taulukossa esitetään yleiskatsaus hankesuosituksista, jotka koskevat yleistä viherryttämistä ja luontopohjaisten ratkaisujen toteuttamista ja erityisesti 3+30+300-periaatteen täytäntöönpanoa.

ES2-taulukko. Yggdrasil – The Living Nordic City -hankkeen suositukset. (Katso lisätiedot, lähteet ja vastaavat koko raportista.)

Suositusalue	Erityiset suositukset
<i>Yleiset suositukset</i>	
Politiikat ja suunnittelu	- Pohjoismaisilla kaupungeilla ja muilla kunnilla on pitkät perinteet kaupunkien viherryttämisessä. Kaupunkien tiivistymisen, ilmastonmuutoksen ja biologisen monimuotoisuuden köyhtymisen vuoksi tämä perinne on kuitenkin uhattuna, koska vaarana on, että kaupunkialueista tulee vähemmän vihreitä ja siten myös haavoittuvampia ja vähemmän asumiskelpoisia ja terveitä. Tietoisuutta tästä riskistä on lisättävä ja sen torjumiseksi on ryhdyttävä toimiin. - Edellä mainittuun liittyen on tärkeää varmistaa, että viheralueita ja puita ei poisteta kaupunkien elvyttämisohjelmissa tai tihentämisstrategioissa, jotka toteutetaan kaupunkien houkuttelevuuden lisäämiseksi ja sosioekonomisesti haavoittuvien alueiden turvallisuuden tukemiseksi. - Uudisrakentamisessa on tarjottava riittävästi latvuspeittävyttä ja viheralueita, jotta vältetään haavoittuvien asuinalueiden syntyminen tulevaisuudessa. Ilmastonmuutos ja ennustettu lämpimämpi, kuivempi ja kosteampi ilmasto sekä äärimmäisten sääilmiöiden yleistyminen vaikuttavat pohjoismaisiin kaupunkeihimme, ja alueet, joilla ei ole puita ja viheralueita, ovat alttiimpia ja haavoittuvampia. - Sosioekonomisten hyötyjen maksimoimiseksi puut on sisällytettävä laajempaan kaupunkisuunnittelu- ja kehityspolitiikkaan. Puiden istutusaloitteet olisi sovittava yhteen asumis-, liikenne- ja kansanterveysstrategioiden kanssa suuremman vaikutuksen saavuttamiseksi. - Lapset, vanhukset, sairaat tai muuten haavoittuvassa asemassa olevat tarvitsevat erityisesti vihreää infrastruktuuria ja korkealaatuisten julkisten viheralueiden läheisyyttä, osittain siksi, että he ovat herkempiä ilmansaasteiden ja kuumuuden vaikutuksille, ja osittain siksi, että he viettävät usein suuren osan ajastaan lähellä kotiaan tai erilaisia laitospäristöjä. On kuitenkin huomattava, että pohjoismaisissa kaupungeissa ei useinkaan ole tavanomaista yhteyttä asuinalueiden suuremman haavoittuvuuden ja vähäisemmän vihreyden välillä. 3+30+300-periaatteen täytäntöönpanoa olisi tarkasteltava laajemmassa kansainvälisessä ja kansallisessa poliittisessä kontekstissa. Esimerkiksi Euroopan unionin uusi luonnon ennallistamista koskeva laki asettaa vähimmäisvaatimukset kaupunkien puiden latvuspeittävyydelle ja julkisten viheralueiden osuudelle.
Rahoitus ja investoinnit	Julkiset investoinnit kaupunkimetsätalouteen sekä yksityisten maanomistajien kannustimet puiden istuttamiseen ja hoitamiseen ovat ratkaisevan tärkeitä. Kaupungit voivat ottaa käyttöön verohelpotuksia tai avustuksia viherryttämistoimiin. Vaikka hankkeessa ei käsitelty erityisesti rahoitusta ja investointeja, ei ole epäilystäkään siitä, että järkevät kaupunkimetsätalousohjelmat ja kaupunkien viherryttämisohjelmat edellyttävät riittävästi varoja, myös pidemmän aikavälin hoidossa.
Puiden suojele ja hoito	- Meidän on säilytettävä ja hoidettava olemassa olevia puita kaupunkimaisemassa. Tämä on erityisen tärkeää vanhemmille puille, koska ne tarjoavat enemmän ekosysteemipalveluja kuin pienemmät puut. - Rakentamisen lähellä oleville katu- ja kaupunkipuille tulee tehdä suojelutoimenpiteitä sekä ylä- että alapuolella, jotta puut voivat ikääntyä ja tarjota enemmän ekosysteemipalveluja. Tärkeät puut, jotka tarvitsevat juurivyöhykkeen kunnostamista ja soveltuvat siihen olemassa olevien kaupunkipuiden kasvuolosuhteiden parantamiseksi, olisi tunnistettava ja hoidettava asianmukaisesti. - Pohjoismaisten kuntien tulisi suunnata enemmän resursseja puukantojensa kartoittamiseen ja seurantaan. Mitä enemmän tietoja kerätään, sitä parempia puiden monimuotoisuutta koskevia käytäntöjä ne voivat tuottaa ja ottaa käyttöön.
Puiden istutus ja perustaminen	- Sitä, että istutetaan vain mahdollisimman paljon puita riippumatta siitä mihin tai mitä lajeja, tulisi välttää. On tärkeää ottaa huomioon esimerkiksi tulevat ilmasto-olosuhteet ja luonnon monimuotoisuuteen liittyvät huolenaiheet. - Puita istutetaan pitkällä aikavälillä siten, että niiden välissä on runsaasti tilaa kasvaa isoksi puuksi. Parempi olla muutama hyvä puu, joiden on oikeasti mahdollista kasvaa vanhemmiksi ja isommiksi kuin monilla pienemmillä puilla. - Varmista, että istutat erilaisia lajeja kestäväen ja joustavan kaupunkimetsäpeittävyys saavuttamiseksi.

Puiden monimuotoisuus, mukaan lukien kotoperäisten ja eksoottisten lajien käyttö	• Pyrkimys monimuotoisempaan puukantaan on tärkeää ilmastonmuutoksen hillinnän ja siihen sopeutumisen kannalta. Kaikissa pohjoismaisissa kunnissa ei tällä hetkellä ole riittävän monimuotoista kaupunkimetsää, ja ne ovat siten alttiita ilmastonmuutokselle, nykyisille ja uusille tuholaisille ja taudille ja vastaaville. Puiden monimuotoisuutta voidaan lisätä istuttamalla kaupunkiin uusia lajeja yleisempien lajien sijaan esimerkiksi lajien soveltuvuuden perusteella tulevaisuuden ilmastoskenaarioissa. Lisäksi puulajien sisällä monimuotoisuus tekee populaatioista vähemmän alttiita ympäristön muutoksille ja lisää niiden sopeutumiskykyä. Monimuotoisuuteen liittyy myös hyvä ikäjakauma kaupunkimetsissä, jotta terve latvus voidaan säilyttää. Puistoissa ja metsissä lahopuut voivat myös tukea luonnon monimuotoisuutta. • Monimuotoisuus on tärkeää myös ekosysteemin karhunpalvelusten, kuten siitepölyallergeenien, lieventämiseksi, ja puiden monimuotoisuus on hyväksi eri lajeista riippuvaisen kasviston, eläimistön ja sienten monimuotoisuudelle. Lisäksi puiden valinnassa tulisi ottaa huomioon sekä puiden positiiviset että haastavammat ominaisuudet, myös pidemmällä aikavälillä. • Olisi varmistettava, että uudet puut valitaan paitsi nykyisen ilmaston myös tulevan ilmaston kannalta. • Istutettavien koristepuiden määrää tulisi vähentää varjopuiden hyväksi, sillä puiden viilentävät ja muut ilmastovaikutukset ovat nousseet etusijalle. • Eksoottisten puiden käyttö on suoritettava erittäin huolellisesti. On erittäin tärkeää olla varovainen sen riskin suhteen, että tulokaslajeja tuodaan sinne, missä ne voivat levitä ja kilpailla paikallisen kasviston ja elinympäristöjen kanssa. Muiden kuin kotoperäisten kasvien käyttö voi myös vaikuttaa pölyttäjyhteisöihin.
Yhteisön sitoutuminen	• Paikallisyhteisöjen osallistuminen kaupunkipuualoitteisiin edistää omistajuuden tunnetta ja varmistaa, että puiden istutushankkeet ovat linjassa yhteisön tarpeiden kanssa. Osallistuminen paikallisiin viherryttämishankkeisiin voi voimaannuttaa asukkaita ja varmistaa pitkän aikavälin menestyksen.
3+30+300-periaatteen erityiset suositukset	
Yleinen 3+30+300-lähestymistapa ja käyttöönotto	• On tärkeää laatia selkeä, pitkän aikavälin visio kunnan puista ja viheralueista (tai eri mittakaavassa) ja katsoa sitten, miten 3+30+300 voi auttaa sinua toteuttamaan tämän vision. • Tämä periaate on hyvä lähtökohta, koska sillä on kunnollinen näyttöpohja, sitä testataan ja otetaan käyttöön yhä enemmän ja se toimii kansainvälisenä vertailukohtana. Lisäksi se tarjoaa yksinkertaisen mittarin tai ohjeen, jossa yhdistyvät näkyvän vihreän, ympäröivän vihreän ja vapaa-ajan vihreän merkitys. • 3+30+300 on aina integroitava laajempaan politiikan ja suunnittelun kontekstiin muiden ohjeiden, mittareiden jne. kanssa. 3+30+300 ei koske vain puiden ja viheralueiden suunnitelmia ja politiikkoja. Yritä integroitua suunnitelmiin ja politiikkoihin, jotka koskevat terveyttä, ilmastotoimia, biologista monimuotoisuutta, sosiaalista oikeudenmukaisuutta, koulutusta jne. Työskentele kuitenkin kontekstikohtaisesti ja katso, mikä on realistista ja toivottavaa. • Mieti, kuinka tarkoituksenmukaista 3+30+300-periaatteen käyttöönotto on paikallisissa olosuhteissa. Joissakin tapauksissa puiden lisäämistä alueille voidaan pitää vähemmän tarkoituksenmukaisena ja ristiriitaisena esimerkiksi paikallisten elinympäristöjen kanssa. • Älä unohda paikallisia yhteisöjä ja heidän toiveitaan. Etsi tapoja sitouttaa heidät 3+30+300-periaatteen toteuttamiseen. • Ei pidä vaatia, että uusi kehitys on alusta alkaen 3+30+300-vaatimusten mukaista, koska se on mahdotonta (ellei kehitys tapahdu alueella, jolla voidaan säilyttää huomattava olemassa oleva kasvillisuus). Puiden kasvaminen vie aikaa. Vaihtoehtoisesti sitä voidaan vaatia 3+30+300-yhteensopivaksi esimerkiksi 20 vuoden kuluttua. • Opi muilta, sillä yhä useammat kunnat – myös pohjoismaiset kunnat – saavat kokemusta periaatteen toteuttamisesta. • Tehdään kuiluanalyysseja ja asetetaan painopisteet 3+30+300-toteutukselle siellä, missä tarpeet ovat suurimmat, esimerkiksi lastentarhojen, koulujen, hoitolaitosten ja muiden sosiaalisten laitosten läheisyydessä sekä alueille, joilla lasten ja vanhusten osuus on suuri.

Arviointi ja seuranta	• On tärkeää tehdä alustava 3+30+300-arviointi kunnastasi, asuinalueestasi tai muusta alueesta. • Voit peittää 3+30+300-kartat muilla asiaankuuluvilla kartoilla, kuten tässä raportissa esitetyillä sosiodemografisilla asuinalueen ominaispiirteillä ja ilmastokartoilla, mutta myös esimerkiksi liikkuvuuskartoilla, maanlaisella infrastruktuurilla ja vastaavilla. • Kuiluanalyysi kertoo, missä pitää priorisoida ja aloittaa ensin, kun budjetit ovat rajallisia. Kuiluanalyysi voi olla muodoltaan erilainen, ja siinä voidaan keskittyä koko kuntaan, mutta myös tiettyihin asuinalueisiin sekä maankäyttö- tai rakennustyyppeihin (esimerkiksi kouluihin, sairaaloihin ja vanhainkoteihin). • Yksittäisten 3-, 30- ja 300-osa-alueiden avulla voit tietää, pitäisikö sinun keskittyä puiston luomiseen, uusien katupuiden luomiseen vai paremman tuen/politiikan luomiseen puille yksityisellä alueella. • Jatkotoimena: ajan mittaan voit seurata, ovatko ponnistelusi olleet tehokkaita. Lisäksi voit yhdistää 3+30+300-pisteidesi seurannan eri ekosysteemipalveluihin (tai niiden muutoksiin), kuten viilentämiseen ja kansanterveydellisiin hyötyihin. Erilaiset arviointityökalut, mukaan lukien i-Tree, voivat auttaa tässä ja joskus myös tarjota tietoa taloudellisista kustannuksista ja hyödyistä. • On tärkeää huomata, että 3+30+300 tulisi nähdä vähimmäistasona. Tämä on erityisen tärkeää pohjoismaisessa kontekstissa, koska kaupungit saavat yleensä korkeat pisteet yhdestä tai useammasta säännön osasta. Hyvät edellytykset ja pitkä historia kaupunkien viheralueiden säilyttämisessä ja turvaamisessa ovat vahvuus, eikä niitä tule pitää itsestäänselvytenä. • Älä lannistu, vaikka jokin kolmesta osa-alueesta olisi heikompi. Tähän voi olla hyviä syitä, esimerkiksi tiettyjen puulajien korvaaminen toisilla, jotka ovat ilmastokestävämpiä tai toimivampia (ja jotka voivat johtaa esimerkiksi latvuspeittävyys tilapäiseen vähenemiseen).
-----------------------	---

Nämä suositukset liittyvät myös hankkeen neljään keskeiseen viestiin:

- Pidetään pohjoismaiset kaupungit vihreinä niiden kasvaessa ja muuttuessa.
- Käytä 3+30+300-periaatetta arvioidaksesi, edistääksesi ja juhliaksesi kaupunkipuiden mahdollisuuksia.
- Kaupunki on luonnon elinympäristö puille, ja siksi tarvitaan erityisiä toimia sen varmistamiseksi, että puut kukoistavat ja edistävät parempia kaupunkeja.
- Sosioekonomisen haavoittuvuuden, puiden ja viheralueiden välisillä suhteilla on erityinen pohjoismainen ulottuvuus.

Samantekt á íslensku

Í þessari skýrslu eru kynntar niðurstöður verkefnisins „Yggdrasil - hin lifandi norræna borg“, sem er hluti af stærra verkefninu Náttúrumiðaðar lausnir fyrir norrænar borgir (e. Nordic Cities Nature-Based Solutions) sem miðar að því að uppfylla framtíðarsýnina fyrir 2030 – að gera Norðurlöndin að sjálfbærasta og samþættasta svæði heims. Verkefnið miðar að því að efla náttúrumiðaðar lausnir í borgum og sveitarfélögum á Norðurlöndum og byggist á 3+30+300 meginregluna, það er ný þumalputtaregla fyrir trjárækt og grænar lausnir í þéttbýli, þar sem áhersla er lögð á líffræðilegan fjölbreytileika, loftslagsaðlögun og lýðheilsu. 3+30+300 meginreglan eru skýr viðmiðunarmörk fyrir lágmarksfjölda trjáa í þéttbýli allir borgarar ættu að geta séð þrjú stór tré frá heimili sínu, skóla, vinnustað eða dvalarstað; með að minnsta kosti 30 prósent laufþekju í hverju hverfi og enginn ætti að búa í meira en 300 metra fjarlægð frá grænu (og vönduðu) almennu svæði.

Yggdrasil – hin lifandi norræn borg hefur haft það að markmiði að:

- Meta árangur 3+30+300 meginreglunnar við að efla lýðheilsu, sem svar við loftslagsbreytingum og til að stuðla að líffræðilegum fjölbreytileika, með sérstaka áherslu á innlendar trjátegundir.
- Leiðbeina Norðurlöndunum við innleiðingu á Kunming-Montreal hnattrænu markmiði varðandi líffræðilega fjölbreytni 12 (Kunming-Montreal Global Biodiversity Framework Target 12) fyrir grænar borgir (markmið 12 (cbd.int)) og styðja þau við að ná markmiðum 8 og 11 varðandi loftslagsbreytingar, náttúrumiðaðar lausnir og vistkerfisþjónustu.
- Koma á samstarfsneti norrænna borga til að stuðla að varðveislu og útbreiðslu innlendar trjáflóru.
- Í löndum þar sem það kann að vera að innleiðing 3+30+300 meginreglunnar henti ekki (t.d. Færeyjar, Ísland og Grænland) vegna skorts á innlendum trjátegundum og áskorana við að ná hárri laufþekju hefur markmiðið verið að leggja mat á raunhæfa nálgun við að uppfylla markmið 3+30+300 meginreglunnar og aðrar grænar lausnir fyrir þéttbýli verði skoðaðar s.s. áhersla á annan innlendan gróður.

Eins og greint er frá í þessari skýrslu hafa verið veittar ítarlegar upplýsingar og greiningar á því hvernig 3+30+300 meginreglan hefur verið innleidd á Norðurlöndum og borgum til þessa. Niðurstöðurnar fela meðal annars í sér yfirlit yfir heildarstöðu skóga og grænna svæða í þéttbýli samkvæmt þessari

meginreglu á öllum Norðurlöndunum, sem sýnir að góðar einkunnir hafa náðst hjá flestum löndum og sveitarfélögum þegar kemur að hlítni við 3+30+300 meginregluna, þó að ES1 tafla sýni fram á nokkurn mun á milli landa. Finnland og Noregur eru með hæstu einkunn í hlítni við 3+30+300 meginregluna og yfirgnæfandi meirihluti bygginga skorar hátt í öllum þremur þáttunum, á meðan Ísland og Grænland (sem er ekki að undra, miðað við almennt litla laufþekju) eru með lægstu einkunnirnar.

Greining fyrir sveitafélög er enn mikilvægara en greiningar á landsvísu. Gloppugreiningar á þeim sveitafélögum sem taka þátt í áætluninni hafa sýnt fram á að hægt er að grípa til frekari umbóta við að uppfylla viðmið 3+30+300. Niðurstöðurnar sem kynntar eru í þessari skýrslu varpa einnig ljósi á tengsl 3+30+300 við lýðheilsu, loftslagsbreytingar og líffræðilegan fjölbreytileika.

Tafla ES1. Yfirlit yfir einkunn á skala yfir hlítni við 3+30+300-meginregluna á Norðurlöndum. Hlutföll og meðaltöl eiga við allar byggingar í hverju landi fyrir sig. Einkunnir miða við allar byggingar í viðkomandi löndum, að meðtöldum borgum og dreifbýli. Með „grænu svæði“ er átt við grænt svæði sem almenningur hefur aðgang að og er að minnsta kosti 1 hektari að stærð, í samræmi við mat á þeim 300 þáttum sem tilgreindir eru í 3+30+300 meginreglunni.

Land	Hlítni bygginga sem ná					Meðaltal á hverja byggingu		
	3-regla (%)	30-regla (%)	300-regla (%)	Jákvæð heildar-einkunn (%)	Allar 3 reglurnar í einu (%)	Fjöldi trjáa	Laufþekja (%)	Fjarlægð að grænu svæði (m)
Noregur	85.63	84.06	95.88	92.29	74.48	40.39	54.83	42.0
Danmörk	71.70	32.83	93.45	66.96	26.73	24.31	26.25	60.6
Svíþjóð	83.11	79.94	97.23	89.74	70.74	38.24	53.99	27.1
Álandseyjar	86.48	92.48	51.40	88.02	43.89	40.96	60.25	329.9
Finnland	97.55	92.54	97.70	97.12	87.39	56.69	56.24	22.6
Færeyjar	73.67	18.56	80.75	51.74	17.17	28.47	16.23	140.2
Ísland	39.26	4.08	51.52	23.50	3.57	11.00	7.93	327.7
Grænland	1.46	0.02	2.73	0.10	0.01	0.18	0.43	632.2

Vinnan sem framkvæmd er af Yggdrasil verkefnishópnum er mikilvægt framlag til víðtækari framfylgdar á stefnu og markmiðum um græn svæði, líffræðilegan fjölbreytileika og náttúrumiðaðar lausnir á mismunandi stigum og felur meðal annars í sér Kunming-Montreal hnattræna markmiðið varðandi líffræðilega fjölbreytni 11. Í þessari skýrslu er fjallað um áþreifanlegar leiðir til að samþætta 3+30+300 við stefnumótun og áætlanagerð á hátt sem byggir á reynslu frá norrænum löndum og borgum ásamt öðrum heimshlutum. Eitt dæmi um viðeigandi stefnuramma er aðalskipulag fyrir skógrækt í þéttbýli en eins og nokkur dæmi úr sænskum borgum sýna fram á þá mætti jafnvel innleiða 3+30+300 í aðalskipulag sveitarfélaga. Meginreglan gæti reynst mikilvæg leið til framkvæmda og mælikvarði fyrir víðtækari innleiðingu náttúrumiðaðra lausna sem hægt er að beita með jöfnum hætti.

Með Yggdrasil verkefninu býðst tengslanet samtaka og sveitarfélaga sem getur stuðlað að innleiðingu 3+30+300, eflit líffræðilega fjölbreytni og lýðheilsu þjónað sem hluti af áætlunum um loftslagsaðgerðir, t.d. með víðtækari innleiðingu náttúrumiðaðra lausna í sveitarfélögum á Norðurlöndum. Mikilvæg þekkingar- og reynslumiðlun hefur átt sér stað innan þessa tengslanets.

Þótt flest Norðurlönd og sveitarfélög séu vel í stakk búin til að innleiða 3+30+300 er mikilvægt að þau sníði sér stakk eftir vexti og taki mið af því að upphafsskilyrði og þarfir staða eru breytilegar. Tré og græn svæði eru mikilvægur þáttur í loftslagsaðlögun og lýðheilsu og jafnvel lönd og svæði með lægri tré og minni laufþekju eins og Færeyjar og Ísland sýna að 3+30+300 getur reynst gagnlegt úrræði við uppbyggingu í þéttbýli og annars konar byggð. En augljóslega þarf að huga að landslagi og líffræðilegum fjölbreytileika á hverjum stað fyrir sig. Þessi skýrsla sýnir einnig fram á veigamikinn þátt líffræðilegs fjölbreytileika og gróðursetningu innlendra trjátegunda í að uppfylla stefnumarkmið sem tengjast lífvænlegum og traustum borgum, auk þess sem hún undirstrikar mikilvægi þess að byggja upp fjölbreytta og stöðuga skógrækt í þéttbýli sem kann að ná til innfluttra tegunda.

Í ljósi þess starfs sem unnið hefur verið innan Yggdrasils er hægt að leggja fram nokkrar tillögur, bæði um græna þróun hjá sveitarfélögum á Norðurlöndunum og innleiðingu náttúrumiðaðra lausna sem sérstaklega varða innleiðingu 3+30+300 meginreglunnar.

Tafla ES2 sýnir yfirlit yfir tillögur að verkefnum fyrir heildarsýn um græna þróun og innleiðingu náttúrumiðaðra lausna sem sérstaklega varða innleiðingu 3+30+300 meginreglunnar.

Tafla ES2. Tillögur úr verkefninu Yggdrasil - hin lifandi norræna borg. (Fyrir nánari upplýsingar, heimildir og þess háttar vísam við til skýrslunnar í heild sinni.)

Tilmælasvið	Sértæk tilmæli
<i>Almenn tilmæli</i>	
Stefnumótun og áætlanagerð	- Græn þróun í þéttbýli í borgum og sveitarfélögum á Norðurlöndunum á sér langa sögu. En þétting byggðar, loftslagsbreytinga og skerðingar á líffræðilegum fjölbreytileika ógna þeirri hefð þar sem hætta er á að það leiði til færri grænna svæða í þéttbýli og auki þar með óstöðugleika og dragi úr lífvænleika og heilsu þeirra borga. Því þarf að verða vitundarvakning um þessa áhættu og grípa til aðgerða til að sporna við henni. - Í ljósi þess er mikilvægt að tryggja að græn svæði og tré séu ekki fjarlægð sem hluta af endurnýjunaráætlunum þéttbýliskjarna eða þéttingu byggðar með það að leiðarljósi að laða fólk að þéttbýliskjörnum auk þess sem huga þarf að öryggi á svæðum sem eru félagslega eða efnahagslega viðkvæm. - Huga þarf að fullnægjandi laufþekju og grænum svæðum fyrir nýbyggingar til að fyrirbyggja að þar myndist viðkvæm hverfi í framtíðinni. Loftslagsbreytingar og spár um hlýrra, þurrara og blautara loftslag og aukinn veðurofsa munu hafa áhrif lifnaðarhætti okkar í þéttbýli á Norðurlöndum og svæði án trjáa og grænna svæða verða berskjaldaðri fyrir áhrifum þeirra. - Til að hámarka félagslegan og efnahagslegan ávinning þarf að flétta trjáræktarstefnu í almenna skipulags- og þróunarstefnu í þéttbýli. Frumkvæði að gróðursetningu trjáa ætti að vera í takt við húsnæðis-, samgöngu- og lýðheilsuáætlanir til að auka áhrif af slíkum framkvæmdum. - Græn innviði og nálægð við vönduð græn svæði sem almenningur hefur aðgang að eru sérstaklega mikilvæg börnum, öldruðum, langveikum og öðrum í viðkvæmri stöðu, sökum þess að þess að loftmengun og hitastig hafa meiri áhrif á þessa hópa, að hluta til vegna þess að þeir dvelja gjarnan lengi nálægt heimilum sínum eða á ýmsum stofunum. Þó ber að hafa í huga að í borgum á Norðurlöndunum skortir oft hefðbundin tengsl á milli þess að færri græn svæði leiði til þess að hverfi verði berskjaldaðari. - Innleiðingu 3+30+300 meginreglunnar ætti að skoða í víðara alþjóðlegu og innlendu stefnumótunarsamhengi. Í nýjum lögum Evrópusambandsins um endurheimt náttúrulegra svæða eru tilgreindar lágmarkskröfur um þak laufþekju í þéttbýli og hlutfall grænna svæða sem opin eru almenningi.
Fjármögnun og fjárfesting	Opinber fjárfesting í skógrækt í þéttbýli, ásamt hvataáætlunum fyrir landareignir í einkaeigu geta skipt sköpum við að stuðla að aukinni gróðursetningu og viðhaldi í skógrækt. Borgir geta innleitt skattaávilnanir eða styrki til að stuðla að grænni þróun. Þrátt fyrir að fjármögnun og fjárfestingar hafi ekki verið tekið sérstaklega fyrir í verkefninu þá er enginn vafi á því að þörf er á nægilegu fjármagni til að halda úti stöðugri skógrækt í borgum og grænni þróun í þéttbýli, til dæmis sem varðar langtímaumsjón með slíkum aðgerðum.
Viðhald og ræktun trjáa	- Við þurfum að varðveita og hlúa að trjám sem fyrir eru í borgarlandslaginu. Þetta er sérstaklega mikilvægt þegar um að ræða eldri tré þar sem vistkerfisþjónusta þeirra er meiri en smærri trjáa. - Það þarf að grípa til verndarráðstafana fyrir götu- og borgartré nálægt byggingum, bæði að ofan og neðan, svo tréin nái að eldast og veiti áframhaldandi vistkerfisþjónustu. Það þarf að greina tré sem hafa aukna þörf fyrir, og henta til, endurnýjunar rótarsvæða til að hægt sé að bæta vaxtarskilyrði núverandi borgartrjáa og að umhirða þeirra verði sem skyldi. - Sveitarfélög á Norðurlöndunum ættu að veita auknu fjármagni til að mæla og hafa eftirlit með innlendra trjáflóru. Aukin gagnaöflun stuðlar að upplýstari stefnumótun í tengslum við fjölbreytileika trjáa sem slík stefnumótun kann að varða.
Gróðursetning og uppsetning	- Forðast skal að planta eins mörgum trjám og hægt er óháð því hvaða tegundir er um að ræða. Mikilvægt er að huga að framtíðarloftslagi og taka tillit til líffræðilegrar fjölbreytni. - Til lengri tíma litið skal gróðursetja tré þannig að þau muni hafa nægilegt pláss til að vaxa og dafna. Betra er að gróðursetja nokkur góð tré sem eiga raunhæfan möguleika á að vaxa og eldast en að gróðursetja fjölda smærri trjáa. - Það þarf að gæta þess að gróðursetja tegundir sem stuðla að sjálfbærri og lífseigri laufþekju í þéttbýli.

Fjölbreytileiki trjáa, þar með talið notkun innlendra og framandi tegunda	• Miða skal við að byggja upp fjölbreyttari trjáflóru til að draga úr áhrifum loftslagsbreytinga og veita aukna aðlögunarhæfni. Ekki eru öll sveitarfélög á Norðurlöndum með nægilega fjölbreytt skóglendi innan borgarmarka og gætu því verið berskjaldaðri fyrir loftslagsbreytingum ásamt núverandi og nýjum meindýrum, sjúkdómum eða öðrum slíkum pestum. Hægt er að auka fjölbreytileika trjáa með því að gróðursetja nýjar tegundir í stað algengari tegunda innan borgarmarkanna, til dæmis með því að miða við hvaða tegundir henti fyrir loftslagssviðsmyndir framtíðarinnar. Að auki, innan hvernar trjátegundar, mun fjölbreytileiki veita aukið viðnám gagnvart umhverfisbreytingum og auka aðlögunarhæfni tegundanna. Fjölbreytileiki tengist einnig góðri aldursdreifingu í þéttbýlisskógum, svo hægt sé að viðhalda heilbrigðri laufþekju. Í almenningsgörðum og skóglendi kann dauður víður einnig að stuðla að auknum líffræðilegum fjölbreytileika. • Fjölbreytileiki er einnig mikilvæg þáttur í að draga úr óæskilegum áhrifum í vistkerfum eins og frjókornaofnæmisvaka og fjölbreytileiki trjáa leiðir til aukins fjölbreytileika í flóru gróðurs, dýralífs og sveppa sem treysta á samlífi við mismunandi tegundir. Að auki ætti val á trjám að taka tillit til jákvæða og krefjandi eiginleika trjáa, einnig til lengri tíma lítið. • Tryggja skal að tréin séu ekki eingöngu valin út frá núverandi loftslagi heldur því loftslagi sem framtíðin kann að geyma. • Hlutfall gróðursettra skrudtrjáa þarf að vera lægra en hlutfall trjáa sem ætluð eru að veita skugga þar sem kælingaráhrif og önnur loftslagsáhrif trjáa eru orðin forgangsatriði. • Gæta skal varúðar við notkun framandi trjátegunda. Sérstaklega skal gæta að áhættu við að ágengar tegundir berist til svæðisins þar sem þær geta dreift sér hratt og keppt við gróður og búsvæði á staðnum. Notkun framandi plantna getur einnig haft áhrif á frjóberasamfélög.
Samfélagsleg þátttaka	• Mikilvægt er að samfélög á hverjum stað fyrir sig taki virkan þátt í trjáræktarverkefnum til að tryggja að þau séu í takt við þarfir samfélagsins. Þátttaka í staðbundnum áætlunum um græna þróun geta kveikt áhuga íbúa og stuðlað að langtímaárangri.
Sértæk tilmæli fyrir 3+30+300	
Heildarnálgun og -framkvæmd við 3+30+300	• Það er nauðsynlegt að móta skýra langtímasýn með tilliti til trjáræktar og grænna svæða innan sveitarfélagsins (eða á öðrum skala) og sjá síðan hvernig 3+30+300 getur hjálpað þér að gera þessa sýn að veruleika. • Þessi meginregla er frábær upphafspunktur þar sem komin er rík reynsla við beitingu og innleiðingu hennar og því getur hún þjónað sem gagnlegt, alþjóðlegt viðmið. Þar að auki felur hún í sér einfaldan mælikvarða eða viðmiðunarreglur sem sameina mikilvægi sýnilegra grænna svæða, umlykjandi grænna svæða og grænna svæða sem ætluð eru til afþreyingar. • Alltaf er nauðsynlegt að innleiða 3+30+300 í breiðara samhengi stefnumótunar og skipulagsmála, ásamt öðrum viðmiðunarreglur, mælikvörðum o.s.frv. 3+30+300 er ekki eingöngu hugsað fyrir áætlanagerð og stefnumótun um tré og græn svæði. Miða skal að því að samþætta áætlanir og stefnur um heilsu, loftslagsaðgerðir, líffræðilegan fjölbreytileika, félagslegt réttlæti, menntun o.s.frv. Hins vegar þarf að vinna með kerfisbundnum hætti og í samhengi við aðrar aðgerðir til greina hvað geti talist raunhæft og æskilegt. • Skoða þarf innleiðingu 3+30+300 stefnunnar í staðbundnu samhengi. Í sumum tilvikum má líta svo á að það að fjölga trjám á tilteknu svæði eigi síður við eða stangist á við búsvæði á viðkomandi stað. • Ekki má gleyma að taka tillit til sveitarfélaga og þeirra óskum. Það þarf að finna leiðir til að virkja sveitarfélögin við innleiðingu 3+30+300 áætlunarinnar. • Ekki fara fram á að nýbyggingar samræmist 3+30+300 frá upphafi, þar sem slíkt er ómögulegt (nema uppbyggingin fari fram á svæði þar sem hægt er að viðhalda núverandi gróðri að verulegu marki). Tréin þurfa tíma til að vaxa. Annar möguleiki er að biðja um að miðað sé við að skilyrði 3+30+300 verði uppfyllt að 20 árum liðnum. • Hægt er að læra af reynslu annarra, þar á meðal reynslu innan Norðurlandanna, um hvernig megi innleiða þessa meginreglu. • Það þarf að framkvæma gloppugreiningar og forgangsraða innleiðingu 3+30+300 þar sem þörfin er mest, t.d. í nágrenni við leikskóla, skóla, vistunarúrræði og aðrar félagslegar stofnanir, og á svæðum þar sem hlutfall barna og aldraðra er hátt.

Mat og eftirlit	• Það er mikilvægt að byrja á að framkvæma frummat fyrir 3+30+300 meginregluna í þínu sveitarfélagi, hverfi eða svæði. • Kortlagning 3+30+300 getur skarast við önnur viðeigandi kort, svo sem kort yfir félagslega og lýðfræðileg eiginleika hverfis og þau loftslagskort sem er að finna í þessari skýrslu, eða kort um hreyfanleika, innviði í jörðu og þess háttar. • Gloppugreining segir þér hvar þarf að forgangsraða og byrja ef miðað er við að takmarkanir í fjárveitingum. Gloppugreining getur tekið á sig ólíkar myndir og getur beinst að sveitarfélaginu í heild en einnig að tilteknum hverfum, landnýtingu eða tilteknum gerðum bygginga (til dæmis skólum, sjúkrahúsum og öldrunarheimilum). • Einstakir þættir í 3, 30 og 300 gera þér kleift að sjá hvort viðleitni þín ætti að snúa að því að byggja almenningsgarða, fjölga götutrjám eða auka stuðning/stefnu fyrir tré í einkaeigu. • Sem hluti af eftirfylgni: með tímanum getur þú fylgst með því hvort viðleitni þín hafi skilað árangri. Einnig er hægt að tengja eftirlit með 3+30+300 einkunninni þinni við (breytingar á) ýmis konar vistkerfisþjónustu, svo sem kælingu og lýðheilsuávinningi. Ýmis matstæki, svo sem i-Tree, geta reynst gagnleg í þessu tilliti og stundum geta þau veitt innsýn í efnahagslegan kostnað og ávinning. • Mikilvægt að hafa í huga er að líta skal á 3+30+300 sem lágmarksframlag. Þetta er einkar mikilvægt í norrænu samhengi þar sem einkunnir borga á þeim slóðum eru almennt háar hvað viðkemur einum eða fleiri þáttum reglunnar. Norðurlöndin njóta góðs af góðum aðstæðum og langri sögu um gróðurvernd og -varðveislu í þéttbýli og því skal ekki taka sem sjálfsgöðum hlut. • Ekki láta hugfallast þó það dragi úr árangri í einum af þremur þáttunum. Það kunna að vera gildar ástæður fyrir því, til dæmis ef ákveðnum trjátegundum er skipt út fyrir tegundir sem búa yfir auknu þoli gegn loftslagsbreytingum eða aukinni virkni (og sem geta leitt til þess að það dragi tímabundið úr laufþekju).
-----------------	---

Þessar ráðleggingar tengjast einnig fjórum lykilskilaboðum verkefnisins:

- Varðveitum græn svæði í borgum á Norðurlöndunum samhliða því sem borgir vaxa og breytast.
- Hægt er að nota 3+30+300 til að meta, kynna og fagna þeim tækifærum sem felast í trjárækt í þéttbýli.
- Borgin er ónáttúrulegt búsvæði trjáa og því þarf að beita sérstökum aðgerðum til að tryggja að tré dafni og stuðli að betri borgum.
- Um er að ræða sérnorræna vídd í sambandi á milli félagslegra og efnahagslegra álagspunkta við tré og græn svæði.



Photo 21. Park during winter in Helsinki, Finland (photo by Leonid Danilov).

References

330300rule.com, 2024. Website about the 3+30+300 rule. Retrieved on 4 October 2024 from www.330300rule.com.

Adewuyi, F.A., Knobel, P., Gogna, P., Dadvand, P., 2023. Health effects of green prescription: a systematic review of randomized controlled trials. *Environmental Research* 236(part 2), 116844.

Agentschap Bos & Natuur, 2024. Naar een gezond Vlaanderen met nieuwe groennormen: de 3/30/300-regel. Brussels. Retrieved on 9 October 2024 from <https://www.natuurenbos.be/groennormen#:~:text=Elke%20woning%20heeft%20nood%20aan,verstedelijkte%20omgeving%20leefbaar%20te%20houden> (in Dutch).

Aguiar Borges, L., Rohrer, L., Nilsson, K., 2024. Green and healthy Nordic cities: How to plan, design, and manage health-promoting urban green space. Nordregio report 2024:1. Nordregio, Stockholm. [10.6027/R2024:11403-2503](https://nordregio.se/publications/2024/10/6027/R2024:11403-2503).

Anguelovski, I., Connolly, J.J.T., Cole, H., Garcia-Lamarca, M., Triguero-Mas, M., et al., 2022. Green gentrification in European and North American cities. *Nature Communications* 13, 3816. <https://doi.org/10.1038/s41467-022-31572-1>.

Åsegård, E., Nordén, B., 2023. Ett försvarstal för den förkättrade tysklönnen. *Svensk Botanisk Tidskrift* 117(1), 367 (in Swedish).

Astell-Burt, T., Feng, X., Mavoa, S., Badland, H.M., Giles-Corti, B., 2014. Do low-income neighbourhoods have the least green space? A cross-sectional study of Australia's most populous cities. *BMC Public Health* 14, 292.

Åström et al., 2019. Ovanligt många dödsfall i Sverige sommaren 2018. *Läkartidningen* 21/2019. URL: <https://lakartidningen.se/klinik-och-vetenskap-1/artiklar-1/originalstudie/2019/05/ovanligt-manga-dodsfall-i-sverige-sommaren-2018/> (in Swedish).

Atlas, R.M., 2013. One Health: Its Origins and Future. Chapter in: Mackenzie, J.S., Jeggo, M., Daszak, P., Richt, J.A. (Eds.), *One Health: The Human-Animal-Environment Interfaces in Emerging Infectious Diseases*, Springer, New York etc., pp. 1-13.

Barker, P., 1975. Ordinance control of street trees. *Journal of Arboriculture* 1, 121–215.

Becker, D.A., Browning, M.H., Kuo, M., Van Den Eeden, S.K., 2019. Is green land cover associated with less health care spending? Promising findings from county-level Medicare spending in the continental United States. *Urban Forestry & Urban Greening* 41, 39–47.

Bellan, P., Östberg, J., Nässlander, G., 2022. Platsspecifika artval – konceptet plantable spots. *Gröna Fakta/Utemiljö* 1 (in Swedish).

Bergen municipality, 2024. FOLKEHELSEOVERSIKTEN: Bergenserne har det bra, men her er våre utfordringer. Bergen. Retrieved on 2024-10-16 from <https://www.bergen.kommune.no/hvaskjer/helse-omsorg-og-inkludering/folkehelseoversikten-bergenserne-har-det-bra-men-her-er-vare-utfordringer> (in Norwegian).

Berland, A., Shiflett, S.A., Shuster, W.D., Garmestani, A.S., Goddard, H.C., Herrmann, D.L., Hopton, M.E., 2017. The role of trees in urban stormwater management. *Landscape and Urban Planning* 162, 167-177.

BL, undated. Udsatte boligområder. Retrieved on 16 October 2024 from https://bl.dk/politik-og-analyser/temaer/her-er-listen-over-parallelsamfund/#collapse_e3ccc976-6356-4570-90b1-3d38ffb215c2_1 (in Danish).

Boverket, 2024. Parker, stadsgrönska och landskap. Retrieved on 9 October 2024 from <https://www.boverket.se/sv/samhallsplanering/arkitektur-och-gestaltad-livsmiljo/arbetssatt/gronstruktur/> (in Swedish).

Brancaleoni, G., Nikitenkova, E., Grassi, L., Hansen, V., 2009. Seasonal affective disorder and latitude of living. *Epidemiology and Psychiatric Sciences* 18(4), 336-343.

Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., De Vries, S., Flanders, J., Folke, C., Frumkin, H., Gross, J., Hartig, T., Kahn, P., Kuo, M., Lawer, J., Levin, P., Lindahl, T., Meyer-Lindenberg, A., Mitchel, R., Ouyang, Z., Roe, J., Scarlett, L., Smith, J., Van den Bouch, M., Wheeler, B., White, M., Zhueng, H. & Daily, G. C. (2019). Nature and mental health: An ecosystem service perspective. *Science Advances* 5(7), eaax0903.

Bratman, G. N., Hamilton, J. P., Hahn, K. S., Daily, G. C., & Gross, J. J. (2015). Nature experience reduces rumination and subgenual prefrontal cortex activation. *Proceedings of the National Academy of Sciences* 112(28), 8567-8572.

Browning, M.H.E.M., Locke, D.H., Konijnendijk, C., Labib, S.M., Rigolon, A., Yeager, R., Bardhan, M., Berland, A., Dadvand, P., Helbich, M., Li, F., Li, H., James, P., Klompmaker, J., Reuben, A., Roman, L.A., Tsai, W.-L., Patwary, M., O'Neil-Dunne, J., Ossola, A., Wang, R., Yang, B., Yi, L., Zhang, J., Nieuwenhuijsen, M., 2024. Measuring the 3-30-300 rule to help cities meet nature access thresholds. *Science of The Total Environment* 907, 167739. <https://doi.org/10.1016/j.scitotenv.2023.167739>.

- Buckley, R.C., Chauvenet, A.L., 2022. Economic value of nature via healthcare savings and productivity increases. *Biological Conservation* 272, 109665.
- Cartesius, 2024. Een thuis voor het leven. Langer gelukkig en gezond wonen in Utrecht. Retrieved on 9 October 2024 from <https://www.cartesius-utrecht.nl/>. (in Dutch.)
- Chakraborty, T., Hsu, A., Manya, D., Sheriff, G., 2019. Disproportionately higher exposure to urban heat in lower-income neighborhoods: a multi-city perspective. *Environmental Research Letters* 14(10), 105003.
- Chi, D., Aerts, R., Van Nieuwenhuysse, A., Bauwelinck, M., Demoury, C., Plusquin, M., Nawrot, T.S., Casas, L., Somers, B., 2022. Residential Exposure to Urban Trees and Medication Sales for Mood Disorders and Cardiovascular Disease in Brussels, Belgium: An Ecological Study. *Environmental Health Perspectives* 130(5), 57003. doi: 10.1289/EHP9924.
- Cowles, J., Boldgiv, B., Liancourt, P., Petraitis, P.S., Casper, B.B., 2018. Effects of increased temperature on plant communities depend on landscape location and precipitation. *Ecology and Evolution* 8(11), 5267-5278.
- Crompton, J.L. 2001. The impact of parks on property values: A review of the empirical evidence. *Journal of Leisure Research* 33(1), 1-31.
- Cruz-Sandoval, M., Ortego, M.I., Roca, E., 2020. Tree ecosystem services, for everyone? A compositional analysis approach to assess the distribution of urban trees as an indicator of environmental justice. *Sustainability* 12(3), 1215.
- Cusick, D., 2021. Trees are missing in low-income neighborhoods. *Scientific American*, 22 July 2021. Retrieved on 20 October 2024 from <https://www.scientificamerican.com/article/trees-are-missing-in-low-income-neighborhoods/>.
- Dahlström, 2023. Norsk polis identifierar utsatta områden enligt svensk modell – Finland sticker ut i nordisk jämförelse. Retrieved on 2024-10-16 from <https://svenska.yle.fi/a/7-10031272> (in Swedish).
- Daland, S., 2023. An investigation of the 3-30-300 rule in a Swedish context. Master thesis. Department of Science, University of Gothenburg, Gothenburg. Retrieved on 5 October 2024 from <https://gupea.ub.gu.se/handle/2077/77317>.
- Day, S.D and Bassuk, N.L. (1994). A review of the effects of soil compaction and amelioration treatments on landscape trees. *Journal of Arboriculture*, 20(1), pp.9–17.
- EEA, 2018. Unequal exposure and unequal impacts: social vulnerability to air pollution, noise and extreme temperatures in Europe. European Environment Agency, Copenhagen. <https://www.eea.europa.eu/publications/unequal-exposure-and-unequal-impacts/>.

- Eisenman, T. S., Churkina, G., Jariwala, S. P., Kumar, P., Lovasi, G.S., Pataki, D.E., (...), Whitlow, T.H., 2019. Urban trees, air quality, and asthma: An interdisciplinary review. *Landscape and Urban Planning* 187, 47-59.
- Eisenman, T.S., Roman, L.A., Östberg, J., Campbell, L.K., Svendsen, E., 2024. Beyond the Golden Shovel. *Journal of the American Planning Association*.
<https://doi.org/10.1080/01944363.2024.2330943>.
- Equiza M,A. Calvo-Polanco M. Cirelli D. Señorans J. Wartenbe, M. Saunders C, Zwiazek J J (2017). Long-term impact of road salt (NaCl) on soil and urban trees in Edmonton, Canada. *Urban Forestry & Urban Greening*, 21, pp.16-28.
<https://doi.org/10.1016/j.ufug.2016.11.003>
- Frederiksberg Kommune, 2018. Frederiksberg Kommunes Træpolitik. Retrieved on 8 October 2024 from <https://www.frederiksberg.dk/media/znzn1xq2/traepolitik.pdf> (in Danish).
- Gilman, E.F. I,A Leone. Flower, F,B (1987). Effect of Soil Compaction and Oxygen Content on Vertical and Horizontal Root Distribution. *Journal of Environmental Horticulture*, 5(1), pp.33–36. <https://doi.org/10.24266/0738-2898-5.1.33>
- Gillerot, L., Landuyt, D., De Frenne, P., Muys, B. and Verheyen, K., 2023. Urban tree canopies drive human heat stress mitigation. *Ecological Indicators*, 155, p.110588. Available at:
<https://www.sciencedirect.com/science/article/abs/pii/S1618866723003631>
 [Accessed 18 Oct. 2024].
- Global Village, 2017. Fakta för förändring global. Retrieved on 2024-10-16 from <https://jarvaveckan.se/wp-content/uploads/2023/05/Fakta-for-forandring-%E2%80%93Sveriges-61-utsatta-omraden.pdf> (in Swedish).
- Gonzales-Inca, C., Pentti, J., Stenholm, S., Suominen, S., Vahtera, J., & Käyhkö, N. (2022). Residential greenness and risks of depression: longitudinal associations with different greenness indicators and spatial scales in a Finnish population cohort. *Health & Place*, 74, 102760.
- Ghosh, S., Sharenbroch, B,C. Burcham D. Ow L F. Shenbagavalli, S. Mahimairaja S (2016). Influence of soil properties on street tree attributes in Singapore. *Urban Ecosystems*, 19(2), pp.949–967. <https://doi.org/10.1007/s11252-016-0530-8>.
- Gustafsson, M., Lindén, J., Forsberg, B. and Åström, S. 2022. Quantification of population exposure to NO₂, PM₁₀ and PM_{2.5}, and estimated health impacts 2019. IVL report number. 2446.O. Retrieved on 2024-10-16 from <https://ivl.diva-portal.org/smash/record.jsf?pid=diva2%3A1691636&dswid=8910>
- Grey, G.W, Deneke, F.J., 1986. *Urban Forestry*, 2nd edition. Wiley, New York.

- Hammarström, E., Anderberg, R., Eriksson, Å., 2022. Trafikverkets växtlista för invasivfria infrastrukturmiljöer. Rapport. Trafikverket, Borlänge (in Swedish).
- Heisler, G.M., 2005. Health impacts of ultraviolet radiation in urban ecosystems: a review. Ultraviolet Ground-and Space-based Measurements, Models, and Effects V, 5886, 180-196.
- Hsieh, C. M., Li, J.J., Zhang, L., Schwegler, B., 2018. Effects of tree shading and transpiration on building cooling energy use. Energy and Buildings 159, 382-397.
- Iceland Monitor, 2021. Icelandic Is Essential to Getting Access to Society. Retrieved on 2024-10-16 from https://icelandmonitor.mbl.is/news/culture_and_living/2021/01/14/icelandic_is_essential_to_getting_access_to_society/.
- Intergovernmental Panel on Climate Change (IPCC), 2021. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Retrieved on 16 October 2024 from <https://www.ipcc.ch/report/ar6/wg1/>.
- Intergovernmental Panel on Climate Change (IPCC), 2023. Climate Change 2023: Synthesis Report. Retrieved on 18 October 2024 from <https://www.ipcc.ch/report/ar6/syr/>.
- Jabbar, M., Yusoff, M. M., & Shafie, A. (2022). Assessing the role of urban green spaces for human well-being: A systematic review. GeoJournal, 1-19.
- Jim, C.Y. (1993). Soil compaction as a constraint to tree growth in tropical & subtropical urban habitats. Environmental Conservation, 20(1), pp.35–49. <https://doi.org/10.1017/S0376892900037206>.
- Jägersro, 2023. Så räknar vi med 3-30-300-regeln: en formel för en mer hållbar stadsdel. Retrieved on 9 October 2024 from <https://projektjagersro.se/sa-raknar-vi-med-3-30-300-regeln-en-formel-for-en-mer-hallbar-stadsdel/>. (in Swedish.)
- Jensen Karlsson, P., Nuder, S., 2023. Den ojämlika värmen – här är sommarkarnas varmaste platser. SVT. Retrieved on 2024-10-16 from <https://www.svt.se/datajournalistik/den-ojamlika-varmen/> (in Swedish).
- KAN Bouwen, 2023. Natuurinclusief bouwen voor gezonde bewoners Top-10 maatregelen voor nieuwbouw en gebiedsontwikkeling. Authors: Mereboer, P., Postma, A. KAN Bouwen - klimaatadaptief bouwen met de natuur. Retrieved on 7 October 2024 from https://www.allesisgezondheid.nl/wp-content/uploads/2023/06/Natuurinclusief-bouwen-voor-gezonde-bewoners_.pdf (in Dutch).
- Kaplan, R., 1985. The role of nature in the urban context. Journal of Social Issues 41(3), 42-55.

- Kaplan, R., Kaplan, S., 1989. *The Experience of Nature: A Psychological Perspective*. Cambridge University Press, Cambridge, etc.
- Kardan, O., Gozdyra, P., Misic, B., Moola, F. and Palmer, L., 2015. Neighborhood greenspace and health in a large urban center. *Environmental Health Perspectives* 123(12), 1203-1208.
- Karger, D. N., Conrad, O., Böhrer, J., Kawohl, T., Kreft, H., Soria-Auza, R. W., Zimmermann, N. E., Linder, H. P., Kessler, M. 2021. Climatologies at high resolution for the earth's land surface areas. *EnviDat*.
<https://www.doi.org/10.16904/envidat.228>.
- Kjellberg Jensen, J., Jayousi, S., von Post, M., Isaksson, C., Persson, A. S., 2022. Contrasting Effects of Tree Origin and Urbanization on Invertebrate Abundance and Tree Phenology. Article e02491. Lund University, Lund.
- Khomenko, S., Cirach, M., Pereira-Barboza, E., Mueller, N., Barrera-Gómez, J., Rojas-Rueda, G., et al., 2021. Premature mortality due to air pollution in European cities: a health impact assessment. *The Lancet Planetary Health* 5(3), e121 - e134.
- Konijnendijk, C., Östberg, J., 2022. 3-30-300 – För grönare och mer hälsosamma städer. *Movium Fakta #4*. Movium, Alnarp (in Swedish).
- Konijnendijk, C.C., 2022. Evidence-based guidelines for greener, healthier, more resilient neighbourhoods: Introducing the 3–30–300 rule. *Journal of Forestry Research* 34, 821–830. <https://doi.org/10.1007/s11676-022-01523-z>.
- Kristjánsdóttir, H. L., Sigurðardóttir, S., & Pálsdóttir, A. M. (2020). The restorative potential of Icelandic nature. *International Journal of Environmental Research and Public Health*, 17(23), 9095.
- Kuo, F.E., 2003. The role of arboriculture in a healthy social ecology. *Journal of Arboriculture* 29(3), 148-155.
- Kuo, M., 2015. How might contact with nature promote human health? Promising mechanisms and a possible central pathway. *Frontiers in Psychology* 6, 1093.
- Laakkonen, V., 2022. The Integration Spectacle: Migration, politics, and multiculturalism in a Finnish suburb. *Focaal* 2022(94), 101-114.
- Lee, J.J., Maheswaran, R., 2011. The health benefits of urban green spaces: A review of the evidence. *Journal of Public Health* 33(2), 212-222.
- Li, H., Browning, M.H.E.M., Bardhan, M., Ying, M., Zhang, X., Cao, Y., Zhang, G., 2024. Nature connectedness connects the visibility of trees through windows and mental wellbeing: a study on the "3 visible trees" component of the 3-30-300 rule. *International Journal of Environmental Health Research* 907, 167739.
<https://doi.org/10.1080/09603123.2024.2334767>.

- Lin, J., Wang, Q., Li, X., 2021. Socioeconomic and spatial inequalities of street tree abundance, species diversity, and size structure in New York City. *Landscape and Urban Planning* 206, 103992.
- Löhmus, M., Stenfors, C. U., Lind, T., Lauber, A., & Georgelis, A. (2021). Mental health, greenness, and nature related behaviors in the adult population of Stockholm County during COVID-19-related restrictions. *International Journal of Environmental Research and Public Health*, 18(6), 3303.
- Maantay, J., Chakraborty, J., Brender, J., 2010. Proximity to environmental hazards: Environmental justice and adverse health outcomes. In: *Strengthening environmental justice research and decision making: a symposium on the science of disproportionate environmental health impacts*, Washington DC, March 17-19, pp. 17-19.
- Malmö Stad, 2023. Ännu fler träd åt folket. Text by Magnus Erlandsson, Vårt Malmö. Retrieved on 8 October 2024 from <https://malmo.se/Aktuellt/Artiklar-Malmo-stad/2023-05-26-Annu-fler-trad-at-folket.html> (in Swedish).
- Mattisson, K., Axmon, A., Carlsson, G., Malmgren Fänge, A., Lethin, C., & Stroh, E. (2022). Sociodemographic variations in the availability of urban green spaces in an older Swedish population. *International Journal of Environmental Research and Public Health*, 19(19), 12651.
- Moll, G., 1989. Improving the health of the urban forest. In: Moll, G., Ebenreck, S. (Eds.), *A Resource Guide for Urban and Community Forests*. Island Press, Washington, pp. 119–130.
- Miller, R.H., Miller, R.W., 1991. Planting survival of selected street tree taxa. *Journal of Arboriculture* 17, 185–191.
- Muscarella, R. et al. 2014. ENMeval: An R package for conducting spatially independent evaluations and estimating optimal model complexity for Maxent ecological niche models. - *Methods in Ecology and Evolution* 5, 1198–1205.
- MSB, 2021. Index över social sårbarhet för klimatrelaterade risker i Sverige. Retrieved on 2024-10-16 from <https://rib.msb.se/filer/pdf/29639.pdf> (in Swedish).
- Myers, S.S., 2017. Planetary health: protecting human health on a rapidly changing planet. *The Lancet* 390(10114), 2860-2868.
- Na, H.R., Heisler, G.M., Nowak, D.J., Grant, R.H., 2014. Modeling of urban trees' effects on reducing human exposure to UV radiation in Seoul, Korea. *Urban Forestry & Urban Greening* 13(4), 785-792.
- Nässländer, G., Östberg, J., 2024. A comprehensive guide to species selection for urban tree planting. *Arborist News* 33.
- Nasar, J.L., 1992. Urban design aesthetics: The evaluative qualities of building and the urban environment. *Environment and Behavior* 24(3), 347-375.

Naturvårdsverket, 2024. Vad är resiliens och ekologisk resiliens? Retrieved October 4, 2024, from <https://www.naturskyddsforeningen.se/artiklar/vad-ar-resiliens-och-ekologisk-resiliens/> (in Swedish).

Nieuwenhuijsen, M.J., Dadvand, P., Márquez, S., Bartoll, X., Pereira Barboza, E., Cirach, M., Borrell, C., Zijlema, W.L., 2022. The evaluation of the 3-30-300 green space rule and mental health. *Environmental Research* 215(part 2), 114387. <https://doi.org/10.1016/j.envres.2022.114387>.

Nikkanen, M., Räsänen, A., & Juhola, S. (2021). The influence of socioeconomic factors on storm preparedness and experienced impacts in Finland. *International Journal of Disaster Risk Reduction*, 55, 102089.

Nordh, H., Aamodt, G., Nordbø, E.C., 2024. Greater perceived access to green spaces near homes: Safer and more satisfied residents. *Journal of Environmental Psychology* 96, 102332.

Nordic Council of Ministers, 2022. Policy Brief: Nordic Cities – Green, Resilient, Healthy Fostering national policies and initiatives for urban green space. Retrieved on 5 October 2024 from <https://www.norden.org/en/publication/policy-brief-nordic-cities-green-resilient-healthy>.

Nowak, D.J., Crane, D.E., 2002. Carbon Storage and Sequestration by Urban Trees in the USA. *Environmental Pollution* 116(3), 381-393.

Nowak, D.J., Hirabayashi, S., Bodine, A. and Greenfield, E., 2014. Tree and forest effects on air quality and human health in the United States. *Environmental Pollution*, 193, pp.119-129. Retrieved on 18 October 2024 from <https://www.sciencedirect.com/science/article/abs/pii/S0269749114002395?via%3Dihub>.

Oke, T. R., 1982. The energetic basis of the urban heat island. *Quarterly Journal of the Royal Meteorological Society* 108(455), 1-24.

Oliveira, J.D. D., Biondi, D., Reis, A.R.N.D., 2022. The role of urban green areas in noise pollution attenuation. *Dyna* 89(220), 210-215.

Orru, H., Tamm, T., Kriit, H. K., Maasikmets, M., & Lõhmus, M., 2024. Green inequality in Estonian cities—what does it mean in health and external costs perspectives. Abstract. In *ISEE Conference Abstracts*, Vol. 2024(1).

Östberg, J., 2024. Balans i trädbeståndet: inhemska, exotiska och invasiva träd i urban miljö. *Trädaktuell* 2024(5) (in Swedish).

Patwary, M.M., Bardhan, M., Browning, M.H., Astell-Burt, T., van den Bosch, M., Dong, J., Dzhambov, A.M., Dadvand, P., Fasolino, T., Markevych, I., McAnirlin, O., Nieuwenhuijsen, M.J., White, M.P., Van Den Eeden, S.K., 2023. The economics of nature's healing touch: A systematic review and conceptual framework of green space, pharmaceutical prescriptions, and healthcare expenditure associations. *Science of the Total Environment* 914, 169635.

Persson et al., 2018. Urban residential greenness and adiposity: A cohort study in Stockholm County. *Environment International* 121 (Part 1), 832-841.

Public Health Agency of Sweden (Folkhälsomyndigheten), 2021. Miljöhälsorapport 2021 – barns miljörelaterade hälsa.

<https://www.folkhalsomyndigheten.se/publikationer-och-material/publikationsarkiv/m/miljohalsorapport-2021/> (in Swedish).

Rantanen, M., Karpechko, A. Y., Lipponen, A., Nordling, K., Hyvärinen, O., Ruosteenoja, K., (...), Laaksonen, A., 2022. The Arctic has warmed nearly four times faster than the globe since 1979. *Communications Earth & Environment* 3(1), 168.

Region Skåne, 2023. 3-30-300 i Skåne - En analysmodell för grönare och hälsosammare städer. Region Skåne, Malmö. Retrieved on 30 September 2024 from <https://utveckling.skane.se/publikationer/publikationer/3-30-300-i-skane/> (in Swedish).

Ren, F., Qiu, Z., Liu, Z., Bai, H., & Gao, H. O. (2023). Trees help reduce street-side air pollution: A focus on cyclist and pedestrian exposure risk. *Building and Environment*, 229, 109923.

Reykjavik.is, undated. Neighbourhood plan Breidholt. Retrieved on 2024-10-16 from <https://reykjavik.is/en/neighborhood-plan/breidholt>.

Sailor, D. J., 2008. A green roof model for building energy simulation. *ASHRAE Transactions* 114(1), 244-253.

Salmond, J. A., Tadaki, M., Vardoulakis, S., Arbuthnott, K., Coutts, A., Demuzere, M., (...), Wheeler, B.W., 2016. Health and climate related ecosystem services provided by street trees in the urban environment. *Environmental Health* 15, 95-111.

Santamour, F.S., Jr., 1990. Trees for Urban Planting: Diversity ,Uniformity , and Common Sense . Proc. 7th Conf. Metropolitan Tree Improvement Alliance (METRIA) 7, 5765.

Schneider, T. E. 2024. Pollen allergy in the Icelandic urban landscape (Frjóðkornaofnæmi í borgarlandslagi á Íslandi) (Thesis). [Agricultural University of Iceland, Retrieved 2024-10-16. Reykjavik, Iceland. http://hdl.handle.net/1946/47529](http://hdl.handle.net/1946/47529)

Scientific Council for Sustainable Development(Vetenskapliga Rådet för Hållbar Utveckling), 2018 Människors hälsa i växande städer. Retrieved on 2024-10-16 from <https://ki.se/media/261934/download> (in Swedish).

Sheridan, S., de Guzman, E.B., Eisenman, D.P., Sailor, D.J., Parfrey, J. and Kalkstein, L.S., 2024. Increasing tree cover and high-albedo surfaces reduces heat-related ER visits in Los Angeles, CA. *International Journal of Biometeorology*. Retrieved on 18 October 2024 from <https://link.springer.com/article/10.1007/s00484-024-02688-4>.

Sinha, P., Coville, R.C., Hirabayashi, S., Lim, B., Endreny, T.A. and Nowak, D.J., 2022. Variation in estimates of heat-related mortality reduction due to tree cover in U.S. cities. *Journal of Environmental Management*, 305, p.114359.

Sinsamala, M., Johannessen, A. Bertelsen, R., Accordini, S., Brandt, J., Frohn, L., Geels, C., Gislason, T., Holm, M., Janson, C., Markevych, I., Orru, H., Real, F., Sigsgaard, T., Skulstad, S., Svanes, C. and A. Marcon. 2024. Pregnancy outcomes as related to in utero exposure to air pollution and greenness: The Life-GAP Project. *Environmental Epidemiology* 8(4), p e318.

Schneider, T.E., 2024. Pollen allergy in the Icelandic urban landscape. Bachelor thesis, Landscape Architecture. Agricultural University of Iceland, Hvanneyri. Retrieved on 16 October 2024 from <https://skemman.is/handle/1946/47529>.

slu.se, 2024. Ny metod mäter rättvis fördelning av grönska i städer (in Swedish). Retrieved on 5 November 2024 from <https://www.slu.se/ew-nyheter/2024/11/rattvis-tillgang-till-gronska/#share-box-header> (in Swedish).

Smiley, E.T., Kielbaso, J.J., Proffer, T.J., 1986. Maple disease epidemic in southeastern Michigan. *Journal of Arboriculture* 12 (5), 126–128.

Sorensen, M., Poulsen, A., Hvidtfeldt, U., Brandt, J., Frohn, L., Ketznel, M., Christensen, J., Im, U., Khan, J., Münzel, T. and Raaschou-Nielsen O. 2018. Air pollution, road traffic noise and lack of greenness and risk of type 2 diabetes: A multi-exposure prospective study covering Denmark. *Environment International* 170, 107570.

Stavanger municipality, 2017. Levekår i Stavanger Geografisk fordeling Rapport nr 7. Retrieved on 24-10-16 from <https://www.stavanger.kommune.no/siteassets/samfunnsutvikling/undersokelser-og-rapporter/levekarsundersokelse-for-stavanger---2017.pdf> (in Norwegian).

Steven J. Phillips, Robert P. Anderson, Miroslav Dudík, Robert E. Schapire, Mary Blair. 2017. Opening the black box: an open-source release of Maxent. *Ecography* 40(7), 887-893.

Stucki, L., Helte, E., Axelsson, Ö., Selander, J., Löhmus, M., Åkersson, A. and Eriksson, C. 2024. Long-term exposure to air pollution, road traffic noise and greenness, and incidence of myocardial infarction in women. *Environment International* 190, 108878.

Sugiyama, T., Thompson, C.W., 2008. Outdoor environments, activity, and the social environment: A review of the evidence. *Health & Place* 14(3), 454-467.

Sweco, 2024. Een praktische verkenning naar een Nederlandse groennorm. Een vergelijking van 10 groennormen en doorrekening investering realisatie groennorm. Sweco, De Bilt. Retrieved on 9 October 2024 from <https://natuurenmilieu.nl/app/uploads/Praktische-verkenning-naar-een-Nederlandse-Groennorm-Sweco-2024.pdf> (in Dutch).

Tampere municipality, 2024. Survey for residents of Hervanta, Multisilta, Peltolampi and Tesoma gained more than 1,300 responses. Retrieved on 2024-10-16 from <https://www.tampere.fi/en/current/2024/09/05/survey-residents-hervanta-multisilta-peltolampi-and-tesoma-gained-more>.

Trädkontoret, 2024. Klimatanalyser. Retrieved October 4, 2024, from <https://tradkontoret.se/resurser/klimatprognoser/> (in Swedish).

Umeå municipality, 2020. Umeå växer tryggt och säkert Färdriktning 2020-2025. Retrieved on 2024-10-16 from <https://www.umea.se/download/18.62b6e32a18c2f89114275e4/1701683115875/Ume%C3%A5%20v%C3%A4xer%20tryggt%20och%20s%C3%A4kert%20F%C3%A4rdriktning%202020-2025.pdf> (in Swedish).

United Nations, 2024. The 17 Goals. Department of Social Affairs, Sustainable Development. Retrieved on 16 October 2024 from <https://sdgs.un.org/goals>.

Växtforum, 2022. Naturvårdsverket lanserar mål om minst 25 procents trädkröntäckning. Retrieved on 9 October 2024 from <https://vaxtforum.se/aktuellt/naturvardsverket-lanserar-mal-om-minst-25-procents-krontackning/> (in Swedish).

Venter, Z.S., Figari, H., Krange, O., Gundersen, V., 2023. Environmental justice in a very green city: Spatial inequality in exposure to urban nature, air pollution and heat in Oslo, Norway. *Science of The Total Environment*, 858, 160193.

Viinikka, A., Tiitu, M., Heikinheimo, V., Halonen, JI., Nyberg, E. and Vierikko, K. 2023. Associations of neighborhood-level socioeconomic status, accessibility, and quality of green spaces in Finnish urban regions. *Applied Geography* 157, 102973.

Weimann, H., Rylander, L., Annerstedt van den Bosch, M., Albin, M., Skärbäck, E., Grahn, P and Björk, J. 2017. Perception of safety is a prerequisite for the association between neighbourhood green qualities and physical activity: Results from a cross-sectional study in Sweden. *Health & Place* 45, 124-130.

VKM, Kyrre Kausrud, Vigdis Vandvik, Daniel Flø, Sonya R. Geange, Stein J. Hegland, Jo S. Hermansen, Lars R. Hole, Rolf A. Ims, Håvard Kauserud, Lawrence R. Kirkendall, Jenni Nordén, Line Nybakken, Mikael Ohlson, Olav Skarpaas, Micael Wendell, Hugo de Boer, Katrine Eldegard, Kjetil Hindar, Paal Krokene, Johanna Järnegren, Inger E. Måren, Anders Nielsen, Erlend B. Nilsen, Eli K. Rueness, Eva B. Thorstad, Gaute Velle (2022). Impacts of climate change on the boreal forest ecosystem. Scientific Opinion of the Panel on Alien Organisms and Trade in endangered species (CITES) of the Norwegian Scientific Committee for Food and Environment. VKM Report 2022:15, ISBN: 978-82-8259-390-8, ISSN: 2535-4019. Norwegian Scientific Committee for Food and Environment (VKM), Oslo, Norway.

Willems, H., Dewaelheyns, V., Aerts, R., Somers, B., 2023. Moderniseren van de Vlaamse Groennormen - Eindrapport. Afdeling Bos, Natuur & Landscape & KU Leuven, Leuven etc. Retrieved on 1 October 2024 from <https://www.natuurenbos.be/sites/default/files/2024-02/EindrapportGroennormen.pdf> (in Dutch).

Wolch, J.R., Byrne, J., Newell, J.P., 2014. Urban green space, public health, and environmental justice: A critical review. *Landscape and Urban Planning* 125, 97-109.

Wolf, K.L., Lam, S.T., McKeen, J.K., Richardson, G.R.A., van den Bosch, M., Bardekjian, A.C., 2020. Urban Trees and Human Health: A Scoping Review. *International Journal of Environmental Research and Public Health* 17(12), 4371. <https://doi.org/10.3390/ijerph17124371>

World Health Organization, Regional Office for Europe, 2017. Urban green spaces: a brief for action. WHO, Copenhagen. Retrieved on 12 October 2024 from <https://iris.who.int/bitstream/handle/10665/344116/9789289052498-eng.pdf>.

World Health Organization (WHO) and United Nations (UN), 2022. Compendium of WHO and other UN guidance on health and environment: 2022 update. Chapter 11: Environmental noise. Retrieved on 18 October 2024 from <https://www.who.int/tools/compendium-on-health-and-environment/environmental-noise>.

Yang, Y., Xu, Y., Duan, Y., Yang, Y., Zhang, S., Zhang, Y. and Xie, Y. 2023. How can trees protect us from air pollution and urban heat? Associations and pathways at the neighborhood scale. *Landscape and Urban Planning* 236, 104779.

Zhao, N., Prieur, J-F., Liu, Y., Kneeshaw, D., Morasse Lapointe, E., Paquette, A., Zinszer, K., Dupras, J., Villeneuve, P.J., Rainham, D.G., Lavigne, E., Chen, H., van den Bosch, M., Oiamo, T. and Smargiassi, A., 2022. Tree characteristics and environmental noise in complex urban settings – A case study from Montreal, Canada. *Environmental Research*, 204, p.112072.



Photo 22. Urban woodland scene in autumn (photo by Imad Clicks).

Appendix

A1. Method for GIS-analysis

Heat stress risk maps

The heat stress risk maps have been constructed using data from the US Landsat satellite constellation, with added prognoses from the IPCC. The Landsat series of satellites measure the temperature of the earth, with a spatial resolution of 100 metres, since 1983. This provides us with climatological time series of temperature data for every spot on the planet.

We have downloaded this data for the Nordic region over the last three summers (2021, 2022 and 2023), and we have extracted the hottest temperatures measured per year for every location. We do this every year. Then we take the median value over the last three years, and we consider that to be the current heat stress risk temperature.

Based on IPCC prognoses, we have extrapolated this heat stress risk temperature to the future, being the near future (about 2030), the mid-term future (about 2050) and the far future (about 2090). We have done so using Shared Socioeconomic Pathway 5, which is considered the current worst-case scenario.

After that we have classified the thermal map and predictions into seven classes, based on physiological classes ranging from "too cold for trees" to "morbid heat stress". It is important to note that this classification is meant for trees, not for humans.

Climate analyses

The method used in this report, described in Swedish as *klimatanalyser* (Trädkontoret AB 2024) is based on the *kuenm* package for R (Muscarella et al., 2014), a modelling package based on the Maxent software for modelling species niches and distributions (Philips et al., 2017). The process includes recorded observations of a tree species from Gbif (Global biodiversity infrastructure facility), combined with high-resolution climate data (see Figure A1) to model the future distribution of a species. The model is run on climate data based on the SSP370-scenario. SSP370 is one of the socioeconomic scenarios used in climate models and future projections to examine the effects of different pathways for future development on the climate. SSP stands for "Shared Socioeconomic Pathways"

and is a set of five scenarios that describe possible future societal developments. The number 370 in SSP370 represents the approximate radiative forcing, measured in watts per square metre (W/m^2), expected by the year 2100 under this scenario. SSP370 describes a world with moderate challenges for both climate change and adaptation. This scenario includes relatively high greenhouse gas emissions, leading to a radiative forcing of approximately $7.0 \text{ W}/\text{m}^2$ by 2100. It also implies moderate social, economic, and technological developments, meaning that efforts to reduce emissions and adapt society to climate change are not particularly ambitious (IPCC, 2021).

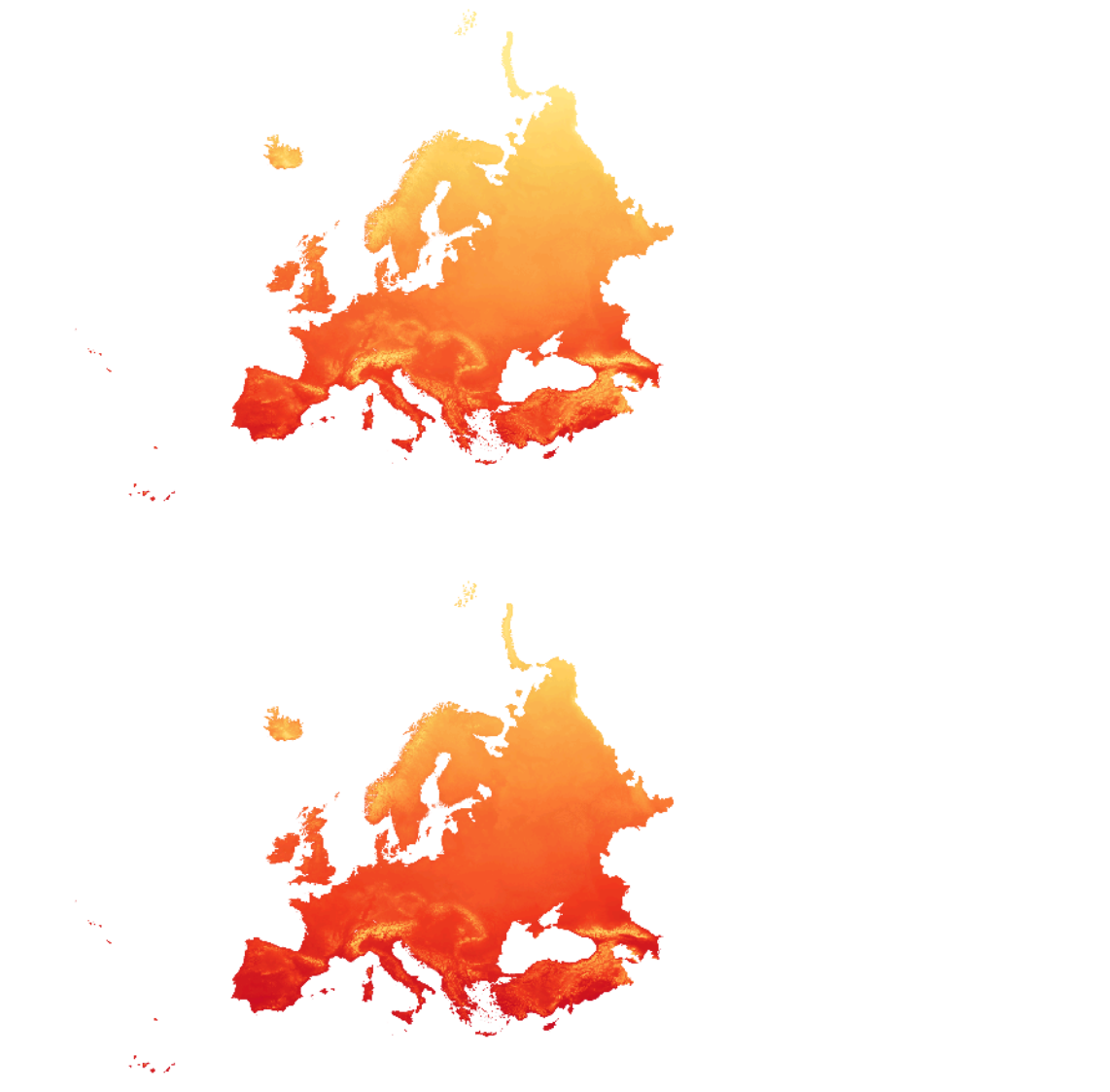


Fig A1. Example of high-resolution climate data: Bio1. The development of mean annual temperature in Europe as modelled by GFDL for the ssp370- scenario for 1981-2010 (first) and 2071-2100 (second). (Karger et al., 2021).

The method is broken down into three main steps:

- *Processing occurrence data:* Occurrence data containing information about a tree species' observed presence. This data has been retrieved from the portal Gbif.org, which hosts a large species library with observations of species from around the world. First, the occurrence data of various species is filtered from CSV files containing species data from GBIF.org. The goal is to prepare and clean this data for use, including removing observations with high uncertainty and duplicate coordinates, as well as partitioning the data into blocks for further analysis.
- *Processing climate data:* High-resolution climate data in raster format is used to model future distribution and provide an overview of a species' historical range. This data has been downloaded from chelsa-climate.org and contains high-resolution global climate data. The climate data is processed using various packages in the R programming language and is then cropped to fit the study area, in this case, the Nordic region.
- *Data modelling:* The cleaned occurrence data, along with climate data is processed through a Maxent script in R, where each species' potential habitat is modelled based on occurrence and climate data. The model processes various modelling scenarios to identify the most suitable scenario for each species and then compiles this into a new raster layer representing the projected occurrence of the species. The raster is then graduated from 0 to 10 where 0 represents unfavourable conditions for the mapped species, and 10 represents favourable conditions.

Socioeconomic analyses

As Malmö was the only participating city in the project that submitted data on socioeconomic parameters, we chose this city for an in-depth case study, while the other 8 cities participating in the project needed another approach. The in-depth analysis of Malmö can inspire similar analyses in other cities in the future. In Malmö, we used data on employment, mean yearly income, and ethnicity as a percentage of the population on DESO (demographic statistical areas) level that are either born outside Sweden or have parents both born outside Sweden (so-called first and second-generation immigrants). Additionally, we used the reported mean number of sick days per DESO area to illustrate the challenges of public health. For the report, we illustrated levels of each of the four datasets and whether the area reached the 3+30+300 score. The three areas in Malmö that are defined by the Swedish police as vulnerable due to their socioeconomic and safety challenges are also shown on the maps. Additionally, we plotted the datasets against 3+30+300 overall score showing the size of the population in each DESO area. Especially for ethnicity, the relationship between a high share of first and second-generation

immigrants and 3+30+300 is almost linear. The higher the share of immigrants, the higher school note.

For the other case cities, we first looked at if and how the different countries define socio-economic vulnerability, and if the countries or cities themselves define any area as vulnerable. Results can be found in Table 8 above. For all cities we were able to identify areas that are seen as vulnerable or experiencing challenges connected to socioeconomic parameters. Data on how these areas score on the different 3+30+300 components were extracted and compared to how the city scores as a whole. We chose not to present this data as maps as the different areas are defined in different manners and that socioeconomic vulnerability is a sensitive issue. The results are instead presented in table form to show general trends instead of pinpointing specific areas in the cities.

Comparison of tree cover data with climate-related parameters

The methodology used for this part of the study is grounded in an analysis of climate data, supplemented by tree canopy data provided by the participating cities. This foundational information facilitated the development of two distinct studies: one examining the correlation between heatmap data and tree cover, and the other investigating the relationship between noise pollution levels and tree cover.

Malmö was selected for the noise pollution study due to its comprehensive and detailed data among the participating cities. This data established a robust framework for analysing how tree cover influences noise levels in urban environments (see Figure A2).

In both studies, statistical analyses were conducted to identify and quantify the correlations between the respective environmental factors – temperature and noise pollution – and tree cover. This involved comparing the spatial distribution of these data sets to the levels of aerial tree cover in the areas studied. This methodological approach aims to inform urban planning practices and enhance understanding of the benefits that tree cover provides in urban settings.

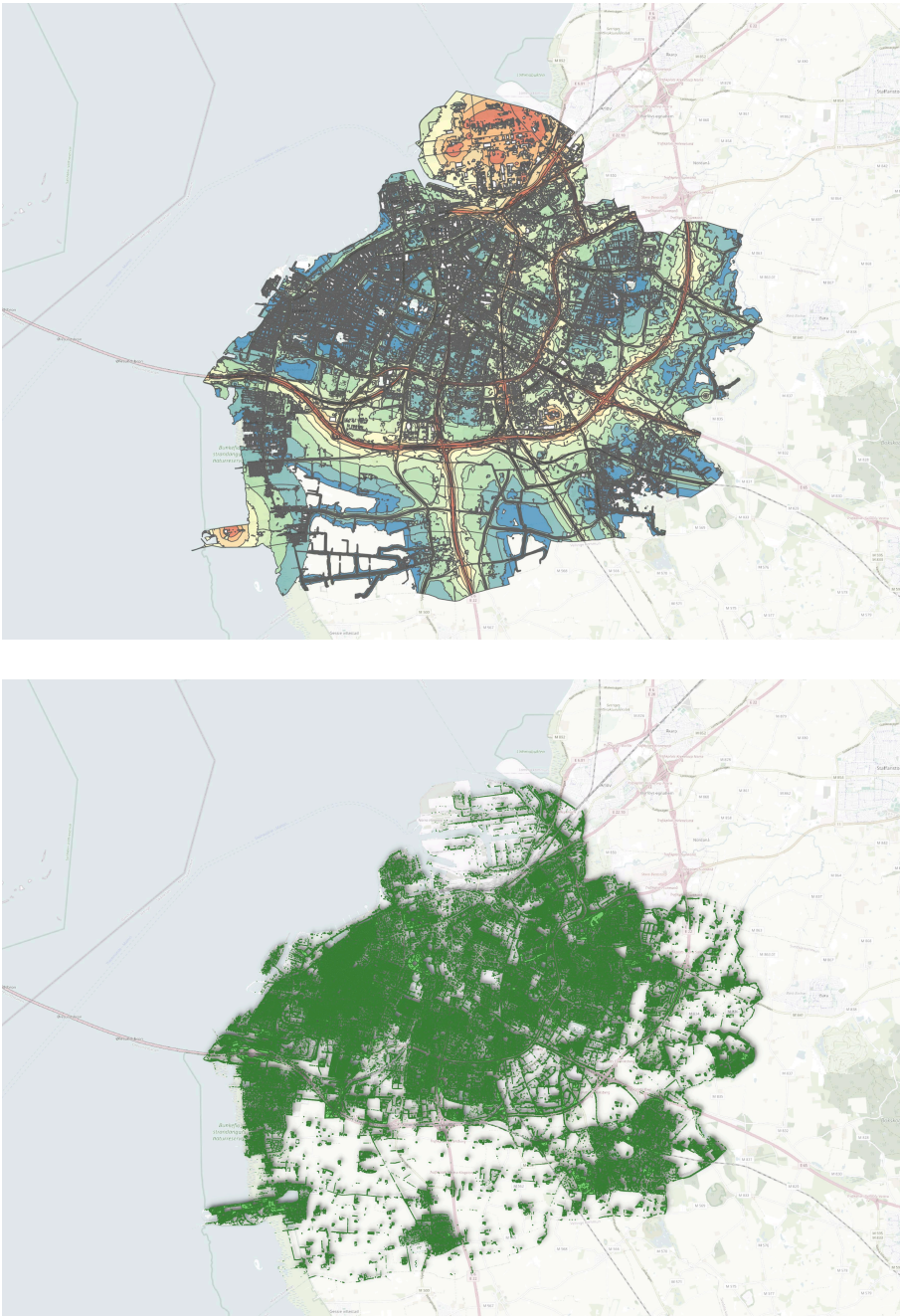


Figure A2. An example of the data used in the studies: noise pollution data from Malmö, Sweden is shown on the left, while tree canopy coverage for the city is displayed on the right.

A2. Workshop series – aims and key findings

As part of the Yggdrasil project, three workshops were held with the participating cities. These workshops aimed to provide the project team with insights for the final report and to equip Nordic municipalities with the knowledge and tools required to implement the 3+30+300 principle effectively (see Table A1). The workshops were facilitated by Clara Lind (Trädkontoret) and Cecil Konijnendijk (Nature Based Solutions Institute), along with other team members. Each municipality was encouraged to have two representatives involved throughout the series, contributing to the project's development and building networks with other participants. Members from the Yggdrasil's external reference group were also invited and were represented at all the workshops.

Table A1. Summary of the project workshop series.

Workshop	Date and time	Description
Workshop 1	2024-09-27 Online 3 hours	Introduction and initial GIS analysis • Introduction workshop series • Introduction 3+30+300 principle • Presentation of initial GIS analysis • Discussion and breakout sessions • Wrap-Up and next steps
Workshop 2	2024-11-08 In-person in Stockholm 6 hours	In-depth analysis and application • Introduction of the day • Deep dive GIS analysis incl. health aspects • Interactive group activity: • Neighbourhood analysis • Reporting from group activity and discussion • Inspiration: Strategies for implementation • Insight into 3+30+300 research findings • Wrap-Up and next steps
Workshop 3	2024-02-25 Online	Conclusion and ambassador creation • Presentation of final results • Discussion: Becoming ambassadors • Interactive group activity: create an action plan • Wrap-Up and final remarks

Workshop 1

The first Yggdrasil workshop, held online in September 2024, brought together participating municipalities to discuss the 3+30+300 principle, the experiences of the municipalities with using the principle to date, and the initial GIS analysis. The Yggdrasil workshop series was also introduced. The municipalities were given a preview of the comprehensive GIS analyses that would be presented and discussed in greater detail during the second workshop. The agenda included an introduction to the project, the role of trees in urban planning, and breakout discussions on challenges, opportunities, and local adaptations of the principle.

Key findings

1. **GIS analysis and mapping:** the cities appreciated the GIS maps, seeing them as useful communication tools. However, they highlighted the need for localised and finer-grained data for planning purposes. Some cities may need to combine this data with their own, and suggested integrating heatmaps or other tools to make the analysis more relevant to their specific contexts.
2. **Application in cities (some examples):**
 - a. Holbaek has already included the 3+30+300 principle in several of its strategies, such as biodiversity and climate planning, with a "bottom-up" approach.
 - b. Malmo has adopted 3+30+300 politically and has integrated it into its comprehensive plan.
 - c. Stavanger has begun using the principle in area-specific planning, especially to assess existing neighbourhoods for the 3 and 30 components. It's seen as a valuable tool to enhance the city's Green Plan.
 - d. Turku has not yet implemented the principle but sees potential, particularly in urban regeneration projects, like transforming former industrial areas into residential zones.
3. **Challenges and contextual adaptation:**
 - a. Participants from northern regions, such as Iceland and Bergen, noted that heat stress is not a pressing issue for them. Instead, they emphasised the need to address stormwater management and other climate impacts, making shading less of a priority.
 - b. In denser urban areas, limited space and lack of long-term maintenance funding were cited as barriers to implementation. Many cities face difficulties balancing the protection of trees with development needs, especially in vulnerable areas.

4. **Communication and engagement:** The principle was acknowledged as a powerful communication tool, especially with stakeholders like politicians, developers, and residents. Its simplicity makes it effective for raising awareness of the benefits of urban greenery, such as climate resilience and improved well-being.
5. **Socioeconomic considerations:** While participants agreed that green spaces contribute to urban equity, they also noted that the correlation between vulnerable areas and green space availability isn't always straightforward. For example, in Visby in Sweden, the wealthier inner city has fewer green spaces but remains less vulnerable, demonstrating the complex interplay between cultural heritage, planning restrictions, and green infrastructure.

Conclusions

The workshop highlighted the importance of adapting the 3+30+300 principle to local conditions, such as different climate zones and urban densities across Nordic cities. The participants called for a toolbox of strategies that could be applied in various contexts, with emphasis on seasonal variations and the socio-economic impact of urban greening. While the principle is a good starting point for strategic planning, cities require more detailed guidance and support on how to implement it effectively in their unique environments. Future workshops will continue to refine these tools and approaches.

Workshop 2

The second workshop took place as a full-day event at the Ekologigruppen office in Stockholm. This workshop focused on in-depth analysis and strategic planning for implementing the 3+30+300 principle. Participants were provided with insights from the project for applying the principle while considering the Nordic and their own specific context. The day combined practical insights with theoretical knowledge, allowing participants to explore and discuss real-world applications of the principle in their own municipalities. Presentations on a GIS deep dive, relations between urban forests and human health, suggestions for strategic principle implementation, and research that has been using the 3+30+300 principle to study health benefits offered inspiration. During the interactive group activity, each municipality analysed maps showing their scores for the 3+30+300 principle, maps that identified possible priority areas expanding the local tree canopy cover, as well as heat stress maps. Most cities found some of their scores surprising, especially where they scored lower than expected. This mapping exercise provided a solid foundation for further analysis and strategic planning.

Key findings

1. **Caution in public sharing without proper explanation**

Although the maps were seen as excellent analysis and communication tools, municipal staff expressed hesitation about sharing these 3+30+300 maps with politicians and the public without robust supporting arguments. There was concern that low-scoring areas in red (and blue) could lead to misconceptions, as a low score does not necessarily mean that a specific area is a priority for green space improvements. City staff emphasised the need for clear communication and prioritisation criteria to help the public and stakeholders understand why certain areas may or may not be prioritised for greening efforts.

2. **Economic justifications for investment in urban trees**

Participants requested economic arguments to support the 3+30+300 principle, highlighting the need for a stronger financial case for investing in urban trees and green infrastructure. Economic data could strengthen the case for tree planting and tree conservation initiatives and help cities secure funding and political support.

3. **Alternative green solutions**

Given space constraints in urban environments, there was interest in exploring whether shrubs, perennial plants, green walls, green roofs, and other types of vegetation could be considered within the 3+30+300 framework, especially in areas where growing full-sized trees is challenging. This reflects a desire to maximise green cover through flexible solutions when traditional tree planting is not feasible.

4. **Guidelines for the use of native and exotic species**

Municipalities expressed the need for clearer guidelines regarding use of native versus exotic species. A consistent framework could help cities make informed decisions about plant selection, promoting biodiversity and ecological resilience across different Nordic regions. The share of native species could differ, for example, according to type of green space (e.g., higher in parks and forested areas than in street tree plantings).

5. **Defining high-quality green spaces**

A key discussion point was how to define what is meant with a "high-quality" green space (for the 300-component). There was consensus that each city should have the flexibility to define this based on its unique context, considering factors like usability, safety, ecological value, and accessibility. For some cities, a high-quality green space may simply be one that is actively used by the public, even if it is small or non-traditional.

6. **Challenges in high-density areas and development zones**

Participants noted the challenges of creating larger green spaces in high-density or heavily developed areas. There was consensus on the importance of preserving existing green spaces in these zones to maintain high scores and ensure that urban expansion does not erode green coverage. Cities emphasised the need to balance green space preservation with other land use needs, such as housing and parking.

7. **Integration with mobility and transit**

The role of green spaces along mobility corridors, such as pedestrian and cycle lanes, which allows residents to benefit from greenery during their daily commutes, was highlighted. Future work that links implementation of the 3+30+300 principle with mobility corridors was suggested.

8. **Encouraging innovation and persistence**

An overarching message was the importance of challenging constraints and not accepting "no" as the final answer. Cities agreed that with creative thinking and perseverance, there are always ways to incorporate green solutions, even areas and spaces that are challenging for trees and parks.



Photo 23. Interactive group-activity during workshop 2 (photo by Cecil Konijnendijk).

Conclusions

The workshop provided a platform for Nordic municipalities to gain insights into their own green space distributions and to understand the broader implications of the 3+30+300 principle. The discussions underscored a strong commitment to enhancing urban green spaces but also highlighted key challenges, such as the need for economic justifications, flexible and context-dependent green solutions, and clearer guidelines on species selection. While each city operates within unique constraints, there was a shared recognition of the importance of adapting the 3+30+300 framework to local contexts.

Going forward, cities are encouraged to use the 3+30+300 analysis and maps as starting points for deeper analysis and strategic planning, rather than seeing them as proposing definitive solutions. Several city staff mentioned that they have plans to enhance their use of the principle. The workshop emphasised that improving urban green coverage requires not only innovative thinking but also careful communication with stakeholders to ensure that green initiatives are well understood and supported.

In summary, the workshop successfully established a foundation for further collaboration and analysis among Nordic cities, setting the stage for practical implementation of the 3+30+300 principle to support balancing ecological, economic, and social needs.

Workshop 3 – to take place after project conclusion

The third workshop was to be held in February 2025 (after project conclusion) and would concentrate on the results from all analyses and activities throughout the project, highlighting key findings. Focus would be on the 3+30+300 handbook that will be finalised in January 2025 and sent out to the workshop attendees beforehand. Group discussions were to be held on how municipalities can act as ambassadors for the 3+30+300 principle, focusing on strategies for promoting awareness and best practices. Participants would also be engaged in an interactive session to create action plans for ongoing support from the established network and advocacy for the 3+30+300 principle in the Nordic region (creation of an ambassador network).

About this publication

Yggdrasil – The Living Nordic City

Cecil Konijnendijk, Clara Lind, Hélène Littke, Dirk Voets, Anna Oudin, Johan Östberg, Kalle Ågren, Gustav Nässlander, Gustaf Viita Adamsson, Poul Enger, Anna Maria Larson, Hanne Johnsrud, Ellinor Scharin, Petra Schoon, Wösel Thoresen, Emanuel Vogel

TemaNord 2025:520

ISBN 978-92-893-8181-9 (PDF)

ISBN 978-92-893-8182-6 (ONLINE)

<http://dx.doi.org/10.6027/temanord2025-520>

© Nordic Council of Ministers 2025

Cover photo: Håkan Wike / imagebank.sweden.se

Published: 31/1/2025



Disclaimer

This publication was funded by the Nordic Council of Ministers. However, the content does not necessarily reflect the Nordic Council of Ministers' views, opinions, attitudes or recommendations.

Rights and permissions

This work is made available under the Creative Commons Attribution 4.0 International license (CC BY 4.0) <https://creativecommons.org/licenses/by/4.0>.

Translations: If you translate this work, please include the following disclaimer: This translation was not produced by the Nordic Council of Ministers and should not be construed as official. The Nordic Council of Ministers cannot be held responsible for the translation or any errors in it.

Adaptations: If you adapt this work, please include the following disclaimer along with the attribution: This is an adaptation of an original work by the Nordic Council of Ministers. Responsibility for the views and opinions expressed in the adaptation rests solely with its author(s). The views and opinions in this adaptation have not been approved by the Nordic Council of Ministers.

Third-party content: The Nordic Council of Ministers does not necessarily own every single part of this work. The Nordic Council of Ministers cannot, therefore, guarantee that the reuse of third-party content does not infringe the copyright of the third party. If you wish to reuse any third-party content, you bear the risks associated with any such rights violations. You are responsible for determining whether there is a need to obtain permission for the use of third-party content, and if so, for obtaining the relevant permission from the copyright holder. Examples of third-party content may include, but are not limited to, tables, figures or images.

Photo rights (further permission required for reuse):

Any queries regarding rights and licences should be addressed to:
Nordic Council of Ministers/Publication Unit
Ved Stranden 18
DK-1061 Copenhagen
Denmark
pub@norden.org

Nordic co-operation

Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland.

Nordic co-operation has firm traditions in politics, economics and culture and plays an important role in European and international forums. The Nordic community strives for a strong Nordic Region in a strong Europe.

Nordic co-operation promotes regional interests and values in a global world. The values shared by the Nordic countries help make the region one of the most innovative and competitive in the world.

The Nordic Council of Ministers
Nordens Hus
Ved Stranden 18
DK-1061 Copenhagen
pub@norden.org

Read more Nordic publications on www.norden.org/publications