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Securing blue-green qualities in urban projects

A qualitative case study of blue-green factor in Asplan Viak

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Master of sciences Landscape Architecture for Global Sustainability

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TITLE
Securing blue-green qualities in urban projects- A qualitative case study of blue-green factor in Asplan Viak

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PREFACE AND ACKNOWLEDGEMENT

This master's thesis, titled "Securing blue-green qualities in urban projects- A qualitative case study of blue-green factor in Asplan Viak" is the culmination of my studies in Landscape Architecture at the Norwegian University of Life Sciences (NMBU) in the spring semester of 2023. This research-based thesis with a topic on blue-green factor encompasses 30 ECTS credits.

This thesis is intended for anyone who seeks to gain an understanding of blue-green factor as a calculation method in urban development projects. Specifically, this thesis targets landscape architects, urban planners, municipalities, and other stakeholders in the building and construction industry and those involved in improving the Norwegian standard for the calculation method.

The primary objective of this thesis is to gain an in-depth understanding of blue-green factor and how it has been utilized in landscape projects to achieve more resilient development. My motivation for the landscape architecture study has been to explore and investigate practical solutions to tackle the challenges associated with climate change and biodiversity loss. Through this thesis, I aim to shed light on the strengths and weaknesses of blue-green factor concerning stormwater management and biodiversity. By examining the implications of blue-green factor in landscape architecture projects, this thesis aims to provide a comprehensive evaluation of the calculation method's strengths and weaknesses. Blue-green factor ensures sufficient space for blue-green structures and landscape architecture in urban development projects. My aspiration is to raise awareness about blue-green factor among stakeholders in the building and construction industry.

I am deeply grateful to Asplan Viak for granting me permission to conduct my research in their company. I would also like to express my sincere gratitude to all the participants who generously took the time to be interviewed. I would like to thank my supervisors, Tore Edvard Bergaust and Line Rosef, for their constructive feedback and guidance in steering me in the right direction. Their insightful input and feedback have been instrumental in shaping the outcome of this thesis. Finally, I extend my thanks to anyone who has contributed to my growth during my academic journey.

Say Kpaw Rustad

Ås, May 2023

ABSTRACT

As the urban populations continue to grow and the demand for housing, commercial and public spaces rise, the competition for limited available spaces is becoming more intense. This has led to an increased pressure on urban planners and policymakers to find innovative solutions to accommodate the needs of all residents and businesses in these areas. Due to climate change, we can expect more frequent and intense rainfall, combined with more dense surfaces in cities, which creates a need for nature-based solutions for stormwater management and green areas.

Landscape architects can use the blue-green factor (BGF) method as a tool to improve and facilitate the incorporation of Blue-Green Infrastructure (BGI) in the designs, ensuring that the environmental benefits are maximized and contributing to a more sustainable and resilient urban environment.

The blue-green factor calculation method has been used in Norway for nearly a decade and is increasingly being adopted by several Norwegian municipalities. However, there are still uncertainties regarding the method, especially related to the practical implementation. This thesis aims to contribute to the current understanding of the strengths and weaknesses associated with BGF in relation to stormwater management and biodiversity. Additionally, the thesis seeks to explore improvements for BGF, that can better facilitate for stormwater management and biodiversity conservation.

This thesis aims to highlight some of the strengths and weaknesses with BGF. To achieve this, Asplan Viak, has been selected as the case company for the thesis. Asplan Viak is a large and recognized actor in Norway- and has great experience in using the Norwegian BGF method in their projects.

The empirical data has been collected through a qualitative study, through pre-structured in-depth interviews. The method has provided insight into the strengths and weaknesses related to the use of the Norwegian BGF-method, through Asplan Viak`s experiences. The empirical evidence shows that BGF is effective in promoting the inclusion of trees and vegetation in landscape projects, but it is not as effective in managing stormwater beyond the first step of the three-step strategy to capture and infiltrate runoff from smaller rain events. The study also identifies improvements for BGF, that can better facilitate for stormwater management and biodiversity conservation. The results of this study provide insight into the practical implementation of BGF and contribute to the ongoing discussion surrounding its use in landscape architecture and urban planning.

SAMMENDRAG

Ettersom befolkningen fortsetter å vokse og etterspørselen etter boliger, kommersielle og offentlige rom øker, blir konkurransen om begrensede tilgjengelige arealer stadig mer intens. Dette har ført til et økt press på byplanleggere og beslutningstakere for å finne innovative løsninger for å imøtekomme behovene til alle innbyggere og virksomheter i disse områdene. På grunn av klimaendringer kan vi forvente hyppigere og intense nedbørsmengder, kombinert med flere tette overflater i byene, noe som skaper behov for naturbaserte løsninger for overvannshåndtering og grøntområder.

Landskapsarkitekter kan bruke blågrønn faktor (BGF) som et verktøy for å forbedre og tilrettelegge for blågrønne strukturer i design, for å sikre at miljøfordelene maksimeres og bidrar til et mer bærekraftig og robust bymiljø.

Blågrønn faktor har vært i bruk i Norge i snart et tiår og blir i økende grad tatt i bruk av flere norske kommuner. Det er imidlertid fortsatt usikkerhet knyttet til metoden, spesielt når det gjelder den praktiske gjennomføringen. Denne oppgaven har som mål å bidra til den nåværende forståelsen av styrker og svakheter knyttet til BGF med tanke på overvannshåndtering og biologisk mangfold. I tillegg ønsker oppgaven å utforske forbedringer for BGF, som kan tilrettelegge for bedre overvannshåndtering og bevaring av biologisk mangfold.

Denne oppgaven har som mål å synliggjøre noen av utfordringene og mulighetene knyttet til BGF. For å oppnå dette er Asplan Viak valgt ut som casebedrift for oppgaven. Asplan Viak er en stor og anerkjent aktør i Norge, og har erfaring med å bruke den norske BGF-metoden i sine prosjekter.

Empirien er samlet inn gjennom en kvalitativ studie, gjennom semistrukturerte dybdeintervju. Metoden har gitt innsikt i styrker og svakheter knyttet til bruk av den norske BGF-metoden, gjennom Asplan Viaks erfaringer. Det empiriske beviset viser at BGF er effektivt for å fremme inkludering av trær og vegetasjon i landskapsprosjekter, men er ikke like effektivt til å håndtere overvann utover det første trinnet i tre-trinns strategien for å fange opp og infiltrere avrenning fra mindre regnhendelser. Studien identifiserer også mulige forbedringer for BGF, som bedre kan legge til rette for overvannshåndtering og bevaring av biologisk mangfold. Resultatene av denne studien gir innsikt i den praktiske implementeringen av BGF og bidrar til den pågående diskusjonen rundt bruken av det i landskapsarkitektur og byplanlegging.

TABLE OF CONTENT

STRUCTURE OF THE THESIS

CHAPTER 1 | The thesis starts out with an introduction given in the background of the assignment, where the topic's context and relevance is placed in a larger context. This is linked to the thesis' problem statement and research questions.

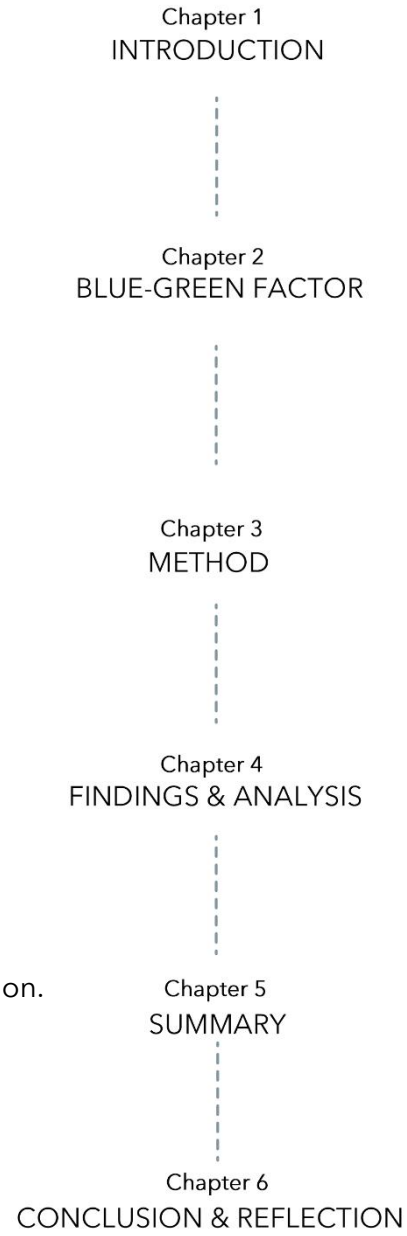
CHAPTER 2 | Going forward it is relevant to look into the theoretical framework, which provides a deeper knowledge about the topic.

CHAPTER 3 | After looking at the theoretical framework, I will present the methodology for data collection.

CHAPTER 4 | Chapter 4 is the main part of the thesis, where I will present my findings, and provide further analysis and discussion of the topic.

CHAPTER 5 | Chapter 5 provides a summary of the thesis.

CHAPTER 6 | The last chapter includes conclusion and reflection.



CHAPTER 1

INTRODUCTION

BACKGROUND

The world's physical landscape processes will be impacted by today's changing climate (Pacific Coastal and Marine Science Center, 2022). Simultaneously, the global population has surpassed 8 billion individuals in the year 2022 (The Washington Post, 2022), which implies significant demands on resources and infrastructure. Additionally, the process of urbanization has posed numerous challenges as people migrate to urban centers. According to Seto et al. (2012) urban areas are predicted to triple in size by 2030. At the same time natural habitats are declining (Seto et al., 2012). As urban populations continue to grow and the demand for housing, commercial and public spaces rise, the competition for limited available spaces is becoming more intense. This has led to an increased pressure on urban planners and policymakers to find innovative solutions to accommodate the needs of all residents and businesses in these areas. More frequent and intense rainfall, combined with more dense surfaces in cities, creates a need for nature-based solutions for stormwater management and green areas.

Landscape architects plays a crucial role in addressing the challenges posed by climate change and nature degradation. The profession's core principles of designing and planning outdoor spaces that are sustainable, functional, and aesthetically pleasing align with the urgent need to implement environmental measures. One such measure is the incorporation of Blue-Green Infrastructure (BGI) into the design and planning of outdoor spaces. BGI, such as green roofs and rain gardens can significantly contribute to climate change mitigation and adaptation efforts by reducing the impact of extreme weather events, managing stormwater runoff, and improving air and water quality. Therefore, landscape architects have a unique opportunity to lead the implementation of BGI in outdoor spaces, creating resilient and sustainable environments that benefit both people and the planet.

Incorporating BGI in landscape design and planning requires a systematic approach to ensure its effectiveness. One such approach is the use of BGF calculation method. Landscape architects can use the BGF method as a tool to improve and facilitate the incorporation of BGI in the designs, ensuring that the environmental benefits are maximized and contributing to a more sustainable and resilient urban environment.

Urban stormwater management

Climate change can be defined as changes in temperature, precipitation, wind, and ocean currents. Understandably these changes could have a major impact on natural environments and people. To ensure climate change adaptation, we first need to understand the challenges. One expected result of the climate change is an increase in short-term precipitation, i.e. intense precipitation in short periods of time (NOU 2015: 16, 2015). Floods are normally a result of heavy precipitation during a short period of time, within minutes or hours (Dyrrdal, 2021).

In Norway, rainfall has increased by approximately 20 percent since the 20th century. Preliminary estimates suggest that the rainfall is set to increase by a further 10 to 20 percent towards the end

of the century (Meteorologisk institutt 2021).

To meet the current and future challenges related to stormwater, good and effective solutions for stormwater management are necessary. Local stormwater disposal (LOD) measures are one collective term for various measures to deal with stormwater locally, close to the source as possible.

This can take place in the form of diversion and/or infiltration. An important principle in most municipalities in Norway when it comes to stormwater strategy, is that the stormwater is taken care of in a safe and clever way. In preventing or reduce damage related to stormwater problems, the following three-step strategy by Lindholm et al (2008) could be followed (figure1). This is a well-known strategy in Norway regarding stormwater management.

By using the three-step strategy in planning, and mapping the entire catchment area, both water flow and flood peaks can be reduced.

The strategy "tretrinnsstrategien" or three-step strategy is based on the principle of capturing and draining the runoff from smaller rain events through permeable surfaces, which is illustrated in step one (figure 1). In step 2 of the strategy, the main purpose is to delay runoff from heavy rainfall. Here, the surface water is led away to e.g., a rain garden where the water will be drained and delayed. Furthermore, in step 3, heavy rainfall from extreme precipitation is safely led into open floodway (Lindholm et al, 2008).

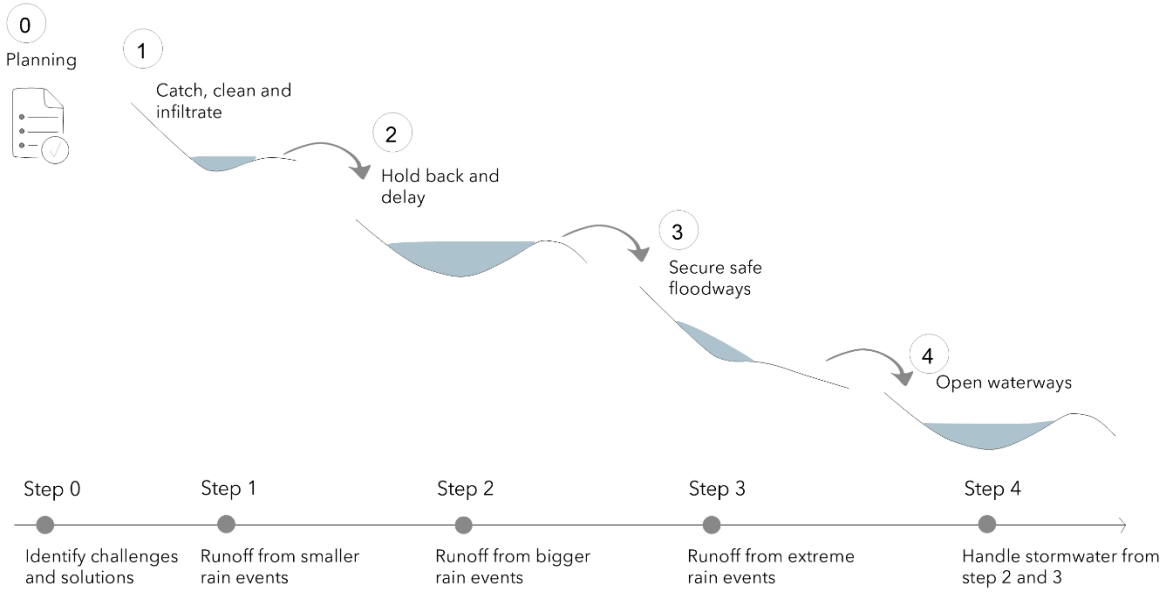


Figure 1: Tretrinnsstrategi/Three step-strategy, (based on Lindholm et al, 2008).

It is worth noting that the most crucial step in the three-step strategy is step 0, which deals with the assessment of stormwater at an early phase, or in the planning phase. This is necessary to ensure that the measures implemented meet the intentions of the strategy. This is where the BGF-method comes in. The BGF-method is primarily used in the planning phase of a project, with a purpose of ensuring implementation of blue-green quality in landscape projects.

In line with climate changes, urbanization also contributes to increased runoff and environmental challenges caused by dense surfaces.

Urbanization and urban green space in Norway

As mentioned, according to Seto et al. (2012), urban areas are predicted to triple in size by 2030, and at the same time natural habitats are declining. In December 2022, 83 percent of Norway's population lived in urban areas. The amount of people who live in urban areas increased from 2021 to 2022 by 0,9 percent, while the amount of people who live in rural areas had a decrease of 0,5 percent (Statistisk Sentralbyrå, 2022).

The densification of cities has led to more dense surfaces and changed runoff patterns for stormwater (figure 2). In non-built-up area, a rainfall event has small consequences for runoff. In partially built-up area, a rainfall event has moderate consequences for runoff. In densely built-up area (urban area), a rainfall event can have major consequences for runoff (figure 2).

Limited capacity in sewage systems can cause problems with contaminated water sources via overflows and leaks during heavy rainfall and/or snowmelt (NOU 2010: 10, 2010, p. 105). This can cause serious consequences for health and the environment (NOU 2010: 10, 2010, pp. 102-103). One dilemma with densification is that the battle for land within the urban areas may come at the expense of the green structure. Loss of green areas is serious both for the biodiversity in the cities and for the physical and mental public health, since the area that can be used for recreation and activity disappear. The combination of more intense rainfall and increased dense surfaces will result in increased runoff, which can lead to local flooding and major material damage.

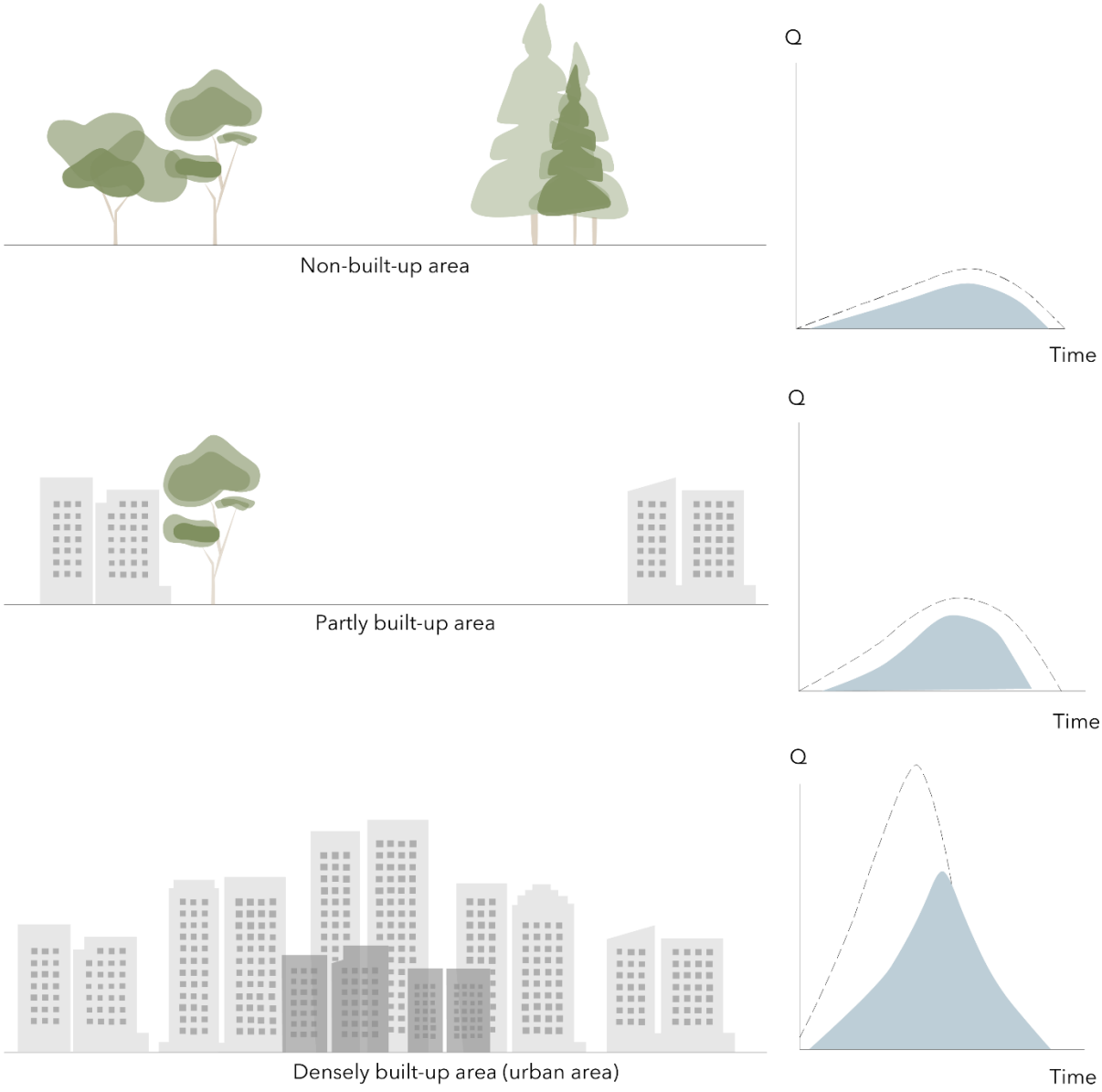


Figure 2: Urbanization and effect on the amount and intensity of stormwater runoff, (based on Byggforsk, 2012).

Biodiversity is under threat

We are currently living in an era of mass extinction of species that could also threaten human existence (Global Assessment on Biodiversity and Ecosystem Services, 2019). Biodiversity loss and ecosystem collapse is one of the top five threats humanity will face in the next ten years (World Economic Forum, 2020). Therefore, biodiversity must be considered and included into urban landscape projects to promote biodiversity in urban areas. Biodiversity loss challenges can be solved by including more and better urban nature in development and urban planning (Green Cities Europe, 2021).

Biodiversity loss in Norway

In Norway, approximately 46,000 species have been identified per 2022. The total number is around 72,000. The Norwegian red list for species from 2015 shows that there are 2752 threatened species in Norway. Of the species that are threatened in Norway, 87 percent are threatened due to diverse types of land changes. Deforestation, drainage, overgrowth, cultivation, construction, and damming are some examples of land use that cause the changes in habitats for varied species. The most important reason for the loss of biodiversity is that the species' habitats are degraded or lost because of land use changes. Climate change, pollution, harvesting and the influence of other species (Norwegian and alien) also cause a loss of biodiversity. Of all the species that are threatened in Norway, 89 percent are threatened due to various types of land changes (Miljøstatus, 2022). This highlights the importance of considering biodiversity in urban landscape development projects.

The species must be seen in connection with the habitat they live in. When the habitats become smaller or disappear completely, species will also disappear or, in the extreme, become extinct. Habitats also change when species disappear or move. When a species disappear, there can be consequences for other species as well (Miljøstatus, 2022).

Among other things, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services' (IPBES) first assessment report for biodiversity highlights measures such as focusing on urban planning, better land management and restoration of nature as decisive to prevent further biodiversity loss (Miljødirektoratet, 2019).

The role as landscape architect in mitigating climate change challenges

Landscape architects play a critical role in addressing climate challenges, as we have the knowledge and expertise to design outdoor spaces that can help mitigate and adapt to the effects of climate change. Landscape architects can design spaces that are sustainable and reduce carbon emissions, such as green roofs and walls, rain gardens, bioswales, and permeable pavements. These features help manage stormwater runoff, reduce urban heat island effects, and improve air quality. Landscape architect can use different framework to plan and design greener outdoor spaces, especially in urban areas, which can manage wilder and wetter climates and improve biodiversity.

The most significant role as landscape architect in relation to sustainable planning and design of urban development projects is to argue for including blue and green values in landscape projects. It is usually landscape architects who are responsible for bringing in those values. There are several costs linked to the establishment

of new trees and other types of vegetation, in addition there is a cost to maintain these green elements, which leads to many actors opting out of the green over the grey. But eventually, it pays off with blue-green structures, especially in urban areas as it provides better and more urban nature that is beneficial for people and nature (Rowe, 2011).

Another way in which landscape architects can contribute to climate change adaptation is by designing outdoor spaces that are resilient to climate change impacts, such as sea-level rise, increased flooding, and drought. This includes designing green infrastructure solutions, such as coastal wetlands and natural systems that can absorb and manage storm surge. Landscape architects can also work with communities to design spaces that reflect their needs and values, while also addressing climate change challenges. This includes engaging with stakeholders, considering local ecosystems, and designing spaces that promote social equity and environmental justice.

For landscape architects, this means, among other things, to organize and plan cities and facilities based on the knowledge we have about the climate and nature challenges Norway and the rest of the world is facing. It is important that landscape architects can contribute to a better living environment for people and nature by conducting climate adaptations and be aware of the use of materials and their impact on the environment in landscape projects. Overall, landscape architects have a critical role to play in addressing climate change challenges, and our work can have a significant impact on the health and resilience of both urban and natural environments.

Blue-green factor- quantifying blue-green values in urban areas

Landscape architects can use the Blue-green factor method as a tool to improve and facilitate the incorporation of Blue-Green Infrastructure (BGI) in the designs, ensuring that the environmental benefits are maximized and contributing to a more sustainable and resilient urban environment.

Blue- green factor is a calculation method that quantifies vegetation and water elements in urban development projects. This contributes to adaptations of water management, vegetation, and biodiversity for outdoor spaces. In another word, it is a way to measure blue-green qualities with numbers, therefore one can set minimum requirements for development projects. The purpose of blue-green factor is to motivate developers to maintain and increase different blue-green qualities in outdoor spaces, for instance stormwater management and conservation or planting trees.

The Norwegian standard for blue- green factor sets guidelines for the use of open stormwater disposal and vegetation elements without specifying specific solutions. This has been done to facilitate innovation and new thinking within the framework of nature-based solutions (Standard Norge, 2020). The use of blue-green factor can be a useful calculation method for the development of better blue-green structures in cities.

Relevant sustainability goals

To counter challenges of climate change, and to achieve a sustainable development going forward, the UN has adopted 17 sustainability goals to be achieved by 2030 (United Nations, n.d.). These provide a common global framework to deal with climate change and applies across countries, businesses, and civil society. The building and construction industry will therefore also have a responsibility to achieve the goals. Of these seventeen sustainability goals, three of these are particularly relevant for this thesis. Going forward, these will be presented in greater detail.

Figure 3: Sustainable Development goal 11, (United Nations, n.d.-a).

Goal 11 is about making cities and human settlements safe, inclusive, resilient, and sustainable. Today, more than half the world's population live in cities, and by 2050 it is estimated that 7 out of 10 people will live in urban areas. One of the targets is to substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards mitigations and adaptation to climate change (Global goals, n.d.-a).

Figure 4: Sustainable Development goal 13, (United Nations, n.d.-b).

Goal 13 is about taking urgent action to combat climate change and its impacts. The effects are already visible and will be catastrophic unless we act now. One way to create action to combat climate change is to integrate climate change measures into national policies, strategies, and planning (Global goals, n.d.-b). Facilitating for more blue and green structures in the urban cities, is a measure to achieve more sustainable urban areas in the cites.

Figure 5: Sustainable Development goal 15, (United Nations, n.d.-c).

One of the targets for goal number 15 is to protect biodiversity and natural habitats. As well as integrating ecosystems and biodiversity in governmental planning (Global goals, n.d.-c). By preserving the nature, you also take care of the climate (The Intergovernmental Panel on Climate Change, 2023)

From topic to problem statement

As mentioned, it is important that landscape architects can contribute to a better living environment for people and nature by conducting climate adaptations and be aware of the use of materials and their impact on the environment in landscape projects. Overall, landscape architects have a critical role to play in addressing climate change challenges, and our work can have a significant impact on the health and resilience of both urban and natural environments. Drawing upon the background information presented, the master's thesis aims to address the following research objectives:

PROBLEM STATEMENT AND RESEARCH QUESTIONS

Problem statement

In 2024 the BGF calculation method will have its 10-years anniversary. However, BGF is still in process of improvement, and there are still questions related to the calculation method and to what extent it functions in practice regarding stormwater management and biodiversity. Several municipalities are introducing blue-green factor requirements, and it will therefore be necessary to be familiar with BGF to meet the requirements set for existing and future development projects. This thesis will review the existing Norwegian BGF-framework, regarding stormwater management and biodiversity and examine proposals for improvements for the calculation method.

"To what degree can the Norwegian standard for blue-green factor promote stormwater management and biodiversity, when applied in planning of urban landscape projects?"

The thesis has identified two specific sub-research questions that will serve as focal points and aid in addressing the main research question.

Sub-research questions

1. What are the strengths and weaknesses of BGF when using the calculation method to facilitate stormwater management and biodiversity?
2. How can the Norwegian standard of blue-green factor be improved for better stormwater management and biodiversity conservation?

Scope and delimitations

Asplan Viak has been selected as the "case company," and only experiences related to blue-green factor in Norway from Asplan Viak will be presented. There are several versions of BGF within Norway and across different countries. The thesis will specifically evaluate the blue-green factor method in the version of Norwegian standard. The focus of this thesis is on landscape projects in urban contexts, where landscape architects engage in designing and making decisions.

Case company- Asplan Viak

Asplan Viak is one of Norway's leading consulting companies in planning, architecture, and engineering. The company has Norway's largest professional environment in landscape architecture and have worked with the BGF-framework in several projects. It is therefore an appropriate case company.

CHAPTER 2

BLUE- GREEN FACTOR

The chapter provides the theoretical framework for the thesis. There are various versions of blue-green factor calculation method that are applied in several countries, but the thesis will be focusing on blue-green factor provided by Norwegian Standard (NS3845:2020). The objective of this chapter is to provide the reader with an understanding of the blue-green factor calculation method and the structure of the Norwegian Standard for BGF.

BLUE-GREEN FACTOR- A CALCULATION METHOD

Numerous frameworks and models exist that address the calculation on blue-green factors. However, the present master's thesis utilizes the blue-green factor calculation method, as outlined in the Norwegian Standard, as a theoretical framework. Theoretical underpinnings provide a foundation for the analysis, which centers around the collected data.

The development of the BGF-calculation method in Norway

The work with an "area factor" in Norway originates from German Biotopflächenfaktor, Swedish Grönytefaktor from Malmö and Green area factor from Stockholm. Blue-green factor is available in different countries in various versions with different calculation models and scales, but the main principle is the same.

The first version of blue-green factor was drafted by “Framtidens byer,” which was supported by the Norwegian Environment Agency and several ministries. This was an initiative from Bærum and Oslo municipality.

This was continued by the Norwegian Environment Agency, which conducted an evaluation and a revision which resulted in version 2. The work has been further developed by Bærum and Oslo municipality. This work, as well as experiences from use in several places in Norway, form the basis for the current standardization work (Standard Norge, 2020). This is the version that this thesis will examine.

BGF contributes to the use of nature-based solutions that can provide healthier environments, more biological diversity as well as more robust stormwater management. Conservation of vegetation, and especially trees and their root zone, is central to this (Standard Norge, 2020).

The calculation method is best suited for construction projects but can also be used for area plans and zoning plans on an overall level. Blue-green factor is a calculation method that stimulates the use of open stormwater management, without giving specific requirements for dimensioning (figure 6).

Regardless of blue-green factor, it must therefore be done properly dimensioning of stormwater management (figure 1). The example in figure 6 shows a courtyard in Oslo. Two alternatives with similar solutions are shown. Alternative 1 shows few green elements and no blue elements. This gives a BGF score of 0.3. In alternative 2, both blue and green elements are included. This gives a BGF score of 0.7. Different choices of vegetation and stormwater management make a significant difference in blue-green factor.

Figure 6: Example of a courtyard in Oslo with two alternatives to similar solutions, but different choices of vegetation and stormwater management, (based on Framtidens byer, 2014).

BGF does not replace laws or regulations. It is a method for promoting blue-green qualities. However, there are several legislations that emphasize that climate change and climate adaptation must be taken care of locally in community planning, planning strategy, planning program and plan for land use. In 2018, the Norwegian government adopted state guidelines (SPR) for climate and energy planning and climate adaptation in the municipalities (Regjeringen, 2018). The SPR stated that a vibrant and varied natural environment is less vulnerable to changes and can contribute to society's adaptation. According to the SPR, considerations for climate changes must be safeguarded when planning new areas for development, densification or transformation (Statlige planretningslinjer for klima- og energiplanlegging og klimatilpasning, 2018).

The guidelines in Norsk Standard states that plans must take account of the need of open waterways, overall blue-green structures, and proper stormwater management. Conservation, restoration, or establishment of nature-based solutions (such as existing wetlands and natural streams or new green roofs and walls, artificial streams, and pools) should be considered.

STRUCTURE OF THE NORWEGIAN STANDARD FOR BLUE-GREEN FACTOR

The Norwegian standard for blue-green factor was published in 2020 and took the original information and the critique of blue-green guideline provided from "Framtidens byer" and tried to make the calculation method easier and more user-friendly. Due to the extensive scope of the framework, the most relevant and significant components have been extracted for the purpose of this master's thesis.

The standard consists of 4 parts, a standard document and three appendices A, B and C:

Part 1: NS3845:2020 Blue-green factor-Calculation method and weighting factors

Part 2: Appendices A: Guidance for BGF

Part 3: Appendices B: Blue-green factor, calculations according to NS 3845:2020

Part 4: Appendices C: Measures for local stormwater management related to the three-step strategy and BGF

The standard is the basis for scoring and calculations of blue-green factor in an area, and it divides the scoring variables into an area plan into three categories:

1.Area measures (O)

2.Area types (A)

3.Additional qualities (T)

Area measures includes "connection to blue-green structures" and solutions for collection of stormwater for irrigation. While area types are a division of the entire project area into different area types according to the characteristics of the surface. Additional qualities give extra score of vegetation and terrain depressions.

Each of the three categories fulfils its own roles for analysis of an area and landscape plans and gives points between 0 and 1 for all areas and factors in a plan. Figure 7 shows the connection between area measures, area types and additional qualities and how they overlap and fulfils each other.

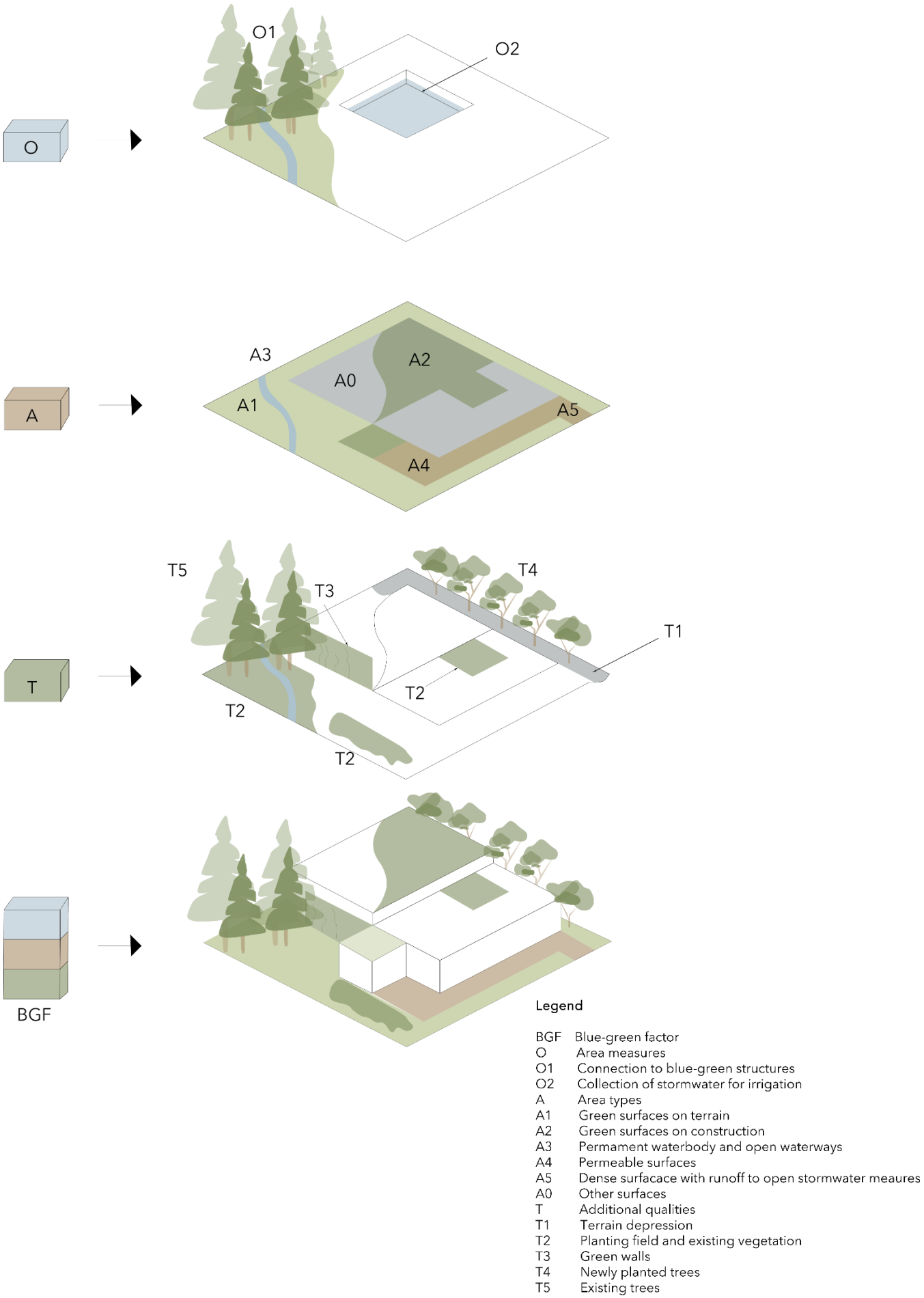


Figure 7: Relation between area measures, area types and additional qualities in BGF, (based on Standard Norge, 2020).

Area measures give points for overall measures such as connections to blue-green structures and collection of excess water for reuse. Area types divide all the area in the project site into categories based on the surface characteristics, and gives points accordingly e.g., permeable surfaces (figure 8). Additional qualities provide extra points for terrain depressions and vegetation elements e.g., green walls (figure 8).

Appendix A in the Norwegian Standard is a short guide for indicating level, mapping, and assessment of existing green structure, in addition to care, management, operation and maintenance. The guidance for specifying the level for blue-green factor briefly explains about blue-green factor, and how the current blue-green factor should be assessed in relevant pilot projects in the municipality. Furthermore, Appendix A points out the importance of mapping and conservation of exciting green structure, especially trees, but also mapping which areas that have less importance and development potential for stormwater management, biodiversity, and ecosystem services. The final statement in Appendix A is about notifying that the calculation method is only a planning tool and that outdoor areas will go through changes over time, which will affect BGF and maintenance of the plan.

Appendix B in the Norwegian Standard is the spreadsheet for calculating the blue-green factor and is described in chapter 8.4 calculation of blue-green factor.

Appendix C in the Norwegian Standard is an informative section with measures for "lokal overvannsdisponering (LOD)," or local stormwater disposal with connection to stormwater processes and connection types in blue-green factor. The Appendix contains a table of the most common measures for stormwater management, divided according to where the various measures are the most common to use. The table provides information on measures for local stormwater disposal, LOD levels, retention process, area type and additional qualities for BGF, in addition to a brief description of the measures. The measures are divided into these categories:

- For buildings
- For urban and semi-urban areas
- For agricultural areas
- For forest and natural areas
- For technical and conventional solutions
- For green area in the operational phase

Each category lists the most relevant measures for the area type and provides information about which processes and LOD steps they have an impact on. For example, green roofs for buildings are considered to help with step 1 (infiltration) and step 2 (dissipation) in the three-step strategy (figure 1). This is considered as an area type A2 in BGF with the possibility of additional quality T2, T4, T5 (figure 8).

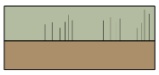
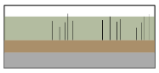
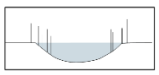
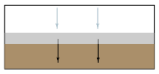
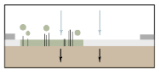
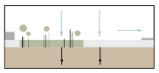
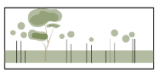
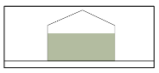
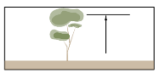
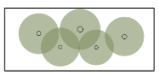
Icon	Elements	Point in NS3845	Weighting factors	Per unit
	Area measures (01-02)			
	01 connection to blue-green structures	Point 6.1	0.05	Unit
	02 Collection of stormwater for irrigation	Point 6.2	0.05	Unit
	Area types (A0-A5)			
	A1, Green surfaces on terrain	Point 7.1	1	m2
	A2, Green surfaces on constructions	Point 7.2		
	A2.1, Growing medium with depth 0 - 3 cm (a)		0.2	m2
	A2.2, Growing medium with depth 3 - 20 cm		0.4	m2
	A2.3, Growing medium with depth 20 - 60 cm		0.7	m2
	A2.4, Growing medium with depth > 60 cm		0.9	m2
	A3, Permanent waterbody and open waterways	Point 7.3	2	m2
	A4, Permeable surface	Point 7.4	0.3	m2
	A5, Dense surfaces with runoff to open stormwater measures	Point 7.5	0.2	m2
	A0, Other surfaces	Point 7.6	0	m2
	Additional qualitites (T1-T5)			
	T1, Terrain depressions	Point: 8.1.1 and 8.1.2		
	T1.1, infiltration as main function		1	m2
	T1.2, retention as main function		0.5	m2
	T2, Planting field and existing vegetation	Point 8.2	0.5	m2
	T3, Green walls	Point 8.3	0.4	m2
	T4, Newly planted trees (entered as 25 m2 or 50 m2, see piont 8.4 for calculation of square meter per tree)	Point 8.4	1	m2
 	T5, Existing trees (entered as 50 m2 or 100 m2, see point 8.5 in NS3845:2020 for calculation of square meter per tree)	Point 8.5	1	m2
(a) Areas that are facilitated for moss growth				

Figure 8: Calculation spreadsheet of BGF, (based on Standard Norge, 2020).

To find the factor, it is possible to calculate both directly through the formula for blue- green factor and through the spreadsheet in the Norwegian standard for blue-green factor. In the case of larger and more complex plans, direct calculation can become complicated if one does not have generated areas from planning tools. The blue-green factor of a project is calculated by the following formula:

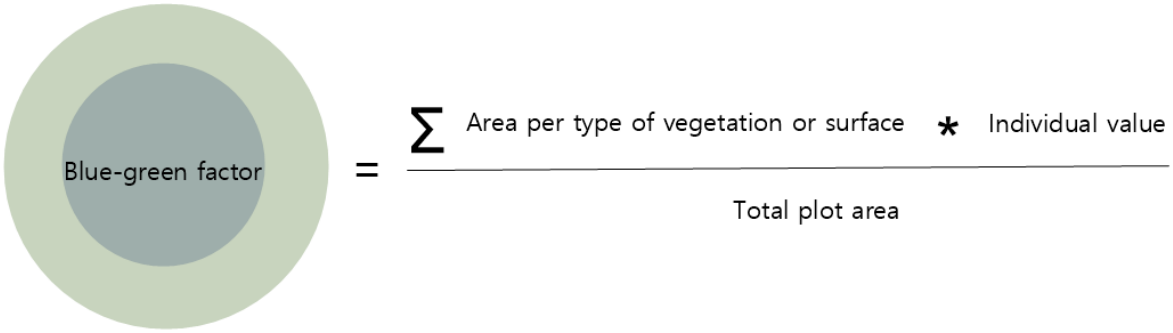


Figure 9: Calculation formula for BGF

Σ= Sigma (sum)

*= Multiplication

It is important to include the whole area of the project site, including the catchment area during calculations of BGF. Everything from green structures, roads, existing and future building surfaces, parking lots and playgrounds must be included in the calculation. The exception is when calculating on larger area plans where larger green areas and oceans should count to a lesser extent than planned, as they provide no other benefit for stormwater management than that they are a recipient or green space on the edge of a plan. If one plan is linked to a larger existing green structure, two factors should be calculated for the area, one with green structure included, and one where the structure is counted as an O1 link to blue-green structure (where the requirements for O1 are met).

If only one factor is calculated with the green structure, it could be possible to greenwash oneself as a high factor, even if it is not set up as a good blue-green stormwater management. A detailed explanation of the different elements of BGF can be found in Appendix 1 (Blue-green factor: calculation method and weighting factors).

The objective of the theoretical background (chapter 2) presented is to provide the reader with an understanding of the blue-green factor calculation method and the structure of the Norwegian Standard for BGF. This knowledge base serves as a foundation for the subsequent analysis and interpretation of the thesis. The elements and components of the BGF calculation method that have been outlined will be further discussed in chapter 4 (findings and analysis).

CHAPTER 3
METHOD

In this chapter the research design and data collecting methods used in the thesis are presented to examine the problem statement and research questions. Furthermore, the reliability and validity of the thesis are presented as well as the ethical challenges.

RESEARCH DESIGN

To address the main research questions and sub research questions and, a qualitative research approach utilizing semi-structured interviews was employed within the case company Asplan Viak. A total of six interviewees, including five landscape architects and one water engineer were interviewed. The upcoming chapter provides a detailed explanation and justification for the selection of this research method.

The research design describes the implementation of a study to explain how one wants to answer the research questions and achieve the purpose of the study (Krumsvik, 2014). This thesis examines Asplan Viak's experiences with blue-green factor method in landscape projects. It can be stated that the research question determines which research design is most suitable, in pursuit of answering the research question in a best possible way (Krumsvik, 2014). Case studies are one sensible approach when the problem concerns how something happens and is experienced, rather than why (Widding, 2005). This thesis falls within the definition of one case study, or a single study (Widding, 2005). This is an approach that emphasizes the understanding of individual phenomena.

Within case studies, loose links can arise between theory and empirical evidence, because of empirical variation (Widding, 2005). This is usually offset by going back and forth between empiricism and theory, so that you can adjust this in relation to each other. In the process of working on this thesis, an abductive approach has been used, where the researcher studies the topic beforehand.

Such an approach and working methodology means that the master's thesis falls within a so-called abductive approach. In such an approach, a relationship arises between theory and empiricism where there is constant movement and change (Thagaard, 2013). In this way, both an inductive and a deductive approach are used.

An abductive approach is used when looking for people's own experiences and understanding of the phenomenon. The informants' descriptions are their own interpretations of their situation, from which the researcher must form an explanation and understanding (Blaikie & Priest, 2019).

The research design of the thesis is illustrated in figure 10. The thesis's qualitative method consists of semi-structured in-depth interviews. This forms the basis for the critical evaluation of the calculation method BGF regarding stormwater management and biodiversity, and further suggestions for improvement of the calculation method (figure 10).

Figure 10: Research design with research questions and methods systematized

CHOICE OF METHOD

Given that this master's thesis pertains to a case company and based on the problem statement and research questions, a qualitative research method is deemed appropriate. This method enables a thorough and detailed analysis of the phenomenon at hand, in contrast to quantitative methods. Moreover, to gain a comprehensive understanding, in-depth interviews have been selected as the research method.

Primary data- in-depth interviews

The primary data is obtained in the form of in-depth interviews relatively from few respondents, which is typical for a qualitative method (Jacobsen, 2022). In-depth interviews are a qualitative data collection method that makes interpretation of the respondents' reactions easier, and it is easier to avoid misunderstandings compared to other methods such as online surveys and e-mail. The method is more personal and allows one to interpret each other's non-verbal communication, i.e., facial expression. This is one of the reasons why visual interviews provide higher reliability and validity compared to e.g., telephone interview (Jacobsen, 2022).

In-depth interview is a good method within qualitative research, as the approach provides a deeper level (Jacobsen, 2022). Through a directed focus, small selections, and the opportunity to see the informants, one can achieve an understanding of the topic as justified in comprehensive data. In-depth interview is not unlike a normal conversation but is a professional approach that focuses on collecting data. Through such in-depth interviews the researcher can listen and show interest in the informants, and in this way create security and trust. If you want elaboration or clarification, the situation also allows that you can ask follow-up questions based on what the information that informant provides.

Through in-depth interviews, the thesis gives an insight in how the informants and Asplan Viak work with blue-green factor and their experiences with the calculation method related to stormwater management and biodiversity. The master's thesis includes comprehensive interview guides, which are appended at the end of the document as Appendix 2 and Appendix 3.

Secondary data- selection of relevant literature

The secondary data consists of articles and research reports from electronic archives and various websites. Literatures have been selected through the Norwegian University of Life Sciences' (NMBU) electronic archives. The data from literature consist among other things of secondary data that has been systematized and collected by other than the researcher himself (Krumsvik, 2014). The present study relies on secondary data obtained from a thorough analysis of research literature pertaining to the subject areas of blue-green factor, stormwater management, and biodiversity. The utilization of secondary data is prominent in the findings and analysis chapter to complement, supplement, or challenge the empirical evidence presented in the study.

By employing secondary data, the study can draw upon previously conducted research to provide a broader perspective on the topic at hand. In this way, the use of secondary data allows for the consideration of multiple viewpoints and enables the study to make informed judgments and conclusions regarding the research questions.

THE PROCESS

Preparations of in-depth interview

To obtain data in a good and efficient way, semi-structured interviews was conducted in in-depth interviews on Teams, but there were also some physical informal meetings as well.

The benefits of having digital interviews on Teams is that all informants can participate regardless of their location. Another benefit of having digital semi-structured interviews is that you have pre-structured questions that are prepared in advance. This helps to create an appropriate flow in the interview, capture specific information that you are looking for, and ensure that the informants are prepared for the interview.

To ensure that the interview questions are good and objective, an interview guide of "the seven deadly sins" provided by Sawatsky have been used (Paterno, 2015). The interview guides were also sent in advance to Sikt and supervisors for quality assurance. As well as the information letter and consent form (see Appendix 4).

Conducting interview and reflections

Based on the research questions, it has been essential to select interview objects that are familiar with the calculation method blue-green factor, which are landscape architects. By using the platform LinkedIn, I managed to get in touch with relevant informants and find a main contact person (informant 1) in Asplan Viak that are familiar with the topic and who came up with a proposal for a topic for the master's thesis (figure 11).

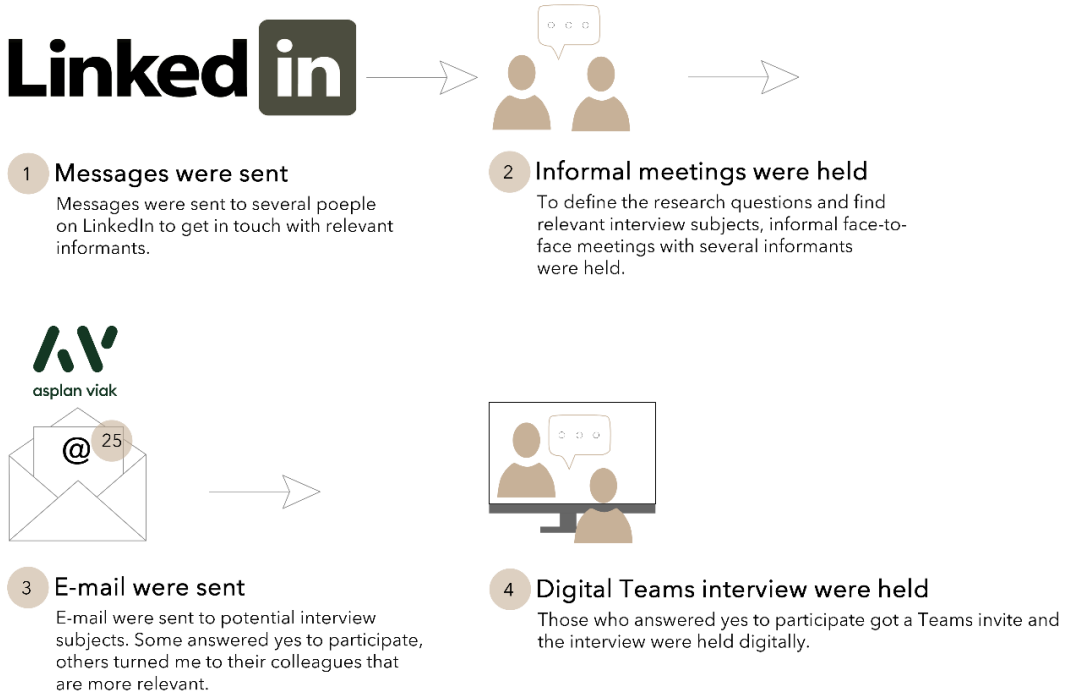


Figure 11: Recruiting of informants and interviewees

The main contact and cooperative resource in Asplan Viak assisted in selection of the right interviewees in Asplan Viak, as well as providing relevant contact information. In-depth interviews were conducted digitally on Teams with six informants (five landscape architects and one water engineer) from Asplan Viak, and it was set aside approximately 1 hour per interview, which was sufficient (figure 12).

Figure 12: Selection of interviewees

Processing of collected data

To ensure good data processing and data overview, all interviews were documented through notes, and recordings. This allows to play back the interview several times. Further transcripts were created, and sent out to all informants for review, to ensure that that no data has been misinterpreted, and to ensure good quality. All informants have been anonymized, which means their identity and names are hidden.

As mentioned, the secondary data consists of articles and research reports from electronic archives and various websites. Literatures have been selected through the Norwegian University of Life Sciences' (NMBU) electronic archives such as Oria, as well at the library and research databases for the Faculty of Landscape and Society (Web of Science and PubMed). Google scholar has been used as the main Web search engine to search for scholarly and relevant literature.

Method criticism

The disadvantage of using a qualitative data collection method is that it is time consuming. When collaborating with a master thesis within a 6-month period, it has been time- and resource consuming. It has been time- and resource consuming to contact good interviewees, conduct interviews, and analyse the data and information afterwards. As mentioned, the interview also has a weakness if the questions become too leading, this is something you want to avoid, as it can promote a false image of the topic. It is also a weakness that I am working with the thesis alone, which may result in the data being shaped by my limited rationality

RELIABILITY

Within research method, and preferably qualitative method, the term reliability and validity are used as criteria for the quality of the research document or thesis. The word reliability means accuracy and shows the extent to which a survey can provide the same result if it is carried out again (Jacobsen, 2022). The classic concept of reliability is linked to the accuracy of the measurement of the individual persons at the time of measurement. Reliability therefore does not necessarily mean that results can be reproduced by new studies, because changes may have occurred in the meantime. Within qualitative research, one often finds that the question of reliability is inconceivable when one examines topics that are in change (Kleven & Hjardemaal, 2018). Due to the singular focus on a single case company, the findings and results presented in this master's thesis cannot be readily generalized to other firms or companies. The experiences Asplan Viak has with BGF are highly unique and subjective in nature.

Regardless of the type of empirical data to be considered, it is relevant to have in mind which random sources of error that can be assumed to have influenced the data. Good reliability within research means that the data is to a small extent influenced by random measurement errors (Kleven & Hjardemaal, 2018).

In this study it has been used semi-structured in-depth interviews digitally on Teams. It is conceivable that the data from the informants who were interviewed digitally with pre-structured questions are little exposed to day-to-day fluctuations, as they get the opportunity to read through the questions and prepare the answers before the actual interview.

The researcher's personality and experiences may have impact on the study. Researchers can therefore interpret and assess the data in different ways, as well as having different influence on the informants during the interviews (Kleven & Hjardemaal, 2018). Such assumptions make it difficult for other researchers to obtain similar results to this study if they were to carry out the same survey. To strengthen reliability, I have as mentioned used Sawatsky's seven deadly sins to reveal weaknesses in the formulation of questions, as well as the order of the questions (Paterno, 2015). The interview guide was also sent to Sikt and supervisors for quality assurance. Transcripts were sent to the informants after the interviews.

VALIDITY

The word validity means that the empirical evidence that are collected gives answers to the research questions that are asked. Within case studies, two main types of validity are discussed: internal and external (Jacobsen, 2022).

Internal validity means to what extent are the data (empirical evidence) relevant for the conclusions made for the topic (Jacobsen, 2022). It is in another word the degree of confidence that the causal relationship the researcher is testing is not influenced by other factors or variables. Although there may be accidental similarities (correlation) between the variables x and y, this does not necessarily mean that x causes y (causality). There is reason to believe that extraneous variables in this master's thesis are controlled to minimize their potential to influence the result of the thesis. All the informants received the same questions in forehand, based on their knowledge of stormwater management and biodiversity. The research design is also consistent throughout the study to ensure that the results are not influenced by changes in the methodology.

External validity involves the extent to which the conclusions and findings can be transferred to other contexts and situations (Jacobsen, 2022). The thesis is a case study which examines only one company, Asplan Viak. One cannot simply assume that the research result is valid for companies other than the one that participated in the survey.

Within an idiographic way of thinking, the problems statement for the thesis will be linked to the individual situation, and then the external validity will be irrelevant, in the first place. But if you ask questions about what others in other situation can learn from the research result, external validity becomes relevant (Kleven & Hjardemaal, 2018). This question can be difficult to answer, especially within the qualitative method, when the unit of analysis is a company or an organizational. Nevertheless, the findings and results made in this master's thesis may hold relevance for all individuals who work with blue-green factor. I will talk more about this in chapter 6 (finale), under the section dissemination and (policy) relevance.

ETHICAL CHALLENGES

In a master's investigation, the researcher has an ethical responsibility towards the participants involved, that must be taken care of. There are three main principles that can be used when evaluating the ethical challenges of the research process: informed consent, confidentiality, and consequences (Thagaard, 2013).

Informants must be aware of the voluntary nature of their participation and that they can withdraw at any time. Voluntary participation can lead to more open expression of thoughts and experiences. As a researcher, one must prevent and protect the informants against any possible burdens that sharing information can entail (Thagaard, 2013). In this study, privacy of the informants is considered, and no sensitive questions were asked. All informants have received transcripts after the interview, which they all approved.

Confidentiality is important to protect the privacy of informants, and they should not be recognizable in the results (Thagaard, 2013). In this study, with few informants, Asplan Viak knows who participated, but no sensitive information was revealed. Informants are anonymized to some extent, but still recognizable to Asplan Viak. The research report was not classified as confidential, as there is no sensitive information.

CHAPTER 4

FINDINGS AND ANALYSIS

Chapter four is the main part of the thesis and has the ambition to answer the research questions for the thesis, which were described in chapter one. Empirical evidence will be assessed against the Norwegian Standard for blue-green factor.

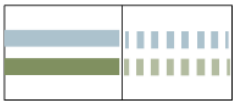
Within the first sub-research question, strengths, and weaknesses of the BGF framework related to stormwater management and biodiversity will be presented, based on the experience of Asplan Viak. These experiences will be analyzed against relevant theory and Norwegian Standard for BGF.

Sub-research question two regarding possible improvements for BGF will be presented, related to stormwater management and biodiversity. The proposed improvements are based on key findings related to Asplan Viak's experiences (primary data) and relevant literature (secoundary data).

What are the strengths and weaknesses of BGF when using the calculation method to facilitate stormwater management and biodiversity?

To examine strengths and weaknesses when using blue-green factor to better facilitate stormwater management and biodiversity, key elements in BGF is presented and discussed. Informants from Asplan Viak has contributed and provided great insight into their experiences with blue-green factor in landscape projects. The informants point out some key strengths and weaknesses when using blue-green factor. The following quotes used in this chapter are from conducted interview with Asplan Viak, see Appendix 2 and Appendix 3 for more detailed transcripts. For more details and information related to the BGF-elements, see Appendix 1: Blue-green factor: calculation method and weighting factors.

Area measures (01-02)



01 Connection to blue-green structures

The first element in BGF is "connection to blue-green structures", as part of the "area measure". Several informants point out the difficulties regarding the definition of this element in BGF.

Connection of blue-green structures can be defined as "bigger planning measures that link the project to the surroundings outside the project with good terrain adaptation and strengthens the blue-green structure of the area." (Standard Norge, 2020). These connections are therefore especially important for preserving and providing the existing and future overall blue-green structures. This prevents fragmented green structures, but instead provides green corridors not only inside the project area, but also the outer areas outside the project site. Asplan Viak points out that green connections have clear strengths and highlights its important impact on both biodiversity and people. It provides habitats for species, improve air and water quality, reduce flooding, and offer recreational opportunities.

Even though connection of blue-green structures is clearly defined in Norwegian standard, operationalizing this concept in practice remains challenging. Several informants point out that the inclusion of element 01, "connection to blue-green structures," is particularly difficult to comprehend.

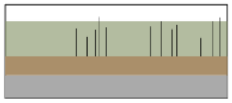
" The element about connection in the Norwegian Standard is difficult to decipher. There is a vague definition of connections in the Norwegian Standard."

In practice Asplan Viak has experienced that this element (01) is somewhat open for interpretation and as a result, could vary, based on who is doing the assessment.

Norwegian standard does not specify anything in relation to who should do the assessments, which can be problematic and is a weakness. Several informants point out the importance of including a professional when assessing which connections are needed in a project, for instance creating a corridor for insects, where including a biologist would be beneficial.

This can provide biodiversity in development projects in an effective way.

Area types (A0-A5)



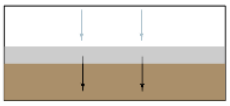
A1 Green surfaces on construction

Another important element related to stormwater management and biodiversity is "green surfaces on constructions." In the Norwegian Standard, green surfaces on constructions, such as green roofs are poorly rated, and is often given a low score in the BGF calculation method. Asplan Viak points out that this is a weakness, since in their experience green roofs often results in better biodiversity and stormwater management. As an example, several of Asplan Viak`s pilot projects that use green roofs does not meet the current BGF requirements of the Norwegian standard.

"The pilot projects Vega Scene and Kristian Augusts Gate 13 are both great pilot projects, with the use of green roofs. These projects meet the requirements for stormwater management and the desire to develop unique local nature, but they do not have a chance to meet the BGF criteria."

For projects with limited spaces, typically in urban areas, there is difficult to find available spaces on the ground, to implement blue-green elements. This resulting in projects getting a bad score regarding BGF requirements. In these type of projects green roofs could make a big difference. If there are no available areas for blue-green measures on the ground, one can use available areas on the roof level.

Asplan Viak points out that another benefit of using green roofs, especially in urban areas where there is a lack of green spaces, is that these types of structures can contribute to better biodiversity in urban cities. It has also been proven that seabirds can settle on green roofs, which is an endangered species. Asplan Viak believes green roofs deserve a higher score, as it plays an important role in stormwater management and biodiversity, especially in urban areas.



A4 Permeable surfaces

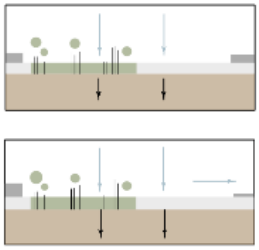
The next element to be discussed in relation to stormwater management is "permeable surfaces". Asplan Viak highlights this elements as one of the clear strengths of using the BGF calculation method because it corresponds to step 1 of the three-step strategy, which is to catch and infiltrate runoff from smaller rain events.

Further, Asplan Viak highlight the strengths of this element, since several municipalities does not have requirements related to stormwater management that for instance ensures permeable surfaces. It is therefore crucial that the step 1 of the three-step strategy is taken care of in other measures such as BGF.

"It is easier to implement permeable surfaces, e.g., in the plan. The good measures for BGF, which would otherwise yield to other reasons, become a requirement in BGF."

Nes & Trommer (2017) found that municipalities that have adopted BGF experience the greatest benefits from stormwater management. In addition, their findings indicate a need to discuss and clarify the purpose of BGF. For example, BGF should not be the only source in solving the entire stormwater issue (Nes & Trommer, 2017).

Additional qualities (T1-T5)



T1.1 Terrain depressions- infiltration as main function

The next element to be discussed is "terrain depressions". Norwegian standard describes this element as depression in the terrain which infiltrates or dissipates water, or as a planting field, green wall, or area for the growth of trees (Standard Norge, 2020). Terrain depression with infiltration as main function must, among other things be recessed in relation to the surroundings, so that water can be collected (Standard Norge, 2020).

A weakness related to this element is that stormwater measures are not observed and controlled, and the measure ends up being inaccurate. Asplan Viak points out that terrain depression with infiltration as main function, such as rain garden can be placed inappropriately in relation to its function and purpose.

"Rain garden can e.g., be placed at the top of the catchment area, and you will get the same factor. Then the measure will not be appropriate. It will dry out, leaving only negative sides. Then the area could be used for something more useful."

Although some of the informants points out the shortcomings of the element "terrain depressions" regarding specific guidelines for implementations, it is worth noting the clarifications made in the Norwegian standard. The standard mention that BGF encourages the use of open stormwater management, but no specific requirements are set for dimensioning (Standard Norge, 2020). It is also pointed out in the Norwegian standard that regardless of the blue-green factor, proper dimensioning of stormwater management must be done. It also points out that regardless of the blue-green factor, proper dimensioning of stormwater management must be done.

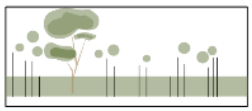
The need for proper understanding of dimensioning is also supported by Tukker (2021), who states that it requires good insight into the dimensioning of measures and good insight into which solutions are available on the market to achieve optimal stormwater management. Blue-green factor is therefore not sufficient to handle stormwater alone, and other considerations and measures must be included (Tukker, 2021).

Setting aside areas for blue-green structures can be difficult. During the early phase of a project, there is usually optimism about using available areas, but during the building phase, it may become clear that setting aside areas for blue-green structures may not be feasible.

Asplan Viak points out that areas that are set aside in the early phase can quickly be halved later in the project.

Despite the weaknesses of the element "terrain depression", it still has some upsides to it. Several informants point out the benefits of having terrain depressions in the projects.

" *In addition, the* calculation method *helps to motivate solutions to deal with stormwater locally, e.g., use of rain garden."*



T2 Planting field and existing vegetation

Another element to be discussed is "planting field and existing vegetation. In the Norwegian Standard for BGF, new vegetation and existing vegetation get the same BGF-score (Standard Norge, 2020). When asked about the weaknesses of BGF, several informants of Asplan Viak highlights this aspect, and points out the difficulties of not considering the existing vegetation and landscape of an area.

" *The* calculation method *does not give points for existing landscapes and does not consider the existing situation of the plot of land. You can build down valuable nature and still get a high BGF*."

In cases where there are plenty of existing vegetation on the plot area, it is possible to get a good BGF results, even if some vegetation must be felled, and the ecological value of the plot is weakened. On the other hand, in situations without existing vegetation, the BGF score comes out worse, even though the ecology on the site is significantly improved, which is a clear weakness and an issue.

Another aspect of the element "planting field and existing vegetation" is that it does not differentiate between native and alien species. These species are given the same score in the BGF framework, which could be defined as a shortcoming and a weakness, as it does not promote biodiversity. It is also worth pointing out that the previous versions of BGF by "Framtidens byer" did differentiate between locally native species and harmful alien species.

" The main shortcoming is that it does not differentiate between plant species. You get the same number of points for harmful alien species and Norwegian species. It does not promote diversity."

It is worth noting that species diversity does not necessarily mean more biodiversity. Alien species can be beneficial in some areas (e.g., in urban environment) where there are restricted areas with boundaries and there is no danger of large spread. Norwegian native species are not always the best choice. Some native Norwegian plants can act as a weed and does not necessarily work well for the intention (e.g., stormwater management) compared to alien species. It is therefore difficult to define what locally native species are.

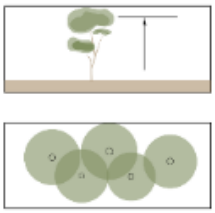
One informant points out that Norwegian Standard defines a tree as Norwegian if it has been in a Norwegian nursery for three years. While a perennial is defined as Norwegian if it has been in a Norwegian perennial nursery for one winter. This means that you will still get imported plant materials even though it is defined as Norwegian after several years. This highlights the difficulties of defining if a plant is native or not. Even though it is considered native, it does not necessary mean that it is good for the local biodiversity of the area.

Further, several informants point out weaknesses of BGF calculation method regarding plant diversity. The standard does not emphasize plant diversity and does not differentiate between different types of vegetation. E.g., between shrubs and perennials, even though they have different ability of soaking up the stormwater and providing biodiversity.

"You get the same number of points for uniform or multi-species plants."

Asplan Viak highlights the importance of plant diversity and including this in the BGF, to improve biodiversity in landscape projects. Even though having different species does not give more score in BGF, it has been crucial having plant diversity in landscape projects to improve biodiversity.

"There should be a distinction between shrubs and perennials in BGF, and there may be a little more variation in the type of vegetation."



T4 Newly planted trees & T5 Existing trees

The Norwegian Standard for BGF differentiate between two different sizes of trees, but they all get the same score, both new and existing trees.

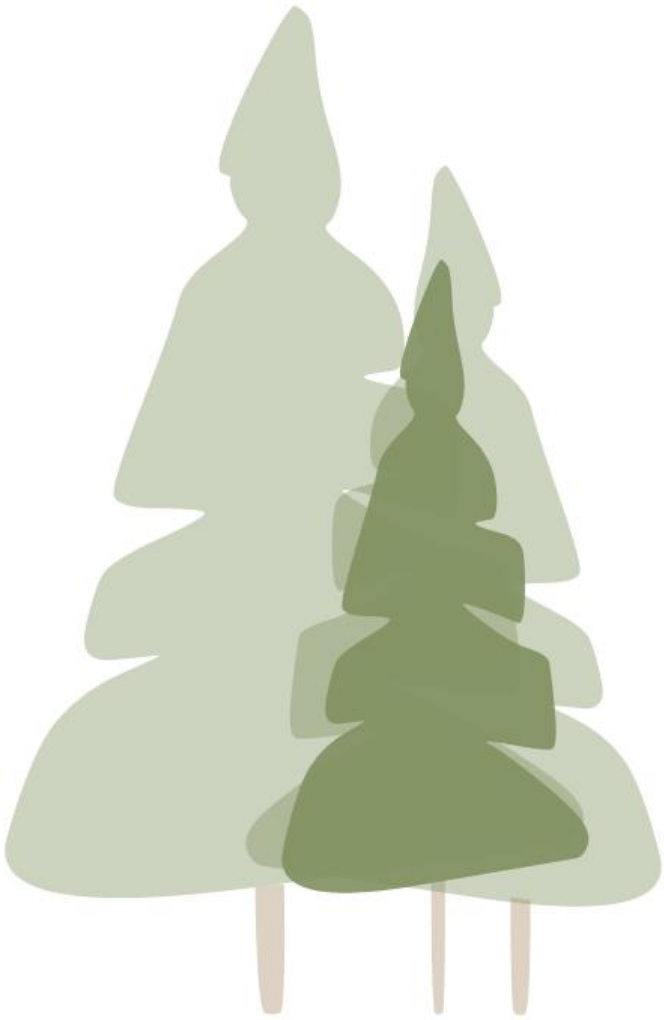
To consider the environmental conditions of an area, it is beneficial to give the same score regardless of the size of the trees. For instance, in the northern part of the Norway the trees and vegetation are not capable of growing that big because of the cold weather and existing climate conditions. The trees in a landscape project in Northern Norway will therefore have the chance to get the same score as trees that are bigger in Southern part of Norway. There are many benefits of having trees in landscape projects, and it is especially important to preserve existing trees to keep the ecology of the area in check. Nevertheless, this is not highlighted in BGF.

Some of the informants point out the weaknesses of BGF regarding trees and that trees are the elements that are often cut from the project in favor of other structures such as roads, since the BGF framework give them such low score.

"Trees have too little value in BGF for both existing and new trees."

Despite for the weaknesses of BGF regarding trees, the element also has its strengths. Several informants point out that the element encourages to the use of trees in landscape projects.

"A good purpose is that more green elements can be brought into projects. We got more trees and shrubs into the project that we probably wouldn't have got otherwise."



Quickly summarized, we see that there are clear strengths and weaknesses within the Norwegian BGF framework. BGF offers opportunities for prioritizing vegetation and blue-green elements in development projects and encouraging local stormwater management solutions, such as rain gardens and more trees and vegetation. The calculation method encourages allocation of space and funds for blue-green structures.

However, there are still some challenges including inadequate stormwater management measures, improper placement of measures like rain gardens, and not considering existing vegetation and site characteristics. The calculation method also does not differentiate between species, and the initial calculation may need to be adjusted during the project.

How can the Norwegian standard of blue-green factor be improved for better stormwater management and biodiversity conservation?

By utilizing the Norwegian BGF framework when working on landscape projects, one can ensure that actual blue-green quality is implemented into urban landscape projects. As mentioned earlier the framework is approaching its 10 years anniversary, but there are still room for improvement going forward.

Area measures (01-02)

01 Connection to blue-green structures

As mentioned, Asplan Viak points out the difficulties of understanding the element "connection to blue-green structures" and the importance of including a professional when assessing which connections are needed in a project, such as biologist.

"Green connection is important especially when it comes to biodiversity. This assessment should be carried out by a biologist."

The main purpose of the element "01 connection to blue-green structures" is to ensure hiking spots, natural biotopes, and existing local nature (Standard Norge, 2020). To meet these purposes, professionals such as a biologist should be included. Assessing what is part of the blue-green structures can be difficult, and the element is somewhat open for interpretation. Therefor results could vary, based on who is doing the assessment.

"The calculation method could have gone further by specifying that certain professionals should carry out the assessments. Biologists or ecologists should have been specified."

Assessing blue-green structures requires knowledge of the biological and ecological processes that are involved in creating and maintaining these structures. Therefore, it is important to have a biologist or ecologist involved in the assessment process. Biologists and ecologists have a deep understanding of how different plant and animal species interact with each other and their environment. This knowledge is crucial for assessing the health and sustainability of blue-green structures. The professions also have knowledge of native plant and animal species, which can be important for creating blue-green structures that are well-suited to the local environment.

Blue-green structures provide many ecosystem services, such as carbon sequestration, water filtration, and habitat creation. Biologists and ecologists can assess the effectiveness of blue-green structures in providing these services (Felson, 2013). Biologists and ecologists can monitor the biodiversity of blue-green structures, which can provide valuable information on the health and resilience of these structures.

Overall, involving a biologist or ecologist in the assessment of blue-green structures can ensure that these structures are designed and managed in a way that maximizes their ecological benefits and contributes to a healthy and sustainable urban environment.

When it comes to the assessment of stormwater management, consulting engineers are often involved in different phases of development project, while biologists are often only involved in the early phase of a project. This is unfortunate considering the biodiversity part of the project. The use of BGF will contribute to nature based solutions that can provide more biodiversity and robust stormwater management (Standard Norge, 2020). Biodiversity and stormwater management are the focus points of BGF, and it is therefore crucial that professionals for each field are included at different phases of a landscape project. Biologist should be included in line with water engineers to ensure correct quality within their professional field.

"Biologists should be included in the work. RIVA (Consulting Engineer Water, Sewer, and Stormwater) is involved in the design work and is therefore more accessible, while biologists have more limited, specific tasks, usually in an early phase."

By including biologists in landscape projects when working with BGF, it will give a better understanding of the connections to blue-green structures, and how to improve this.

Another suggestion to better improve BGF regarding connection to blue-green structures is to divide the element to simplify and improve the definition of the elements. For instance, adding requirements for variation in planting layers. Not only having trees, but also shrubs, perennials, gras. This can provide better and more biodiversity.

"There is room to split the element regarding connections. You can set requirements for the planting fields and have requirements for variation in layers and what type of species you use considering biodiversity."

Although it would be helpful to split this element, it is also important to have in mind that the calculation method BGF is not supposed to give specific solutions for managing stormwater management or biodiversity. This way, it is facilitated for innovation and new thinking within the frame of nature-based solutions. The element should be specified and divided a little more, but to a certain extent. Another aspect of this is the balance between user-friendliness and advanced biological criteria. The more detailed criteria and framework, the more advanced and complicated the method.

Area types (A0-A5)

A1 Green surfaces on construction

When it comes to the element "green surfaces on constructions", a clear suggestion for improving and optimizing this element is to give more points for green roofs. In this way available areas can be used in an efficient way for both managing stormwater and improving biodiversity. This is particularly useful and appropriate in urban areas where there is competition and a lack of available land on the ground. Innovative solutions are needed to better improve the blue-green structures. The thickness of the growing medium on green roofs are often between 10-20 cm. BGF only gives 0.4 points for growing medium between 3-20 cm, this means that regular green roofs have little significance for BGF.

Green roofs are designed to absorb and retain rainwater, which helps to reduce the amount of stormwater runoff that enters the sewer system (United States Environmental Protection Agency, 2022b). This can help to prevent flooding and reduce the load on water treatment facilities. They can also provide habitat for a variety of plant and animal species, including birds, butterflies, and bees (United States Environmental Protection Agency, 2022b). Further they can serve as stepping stones for wildlife to move through urban areas, helping to promote biodiversity and ecosystem health (United States Environmental Protection Agency, 2022b).

Another benefit with green roofs is that they can help to reduce the urban heat island effect, which occurs when urban areas are significantly warmer than surrounding rural areas (United States Environmental Protection Agency, 2022b). By absorbing and reflecting solar radiation, green roofs can help to keep urban areas cooler and more comfortable for people and wildlife. Green roofs can also help to filter pollutants out of air, which improves the overall air quality in urban areas (United States Environmental Protection Agency, 2022c).

Overall, green roofs can provide multiple benefits for both stormwater management and biodiversity, making them an important component of green infrastructure in urban areas.

"There is perhaps something to think about improvement from existing situation, and not always a predetermined minimum BGF requirement."

If there are no available spaces for blue-green structures on the ground, then BGF should encourage to implementation of innovative blue-green structures on constructions such as green roof.

At the same time, there are mainly lower BGF requirements in urban areas, compared to open cities. The fact that one does not get as many points for green roofs also means that the requirement for BGF in urban areas are also lower. It is conceivable that by adding more points for green surfaces on construction, it will stimulate for creating green areas on construction instead of setting aside available plot of land for green elements on the ground where the water has more ability to infiltrate to the ground, and where there is better connection for blue-green structures.

To improve biodiversity and get more points for green structures on constructions where there are a limit of space and soil depth, it is possible to implement other elements such as insect hotels.

A good example of this is the award-winning project in Alkmaar, Netherlands where the main goal was to achieve a greener city by transforming gray areas into green areas and implementing insect hotels (Green Cities Europe, 2022).

Additional qualities (T1-T5)

T1.1 Terrain depressions- infiltration as main function

The Norwegian standard for BGF does not specify the criteria for achieving appropriate rain gardens. A suggested improvement is therefore, to take terrain depressions into account when working with this element. It is critical to think about the terrain/elevation to get an appropriate and correct slope in the terrain.

Very often, rain gardens are placed inappropriately regarding to their purpose for stormwater management. Research shows that rain gardens are one of the best measures for open stormwater management, but it depends on the location and structure. It can be difficult to set aside enough soil volume, for instance to rain garden on a dense construction.

"The calculation method does not say anything about how big lintel you must have. It can be a little demanding, and then there can be great variation in the quality of the measures. Let's say that in a project, you may only have 30 cm above the dense construction. It won't be a good rain garden."

Based on the interviews with informants from Asplan Viak, one could claim that stormwater management in BGF (Norwegian standard) is suboptimal and has the potential for improvement. Step 1 in the three-step strategy, which relates to capturing and draining the runoff from smaller rain events is taken care of through e.g., permeable surfaces to a certain degree. For step 2 and step 3, which relates to delay runoff from heavy rainfall and lead water to open floodways, there are room for improvement.

The element "T1.1, Terrain depression, infiltration as main function" has 1 full points. This highlight how important this element is for contribution of stormwater management and biodiversity. Based on this, there should be a more defined requirements for the structure of these elements, for instance minimum requirement for soil volume for rain garden.

Another suggestion to improve the element is to give a score based on the locations of the terrain depressions, and how much stormwater runoff the terrain depression potentially can manage, as suggested by Tukker (2021).

There is still freedom in the dimensioning and design of the measures, but absolute minimum requirements are necessary in the BGF to achieve its full potential.

"We must make a rain garden that does not function as a rain garden to meet the requirements of Oslo municipality. Then the measure becomes more suboptimized."

It is worth mentioning that some municipalities have their own municipal strategy for managing stormwater.

"Today, stormwater management is not that important for municipalities when working with BGF, because it is taken care of through other requirements that the municipality has."

For example, Oslo municipality has its own stormwater strategy for managing stormwater in the municipality.

Nevertheless, there are several municipalities that do not have the same requirements for stormwater management in their own municipality, so BGF is an important measure to highlight the importance of open stormwater management and biodiversity.

T2 Planting field and existing vegetation

The element "Planting field and existing vegetation", could be improved and optimized through better consideration. Areas should be planned and designed based on existing nature, and not the other way around. For example, points should be given to existing vegetation and the surrounding area. And points should be given for preserving existing nature, versus establishing new plants. Inspection and registration are therefore necessary for this part of the BGF calculation. A distinction should therefore be made between existing vegetation (where a higher value can be obtained for preserving existing vegetation).

Preservation of existing vegetation should be prioritized over the establishment of new vegetation. This will have a positive effect on the natural diversity and existing nature in the area, as well as being economical, since you won`t have to order a bunch of new plants, including planting them. By planning an area based on existing nature, one creates the least possible interferences with nature, which gives greater opportunities to be creative, and to work hand in hand with nature. For example, if a tree is blocking the way of a planned office building, instead of felling the tree, one could work around it and create an atrium or courtyard.

BGF should encourage for preserving existing nature and vegetation during development projects. Existing vegetation should therefore be its own element and get a high score in the BGF. This will encourage to preserve valuable existing vegetation in the building plot, which again will prevent the least possible interference with nature.

Another weakness with BGF in relation to this element, is that BGF does not distinguish between native and alien species. It is mentioned in the Norwegian Standard, says that planting field and existing vegetation must have plants that are suitable for the relevant growing conditions (Standard Norge, 2020). This means that it is still possible to use alien species or species that have high dispersal ability in the landscape projects, and results in the same score for using Norwegian local species. This is not appropriate if one considers the threat to Norwegian nature.

"If you go back to the version provided by Framtidens byer, it is almost better as it differentiates between locally valuable species. None of the versions provided by Oslo municipality and Norsk Standard do so. This is a very important nuance."

A clear suggestion for improvement regarding this, is to differentiate between native and alien species, where the goal is to better preserve the local nature. This could be achieved by giving native species a higher score than alien species.

T4 Newly planted trees & T5 existing trees

As mentioned, consideration should be given to the already existing landscape in the project area. More points should therefore also be given for existing trees versus newly planted trees, so that developers are encouraged and motivated to preserve trees.

"Existing trees should receive more points versus newly planted trees. And trees that get bigger should also be weighted higher. This was differentiated in the previous version."

Trees that have value for wildlife should receive more points than alien cultivated tree species. Assessments should be carried out by professionals, such as biologists or arborists.

"You should get more points for trees if you can take care of trees with a certain circumference. Biologists would say that trees that have value to wildlife will have more value than alien cultivated species."

Considering the value trees have for nature, environment, and people, it should be valued more in BGF and get a higher score for both existing and newly planted trees.

"Trees have too little value in BGF for both existing and new trees. This is very often what is cut. Oslo municipality has changed this and given trees a higher value. I think Norsk Standard should also do that."

No requirement is set for the conservation and planting of trees and vegetation and the general improvement of biodiversity in any other way than in BGF. It is therefore conceivable that this topic should be reinforced, so that more consideration is given to biodiversity in development projects.

There are many reasons why trees should be preserved, including oxygen production, carbon sequestration, biodiversity, soil conservation and water conservation. As well as aesthetic value and economic value. Trees produce oxygen through photosynthesis, which is essential for the survival of many species, including humans (Ainsworth & Gillespie, 2007). Trees can also absorb carbon dioxide from the atmosphere and store it in their biomass. This helps reduce the amount of greenhouse gases in the atmosphere, which is important for mitigating climate change (Pan et al., 2011). They provide habitat for a wide range of plant and animal species (Moffat, 2016). By preserving trees, it is possible to support biodiversity and maintain healthy ecosystems.

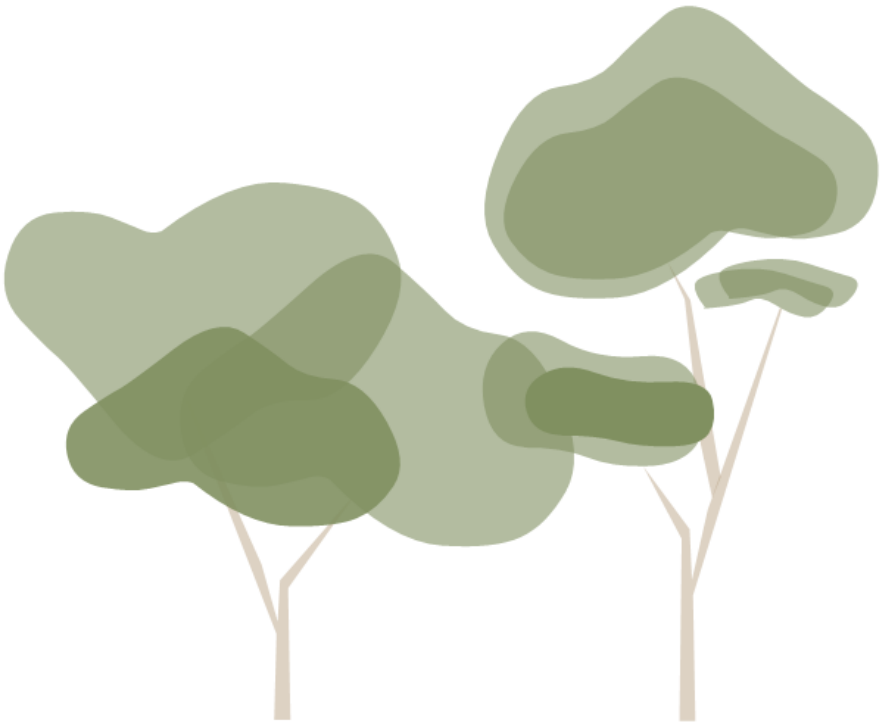
Trees can help prevent soil erosion by holding soil in place with their roots (Bonan, 2008). This is important for preventing nutrient runoff and maintaining healthy soil. They also help regulate the water cycle by intercepting and absorbing rainfall, which reduces the risk of flooding and erosion (Bonan, 2008). Trees also help replenish groundwater supplies (Bonan, 2008).

There are also aesthetic values for preserving trees. Trees are beautiful and add to the visual appeal of urban and natural environments. They can also provide shade and reduce the urban heat island effect (Pauleit et al., 2005). Trees can also provide a range of economic benefits, including timber,

fruit, and other products (Nowak et al., 2014). They can also increase property values and reduce energy costs by providing shade and insulation (Nowak et al., 2014). Overall, preserving trees is essential for supporting human health, maintaining healthy ecosystems, mitigating climate change, and supporting sustainable development.

Quickly summarized, some municipalities already have stormwater strategies, while others do not, making BGF a useful tool for facilitating stormwater management. However, the Norwegian Standard for BGF should better specify its role in facilitating stormwater management and recommend following the stormwater strategy in the municipality. Professional like biologist and ecologists should conduct assessments related to connections to blue-green structures. Further, green roofs should be more valued in the calculation of BGF. The calculation method should also encourage preservation of existing trees and vegetation.

Lastly the BGF should differentiate between local and alien species and improving blue-green structures from the existing situation with individual elements worth one point each.



CHAPTER 5

SUMMARY

SUMMARY

Climate change presents itself as one of the principal predicaments confronting humanity, with expediency of more frequent and intense rainfall. Simultaneously, the global population has surpassed 8 billion individuals in the year 2022 (The Washington Post, 2022). Urban areas are predicted to triple in size by 2030, and at the same time natural habitats are declining (Seto et al., 2012). The combination of more frequent and intense rainfall, and more dense surfaces in cities, creates a need for nature-based solutions for stormwater management and green areas.

Landscape architects play a critical role in addressing these climate challenges. Landscape architects can use the blue-green factor (BGF) method as a tool to improve and facilitate the incorporation of Blue-Green Infrastructure (BGI) in landscape designs, ensuring that the environmental benefits are maximized and contributing to a more sustainable and resilient urban environment. The Norwegian standard for blue- green factor sets guidelines for the use of open stormwater disposal and vegetation elements without specifying specific solutions. In 2024 the Norwegian BGF calculation method will have its 10-years anniversary. However, BGF is still in process of improvement, and there are still questions related to the calculation method and to what extent it functions in practice regarding stormwater management and biodiversity. Asplan Viak has one of Norway's largest professional environments in landscape architecture and have worked with the BGF-framework in several projects. Making Asplan Viak a preferred case company.

Based on this, the following research question was presented.

"To what degree can the Norwegian standard for blue-green factor promote stormwater management and biodiversity, when applied in planning of urban landscape projects?"

Based on the presented research question, a qualitative case study was conducted on the company Asplan Viak, with the purpose of highlighting strengths and weaknesses related stormwater management and biodiversity in the Norwegian BGF framework, as well as providing improvements suggestions. Furthermore, two sub-research questions were presented, with the purpose of providing a sufficient answer to the main research question.

The first sub-research question examines the strengths and weaknesses of BGF, when using the calculation method to facilitate stormwater management and biodiversity, based on Asplan Viak`s experiences.

When researching the strengths and weaknesses of the Norwegian BGF, the key findings were related to the following elements.

01 Connection to blue-green structures

Asplan viak points out that the use of BGF provides clear strengths in relation to green connections, and highlights its important impact on both biodiversity and people. However, there are some undeniable weaknesses.

Firstly, the element is difficult to decipher and has a vague definition. Even though it is clearly defined in Norwegian standard, operationalizing this concept in practice remains challenging. In Asplan Viak's experience, this element is open for interpretation, which results in many different variations based on who is doing the assessment. In addition, the Norwegian standard does not specify anything in relation to who should perform the assessments. Asplan Viak points out the importance of including a professional when assessing which connections are needed in a project, such as a biologist.

A1 Green surfaces on construction

Green surfaces on construction, such as green roofs have several benefits and strengths in managing stormwater and preserving biodiversity, especially in urban areas, where there is a lack of available spaces on the ground. In these type of projects, green roofs could make a big difference by utilizing available areas on the roof level. Unfortunately, green roofs are poorly rated in the BGF calculation method and is often given a low score.

A4 Permeable surfaces

Asplan Viak points out that permeable surfaces are one of the clear strengths of using BGF calculation method, because it corresponds to step 1 of the three-step strategy. In addition, several municipalities do not have requirements related to stormwater management that for instance ensures permeable surfaces. It is therefore crucial that the step 1 of the three-step strategy is taken care of in other measures such as BGF. Research shows that municipalities that have adopted BGF experience the greatest benefits from stormwater management.

T1.1 Terrain depressions- infiltration as main function

The use of the calculation method related to this element encourages solutions that deals with stormwater locally, e.g., use of rain gardens. BGF encourages the use of open stormwater management. A weakness related to this element is that stormwater measures that are implemented are not observed and controlled later in the project, and the measure could easily ends up being inaccurate. Asplan Viak points out that terrain depression with infiltration as main function, such as rain garden can be placed inappropriately in relation to its function and purpose, resulting in the rain gardens to dry out and leaving only negative sides.

T2 Planting field and existing vegetation

In the Norwegian Standard for BGF, new vegetation and existing vegetation get the same BGF-score, meaning it does not give points for existing landscapes. One could remove valuable nature and weaken the ecological value, and still get a high BGF score. On the other hand, in situations without existing vegetation, the BGF score comes out worse, even though the ecology on the site is significantly improved, which is a clear weakness.

Secondly, it does not differentiate between native and alien species. These species are given the same score in the BGF framework, which is also a weakness as it does not promote biodiversity.

Asplan Viak highlights the importance of plant diversity and including this in the BGF, to improve biodiversity in landscape projects.
Even though having different species does not give a better score in BGF, it has been crucial having plant diversity in landscape projects to improve biodiversity.

T4 Newly planted trees & T5 Existing trees

There are many benefits of having trees in landscape projects, and it is especially important to preserve existing trees to keep the ecology of the area in check. Nevertheless, this is not highlighted in BGF. Asplan Viak points out the weaknesses of BGF regarding trees and that trees are the elements that are often cut from the project in favor of other structures such as roads, since the BGF framework give them such a low score.

The second sub-research questions builds on the first one, but goes further and discusses how the Norwegian standard of blue-green factor can be improved and optimized in relation to stormwater management and biodiversity. This will also be based on Asplan Viak`s experiences.

When discussing how BGF could be improved and optimized in relation to stormwater management and biodiversity, the key findings were related to the following elements.

01 Connection to blue-green structures

A suggested improvement for BGF related to this element is including professionals, when assessing which connections are needed in a project. The calculation method could be challenged to go further and specify that certain professionals should carry out the assessment, such as biologist or ecologist. This can ensure that these structures are designed and managed in a way that maximizes their ecological benefits and contributes to a healthy and sustainable urban environment.

A1 Green surfaces on construction

An apparent improvement for this element is to increase the points given for green roofs in the BGF. In this way available areas can be used in an efficient way for both managing stormwater and improving biodiversity. This is especially useful in urban areas where there is lack of available land on the ground. Overall, green roofs can provide multiple benefits for both stormwater management and biodiversity, making them an important component of green infrastructure in urban areas.

T1.1 Terrain depressions- infiltration as main function

The Norwegian standard for BGF does not specify the criteria for achieving appropriate rain gardens. A suggested improvement is therefore, to take terrain depressions into account when working with this element. It is critical to think about the terrain/elevation to get an appropriate and correct slope in the terrain. Research shows that rain gardens are one of the best measures for open stormwater management, but it depends on the location and structure. There should be a more defined requirements for the structure of these elements, for instance minimum requirement for soil volume for rain garden. Another suggestion to improve the element is to give a score based on the locations of the terrain depressions, and how much stormwater runoff the terrain depression potentially can manage, as suggested by Tukker (2021).

T2 Planting field and existing vegetation

This element could be improved and optimized through better consideration. Areas should be planned and designed based on existing nature, and not the other way around. For example, points should be given for preserving existing nature, versus establishing new plants. Inspection and registration are therefore necessary for this part of the BGF calculation.

Secondly BGF does not distinguish between native and alien species. This means that it is still possible to use alien species or species that have high dispersal ability in the landscape projects, and results in the same score for using Norwegian local species. A suggestion is to differentiate between native and alien species, where the goal is to better preserve the local nature. This could be achieved by giving native species a higher score than alien species.

T4 Newly planted trees & T5 Existing trees

Existing trees should receive more points versus newly planted trees. And trees that get bigger should also be weighted higher. This was differentiated in the previous version of BGF. Trees that have value for wildlife should receive more points than alien cultivated tree species. Assessments should be carried out by professionals, such as biologists or arborists. Trees have too little value in BGF for both existing and new trees, and it therefore often cut from the project. Oslo municipality has changed this and given trees a higher value. Norwegian Standard could be challenged to also do so.

CHAPTER 6
FINAL

The final section of the master's thesis provides a conclusion followed by a reflection.

CONSLUSION

Main research question

To what degree can the Norwegian standard for blue-green factor promote stormwater management and biodiversity, when applied in planning of urban landscape projects?

The Norwegian standard for blue- green factor sets guidelines for the use of open stormwater management and vegetation elements without specifying specific solutions.

The use of the Norwegian Standard for blue-green factor in the planning phase of urban landscape projects undeniably promote implementation of blue-green values and provides the user with a set of guidelines in relation to stormwater management and biodiversity. Overall, the different elements in BGF ensures prioritization of vegetation and blue-green elements in development projects and shows the values of these structures. BGF promotes solutions for local management of stormwater, e.g., implementation of rain garden, as well as implementation of more trees and vegetation. The calculation method encourages municipalities and developers to allocate space and funds for blue-green structures, which would otherwise yield to other reasons.

Several municipalities take care of stormwater management through their own stormwater strategies. For these municipalities this will be the optimal framework for stormwater management and will exceed the BGF framework. However, it is possible to use the two frameworks in combination. For municipalities that does not have their own stormwater strategies, BGF could be a sufficient framework in relation to stormwater management. The empirical evidence shows that BGF is not as effective in managing stormwater beyond the first step of the three-step strategy to capture and infiltrate runoff from smaller rain events. When it comes to biodiversity, it does not have an equivalent strategy as opposed to stormwater management. Therefore, the BGF framework has an important role in safeguarding biodiversity. In this case, the empirical evidence shows that BGF is effective in promoting the inclusion of trees and vegetation in landscape projects.

Based on empirical evidence, one could claim that some of the BGF elements has observable weaknesses and shortcomings that effects to what degree BGF promote stormwater management and biodiversity. Firstly, there is a need for a better specification related to necessary assessments and inclusion of professionals. Secondly, there are improvements related to the "scoring system", for new and existing vegetation, including giving green roofs and trees a higher score. Further the scoring system should differentiate between native and alien species, for better promotion and conservation of biodiversity. Lastly, areas should be planned and designed based on existing nature, not the other way around.

Going forward it is critical that the Norwegian standard for blue-green factor continues improving and evolve in line with the rapid changing society to ensure the quality of the framework.

REFLECTION

Dissemination and (policy) relevance

Blue-green factor is approaching its 10th anniversary, but there are still many municipalities and others in the building and construction industry that still have questions to the calculation method. Although BGF is not that common in all municipalities, there are several municipalities that are planning on implementing BGF in the the land-use part of the municipal master plan. This means that existing and future projects in the municipality requires a minimum BGF score of the development project.

My thesis may be relevant for municipalities and companies that are working with BGF or are planning on working with BGF to get an insight on the experiences Asplan Viak, as a consultant firm has with the calculation method in landscape projects. What strengths and weaknesses exist, and how to improve the calculation method. This is also something that the Norwegian Standard have requested. They want to get an insight in these topics of BGF to better improve the calculation method for BGF.

Further research

Climate gas accounting is an important topic to bring up when discussing BGF. As the situation is per 2023, it is possible to create landscapes that will not be climate positive for several generations. A construction project that strives a little towards this will not be climate positive for several generations. These methods should therefore also consider the requirements for a climate gas accounting for the development of this landscape. It would therefore be interesting to look further into the relation between calculation methods such as blue-green factor and climate gas accounting in landscape projects.

Another interesting topic would be to further investigate what experiences other firms has with BGF, e.g., smaller landscape architecture firms that are more likely to use the calculation method in smaller delimited landscape projects. It would also be interesting to get an insight in what experiences other professions such as biologists and water engineer have with BGF. It would also be interesting to dig into a specific landscape project, a case-area and research on how BGF has been used throughout all the phases of the project, and how has it been followed up throughout the years? Has it been successful?

FIGURE LIST

REFERENCES

Ainsworth, E. A. & Gillespie, K. M. (2007). Estimation of total phenolic content and other oxidation substrates in plant tissues using Folin-Ciocalteu reagent. *Nature Protocols*, 2. doi: 10.1038/nprot.2007.102.

Blaikie, N. & Priest, J. (2019). *Designing social research (third edition)*. Cambridge: Polity Press.

Bonan, G. B. (2008). Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests. *Science* 320 (5882). doi: 10.1126/science.1155121.

Convention on Biological Diversity. (2006). *Article 2. Use of Terms*. Available at: https://www.cbd.int/convention/articles/?a=cbd-02 (accessed: 3 January 2023).

Dyrrdal, A. V. (2021). *Dimensjonerende nedbør*. Available at: https://snl.no/dimensjonerende_nedb%C3%B8r (accessed: 20 February 2023).

European Commission. (2021). *Green and Blue Infrastructures*. Available at: https://knowledge4policy.ec.europa.eu/glossary-item/green-blue-infrastructures_en (accessed: 11 January 2023).

Felson, A. (2013). Involving Ecologists in Shaping Large-Scale Green Infrastructure Projects. *BioScience*, 63. doi: 10.1525/bio.2013.63.11.7.

Global Assessment on Biodiversity and Ecosystem Services. (2019). *Media Release: Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating'.* . Available at: https://ipbes.net/news/Media-Release-Global-Assessment (accessed: 3 February 2023).

Global goals. (n.d.-a). *11 Sustainable cities and communitites*. Available at: https://www.globalgoals.org/goals/11-sustainable-cities-and-communities/ (accessed: 11 January 2023).

Global goals. (n.d.-b). *13 Climate action.* Available at: https://www.globalgoals.org/goals/13-climate-action/ (accessed: 11 January 2023).

Global goals. (n.d.-c). *15 Life on land.* . Available at: https://www.globalgoals.org/goals/15-life-on-land/ (accessed: 11 January 2023).

Green Cities Europe. (2021). *A proposal for green norm 2.0.* . Available at: https://thegreencities.eu/wp-content/uploads/2020/10/Gron-norm-2.0-ENG-MAR-2021-WEB.pdf (accessed: 11 January 2023).

Green Cities Europe. (2022). *Candidate – The Netherlands*. Available at: https://award.thegreencities.eu/award-2022/the-netherlands/ (accessed: 10 April 2023).

Jacobsen, D. I. (2022). *Hvordan gjennomføre undersøkelser? Innføring i samfunnsvitenskapelig metode* 4ed. Oslo: Cappelen Damm Akademisk.

Kleven, T. A. & Hjardemaal, F. R. (2018). *Innføring i pedagogisk forskningsmetode. En hjelp til kritisk tolkning og vurdering (3. utgave)*. Bergen: Fagbokforlaget.

Krumsvik, R. J. (2014). *Forskningsdesign og kvalitativ metode. Ei innføring*. Bergen: Fagbokforlaget.

Meteorologisk institutt (2021). *Det blir våtere*. Available at: https://www.met.no/vaer-og-klima/det-blir-vatere (accessed: 20 February 2023).

Miljødirektoratet. (2019). *Naturpanelet: Alvorlig utvikling for naturen*. Available at: https://www.miljodirektoratet.no/aktuelt/nyheter/2019/mai-2019/naturpanelet-akselererende-og-alvorlig-utvikling-for-naturen/ (accessed: 20 February 2023).

Miljøstatus. (2022). *Trolig rundt 72 000 arter i Norge*. Available at: https://miljostatus.miljodirektoratet.no/tema/arter/ (accessed: 20 February 2023).

Moffat, A. J. (2016). Communicating the benefits of urban trees: A critical review. *Arboricultural Journal*, 38 (2). doi: 10.1080/03071375.2016.1163111.
Nes, M. & Trommer, M. (2017). *Utbredelse og adopsjon av Blågrønn faktor*. Oslo: Høgskolen i Oslo og Akershus (OsloMet).
NOU 2010: 10. (2010). *Tilpassing til eit klima i endring*. Oslo: Servicesenteret for departementa Informasjonsforvaltning.
NOU 2015: 16. (2015). *Overvann i byer og tettsteder*. Oslo: Departementenes sikkerhets- og serviceorganisasjon Informasjonsforvaltning.
Nowak, D. J., Hirabayashi, S., Bodine, A. & Greenfield, E. (2014). Tree and forest effects on air quality and human health in the United States. *Elsevier* 193. doi: 10.1016/j.envpol.2014.05.028.
Pacific Coastal and Marine Science Center. (2022). *Landscape Response to Climate Change- A Commentary*. Available at: https://www.usgs.gov/centers/pcmsc/news/landscape-response-climate-change-commentary (accessed: 2 february 2023).
Pan, Y., Birdsey, R. A., Fang, J., Houghton, R., Kauppi, P. E., Kurz, W. A., Phillips, O. L., Shvidenko, A., Lewis, S. L., Canadell, J. G., et al. (2011). A Large and Persistent Carbon Sink in the World's Forests. *Science* 333 (6045). doi: 10.1126/science.1201609.
Paterno, S. (2015). *The Question Man- John Sawatsky* Available at: https://interviewfall2015.files.wordpress.com/2015/08/sawatsky-profile.pdf (accessed: 20 February 2023).
Pauleit, S., Jones, N., Nyhuus, S., Pirnat, J. & Salbitano, F. (2005). Urban Forest Resources in European Cities. In Konijnendijk, C., Nilsson, K., Randrup, T. & Schipperijn, J. (eds) *Urban Forests and Trees: A Reference Book*, pp. 49-80. Berlin, Heidelberg: Springer Berlin Heidelberg.
Regjeringen. (2018). *Kommunene må planlegge for klimaendringer*. Available at: https://www.regjeringen.no/no/dokumentarkiv/regjeringen-solberg/aktuelt-regjeringen-solberg/kmd/pressemeldinger/2018/kommunene-ma-planlegge-for-klimaendringer/id2612507/ (accessed: 20 February 2023).
Resilient Cities Network. (n.d.). *What is urban resilience?* Available at: https://resilientcitiesnetwork.org/what-is-urban-resilience/ (accessed: 11 January 2023).
Seto, K. C., Güneralp, B. & Hutyra, L. R. (2012). Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. *Proc Natl Acad Sci U S A*, 109 (40): 16083-8. doi: 10.1073/pnas.1211658109.
Standard Norge. (2020). *Blågrønn faktor- Beregningsmetode og vektingsfaktorer*. Available at: https://www.standard.no/no/Nettbutikk/produktkatalogen/Produktpresentasjon/?ProductID=1130770 (accessed: 20 February 2023).
Statistisk Sentralbyrå. (2022). *Tettsteders befolkning og areal*. Available at: https://www.ssb.no/befolkning/folketall/statistikk/tettsteders-befolkning-og-areal (accessed: 9 January 2023).
Statlige planretningslinjer for klima- og energiplanlegging og klimatilpasning. (2018). *Statlige planretningslinjer for klima- og energiplanlegging og klimatilpasning*. Available at: https://lovdata.no/dokument/LTI/forskrift/2018-09-28-1469 (accessed: 20 February 2023).
Thagaard, T. (2013). *Systematikk og innlevelse: En innføring i kvalitativ metode (4. utgave)*. Bergen: Fagbokforlaget
The Intergovernmental Panel on Climate Change. (2023). *Synthesis report of the IPCC sixth assessment report (AR6) Longer report*. IPCC AR6 SYR.

The Washington Post. (2022). *You're one in 8 billion*. Available at: https://www.washingtonpost.com/world/interactive/2022/world-population-8-billion/ (accessed: 11 January 2023).
Tukker, E. G. (2021). *Hvordan ivaretas overvannshåndtering i henhold til tretrinnsstrategien gjennom Norsk standard for blågrønn faktor?* Ås: Norges miljø- og biovitenskapelige universitet.
Union of Government and Civil society organisations. (n.d.). *Nature-based solutions*. Available at: https://www.iucn.org/our-work/nature-based-solutions (accessed: 11 January 2023).
United Nations. (n.d.). *11 sustainable cities and communities.* Available at: https://www.un.org/sustainabledevelopment/cities/ (accessed: 11 January 2023).
United States Environmental Protection Agency. (2022a). *NPDES Stormwater Program* Available at: https://www.epa.gov/npdes/npdes-stormwater-program (accessed: 11 January 2023).
United States Environmental Protection Agency. (2022b). *Soak up the rain: rain gardens*. Available at: https://www.epa.gov/soakuptherain/soak-rain-rain-gardens (accessed: 4 January 2023).
United States Environmental Protection Agency. (2022c). *Using Green Roofs to Reduce Heat Islands*. Available at: https://www.epa.gov/heatislands/using-green-roofs-reduce-heat-islands (accessed: 1 May 2023).
University of Delaware. (n.d.). *Permeable vs. Impermeable surfaces*. Available at: https://www.udel.edu/canr/cooperative-extension/fact-sheets/permeable-impermeable-surfaces/ (accessed: 11 January 2023).
Widding, Ø. (2005). Case som metode. Hovedutfordringer knyttet til ulike forskningsdesign når hensikten er å generalisere. doi: 10.13140/RG.2.1.3078.8722.
World Economic Forum. (2020). *The Global Risks Report 2020*. Available at: https://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf (accessed: 3 February 2023).

APPENDICES

Appendix 1: Blue-green factor: calculation method and weighting factors

Appendix 2: Interview guides (original in Norwegian)

Appendix 3: Interview guides (translated version in English)

Appendix 4: Information letter and consent form

Appendix 5: Term clarifications

APPENDIX 1: Blue-green factor: calculation method and weighting factors

Area measures (01-02)

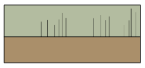
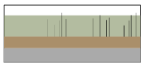
	01 connection to blue-green structures	Point 6.1	0.05	Unit
	02 Collection of stormwater for irrigation	Point 6.2	0.05	Unit

Area measures are overall measures such as blue-green connections in the landscape, which give individual bonus points. Area measures have two categories:

- O1 connection to blue-green structures
- O2 Collection of stormwater for irrigation

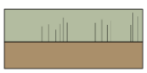
Both categories give 0.05 extra points to the project site. Connection to blue-green structures (O1) can give points to maximum two connections, while collection of stormwater (O2) can only give points one time. This gives a total possible extra point of 0.15 (O1x2 and O2x1). The area measures are especially important for preserving and providing the existing and future overall blue-green structures. This prevent a fragmentated green structures, but instead provides green corridors not only inside the project area, but also the outer areas outside the project site.

Area types (A0-A5)

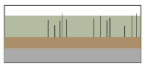
	A1, Green surfaces on terrain	Point 7.1	1	m2
	A2, Green surfaces on constructions	Point 7.2		
	A2.1, Growing medium with depth 0 - 3 cm (a)		0.2	m2
	A2.2, Growing medium with depth 3 - 20 cm		0.4	m2
	A2.3, Growing medium with depth 20 - 60 cm		0.7	m2
	A2.4, Growing medium with depth > 60 cm		0.9	m2

Area types is a classification of the whole area of the project in several types of areas based on the characteristics of the surfaces. The whole project area must be categorized in different area types. Area types is divided into six categories from A0-A5:

- A1 Green surfaces on terrain
- A2 Green surfaces on construction
- A3 Permanent water bodies and open waterways
- A4 Permeable surfaces
- A5 Dense surfaces with runoff to open waterways
- A0 Other dense surfaces

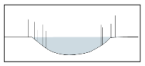
	A1, Green surfaces on terrain	Point 7.1	1	m2

A1 Green surfaces on terrain have a factor 1 and consist of all surfaces that are "natural terrain" e.g., forest, daylight rocks and cultivated green areas that is not on top of a construction. Important characteristics for green surfaces are to have a layer of soil underneath that allows water infiltration. It is also important that the plants are adapted to the local climate. The exception is daylight rocks that do not have soil underneath but count as "green surfaces on terrain."



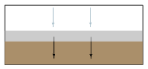
A2, Green surfaces on constructions	Point 7.2		
A2.1, Growing medium with depth 0 - 3 cm (a)		0.2	m2
A2.2, Growing medium with depth 3 - 20 cm		0.4	m2
A2.3, Growing medium with depth 20 - 60 cm		0.7	m2
A2.4, Growing medium with depth > 60 cm		0.9	m2

A2 green surfaces on construction has a factor between 0.2 and 0.9 and they are all green surfaces on construction. The area type is divided into four categories from A2.1 to A2.4, where green roofs have different factors based on the depth of the growing medium as shown in the figure above. The most common areas that are defined as green surfaces on construction is green roofs on buildings, but also green surfaces on the ground without the ability for free water infiltration into groundwater. NS3840 (Norwegian standard) provides provisions for design and construction of green roofs. Otherwise, the same requirements apply to vegetation and growing medium as for A1 green surfaces on terrain.



A3, Permeable waterbody and open waterways	Point 7.3	2	m2

A3 Permanent water bodies and open water ways have factor 2 and consist of water surfaces that have water throughout the growing season with the possibility of filling the tank with stored stormwater. The Norwegian Standard defines permanent water bodies and open waterways as number of square meters with a water body deeper than 20cm or number of square meters with open waterways, according to the "Vannressursloven".



A4, Permeable surface	Point 7.4	0.3	m2

A4 Permeable surfaces has a factor of 0.3 and consist of all surfaces that does not have green areas but has infiltration through the ground through underlaying structure or soil volume. Examples of permeable surfaces are gravel, shingle, some playground surfaces, surfaces with permeable joints, and permeable asphalt.

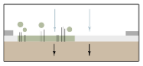
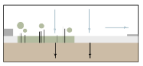
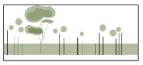
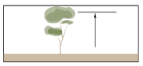
A5, Dense surfaces with runoff to open stormwater measures	Point 7.5	0.2	m2

A5 Dense surfaces with runoff to open waterways has a factor of 0.2 and consist of all dense surfaces where the water is directed with sufficient slope into open depressions or green surfaces. The proportion of dense area that can get a factor in A5 is limited to the total stormwater management because of the low capacity for water infiltration.

	A0, Other surfaces	Point 7.6	0	m2

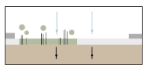
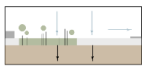
A0 Other dense surfaces have a factor of 0 and consist of all areas that are not classified under category A1 to A5. Even though A0 do not have a factor, the area can still get additional qualities as shown in the figure underneath.

Additional qualities (T1-T5)

	T1, Terrain depressions	Point: 8.1.1 and 8.1.2		
	T1.1, infiltration as main function		1	m2
	T1.2, retention as main function		0.5	m2
	T2, Planting field and existing vegetation	Point 8.2	0.5	m2
	T3, Green walls	Point 8.3	0.4	m2
	T4, Newly planted trees (entered as 25 m2 or 50 m2, see piont 8.4 for calculation of square meter per tree)	Point 8.4	1	m2
	T5, Existing trees (entered as 50 m2 or 100 m2, see point 8.5 in NS3845:2020 for calculation of square meter per tree)	Point 8.5	1	m2
				

(a) Areas that are facilitated for moss growth

Additional qualities have extra factor that can be obtained as an addition to the area type. The area of additional qualities is not considered in the project's total area, but rather as additional area qualities in addition to the area values. The Norwegian Standard states that additional qualities can be that the area also functions as a depression in the terrain which infiltrates or dissipates water, or as a planting field, green wall, or area for the growth of trees.

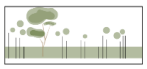
	T1, Terrain depressions	Point: 8.1.1 and 8.1.2		
	T1.1, infiltration as main function		1	m2
	T1.2, retention as main function		0.5	m2

T1 Terrain depression is divided into two categories based on the main function:

- T1.1 Infiltration
- T1.2 Retention

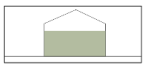
T1.1 Terrain depressions with infiltration as the main function has an additional factor of 1 and consist of terrain depressions and permeable surface that can manage to stand wet over time without permanent water body and must be emptied through infiltration within 24 hours if it rains. The most common solutions for infiltrating depressions are rain garden and bioswale with grassy areas.

T1.2 Terrain depressions with retention as the main function has a factor of 0.5 and consist of terrain depressions that retain runoffs and are emptied via a drainage pipe to a stormwater system. The terrain depression must have an overflow that allows a minimum water depth of 15 cm in the slope, and it is the area that allows more than 15 cm water depth that is calculated in BGF.



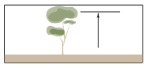
T2, Planting field and existing vegetation	Point 8.2	0.5	m2

T2 Field with plants and existing vegetation have a factor of 0.5 and this refers to plants that have over 20 cm in growing medium and that are well suited to the growing conditions where they are planted. Additional points for field with plants can be provided in combination with ground depression such as rain garden, on green roofs, in waterways and for other plant beds. Trees are not counted under planting fields, but under T4 and T5.



T3, Green walls	Point 8.3	0.4	m2

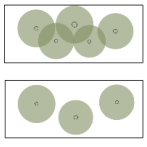
T3 Green walls has a factor of 0.4. It is the number of square meters with vertical growing surface that are suited climbing plants. Or that are established as plant wall. Maximum height for plant walls is 10 m and the area of the wall must be vegetated within five years. Green wall must be conducted according to NS3420-k (Norwegian Standard).



T4, Newly planted trees (entered as 25 m2 or 50 m2, see piont 8.4 for calculation of square meter per tree)	Point 8.4	1	m2

T4 Newly planted trees have a factor of 1 and are calculated based on the number of newly planted trees. This is separated between trees that are below (T4.1) and above (T4.2) 10 m high. The trees must be well suited to the growing conditions where they are planted, have enough and sufficient space and good growing conditions according to the expected size and age of the trees.

T4.1 Tree under 10 meters are counted as 25m2 with crown area, and T4.2 trees over 10 meters are counted as 50m2 with crown area in the spreadsheet. Only the number of trees and not square meters for new ones should be entered.



T5, Existing trees (entered as 50 m2 or 100 m2, see point 8.5 in NS3845:2020 for calculation of square meter per tree)	Point 8.5	1	m2

T5 Existing trees has a factor of 1 and are calculated based on the number of trees with a circumference (SO) smaller than 90 cm (T5.2), SO bigger than 90cm (T5.3) or as the actual tree circumference (T5.1). It is important that existing trees are preserved under the construction process. The critical root zone of the tree cannot be damaged. Trees can either be calculated using the area of the largest circle in the drip line, or by measuring the circumference 1 meter above the ground. Overlap of area is not counted. Trees with circumference SO smaller than 90cm (T5.2) is counted as 50m2. Trees with circumference bigger than 90cm (T5.3) is counted as 100m2.

APPENDIX 2: Interview guides (original in Norwegian)

Intervjuguide for masteroppgave om blågrønn faktor

Intervjuobjekt 1

1. **Løs prat**
   Uformell prat. Jeg presenterer meg selv. Respondenten gir sine personalia.

   Navn: Intervjuobjekt 1
   Rolle/ansatt som: Landskapsarkitekt

2. **Informasjon**
   Dette prosjektet er den avsluttende masteroppgaven for studiet Landscape Architecture for Global Sustainability ved Norges miljø- og biovitenskapelige universitet (NMBU). Arbeidet gjennomføres våren 2023 og tilsvarer 30 studiepoeng. Temaet for oppgaven er kritisk gjennomgang av blågrønn faktor som verktøy knyttet til overvannshåndtering og biomangfold.
   Oppgaven blir belyst gjennom en teoridel og intervju med fagpersoner.

   Intervjuet skal kun brukes til min masteroppgave om blågrønn-faktor. Prosjektet vil etter planen avsluttes 15 mai 2023. Notater fra intervjuet vil lagres på et sikkert sted. Etter prosjektslutt vil eventuelle lydopptak fra samtaler bli slettet etter bearbeiding av informasjon.

3. **Innledende spørsmål**
   Kan du fortelle om din erfaring og kjennskap til blågrønn faktor som verktøy?
   Jeg har vært prosjektleder og utviklet kriteriesett for naturmangfold og overvannshåndtering for Futurebuilt. Jeg har vurdert BGF i den sammenheng, som et kunnskapsgrunnlag. Videre har jeg jobbet med å vurdere BGF for et komplekst bolig- og næringsområde i Oslo med en del historiske bygg. Jeg har også vært oppdragsleder for et større byutviklingsprosjekt hvor vi har testet blågrønn faktor og mulig måloppnåelse. Vi testet 40 ulike alternativer, altså ulike regneark for å se på ulike utbyggingsalternativer for området og hva som skal til for å sikre måloppnåelse i henhold til Oslo kommunes krav.

   Jeg jobber mest på plannivå, og ikke detaljnivå.

   Hvilke oppgaver har/hadde du?
   Litt forskjellig. I det ene prosjektet har jeg vært prosjektleder for det store byutviklingsprosjektet. Jeg hadde ansvar for landskapsarkitektur og konsekvensutredning-temaene.

   I det andre prosjektet er jeg innleid rådgiver for Futurebuilt sekretariatet.

   Hvilken versjon av veilederen for BGF bruker du/har du brukt? (Fremtidens byer (2014), Oslo kommunes veileder (2018) eller Norsk Standard (2020)?

Jeg har brukt alle de ulike versjonene av BGF i ulike prosjekter.

4. Nøkkelspørsmål

Kan du fortelle litt om hensikten med å bruke BGF?
Hovedhensikten er å sikre areal for klimatilpasning. Det grønne og vegetasjon er også et viktig tema, men kommer som underpunkter etter klimatilpasninger.

Kan du fortelle litt om hvordan du har brukt verktøyet?
Jeg bruker verktøyet i hovedsak for å se hvilke muligheter for måloppnåelse det er i sammenheng med de kravene om BGF i Oslo kommune.
Og hvilke grep som er mulig å foreta for å sikre måloppnåelsen for BGF 0.7 i indre by (tett by).

Hva har fungert bra med verktøyet?
Verktøyet sikrer areal til blågrønne strukturer og god landskapsarkitektur. Det er en stor fordel. Det er et viktig bevisstgjøringsverktøy for de involverte aktørene. Det er viktig å bevisstgjøre de ulike aktørene om verdien på å sette av areal til blågrønne strukturer.

Er det noe mangler ved BGF?
Det er en del mangler. Det er i hovedsak overvannshåndtering som ikke blir godt ivaretatt gjennom BGF. Tomtene har ulik karakter med tanke på overvannshåndtering, men måloppnåelsen og kravene blir stort sett det samme. Når det gjelder overvannshåndtering, tar verktøyet i liten grad hensyn til tomtens karakter og hva som egentlig skal håndteres av overvann.

Klimagassregnskap er også et viktig tema å ta opp ved diskusjon av BGF.
Slik som det er i dag, kan man fint opparbeide landskap som ikke vil bli klimapositiv på flere generasjoner. Et byggeprosjekt som bestreber seg litt til dette, vil ikke være klimapositiv på flere generasjoner.
Man kan foreta et overvanntiltak som tilsynelatende er bra, også kan man risikere at det ikke vil være klimapositiv på kanskje flere 100 år. Disse verktøyene bør derfor også ta innover seg krav til et klimagassregnskap for opparbeidelse av dette landskapet. Hvis ikke kan man risikere at man bruker mye plast, betong og langtransportert stein for å få dette til. Da vil et tiltak som egentlig er positiv (i form av at det tilpasser seg klimaendringene) være driver for ytterligere klimaendringer.

Det bør opparbeides en EPD for alle materialene som benyttes til opparbeidelse av blågrønne strukturer. En EPD er en tredjepartsverifisert dokumentasjon som forteller hvor mye klimagassutslipp det enkelte bestanddel har.

Er det noe mangler knyttet til overvannshåndtering?
Manglene er at du vil ha tomter med ulik karakter f.eks. Vega scene, et pilotprosjekt som virkelig slo an. Prosjektet viste at det går an å håndtere overvann på tak for dagens 200- års regnhendelse. Man ser at dette lar seg gjøre. Dette

fungerer som en kule, også med tanke på naturmangfold. Også er det slik at det prosjektet hadde aldri klart å nå opp i blågrønn faktor, selv om det løser overvannshåndtering på en innovativ måte og setter en ny bransjestandard og etablerer en nasjonalt viktig naturtype på en kjempestor flate, men vil aldri nå opp. Jeg mener derfor at verktøyet ikke er godt nok egnet.

Det at tiltakene er på tak gjør et man ikke når opp i BGF?
Ja, det at det er på tak. Det er en del tomter som bare er på tak i dag, spesielt i tettbygde strøk hvor det er vanskelig å få til noe tiltak på bakken.

Det vi har jobbet med i de nye Futurebuilt-kriteriene er å blant annet kutte ut ekstra poeng for trær og busker, og har heller gitt større krav til antall arter og lokal tilhørighet for å gi prosjekterende større frihet. Vi har ikke vært så kategoriske. Pilotprosjektene Vega scene og Kristian Augusts gate 13, med bruk av grønne tak er begge fine pilotprosjekter som ikke når opp i BGF. Prosjektene Det svarer ut både krav til overvannshåndtering og ønske om å utvikle unik lokal natur, men som samtidig ikke har kjangs til å nå opp i BGF (når kun opp til 0.4 i BGF) fordi man ikke tar innover seg innovasjon som er knyttet til tiltak. Et blågrønt tak er hybrid mellom intensive grønne tak og et regnbed.

Er det noe mangler knyttet til biomangfold?
Ja, det er det. I slike prosjekter må man, etter mitt skjønn ha et mer tydeligere svar på hva som er lokalt verdifullt. Og legge til rette for at man bruker en høy andel lokalt verdifullt naturmangfold, og et større fokus på lokalproduserte norske arter både med tanke på fare for plantesykdommer, dette med herdighet, CO2-avtrykk, lokal produksjon og genetikk (selv om dette kanskje ikke har et juridisk hold).
Det stilles lite krav til plantemateriell, slik jeg ser det i disse prosjektene hvor det er krav om BGF.

Kan verktøyet forbedres? Hvordan?
Verktøyet kan forbedres. Da må man fokusere ytterligere for å åpne opp for mer skreddersydd tiltak når det gjelder overvannshåndtering. Hvilke utfordringer står man faktisk overfor på den aktuelle tomten? Det er kjempeviktig. Man må også jobbe veldig aktivt med å kartlegge hva slags type funksjon dette anlegget skal ha med tanke på utvikling av naturmangfold med særlig fokus på hvordan anlegget kan bidra til å styrke økologien i området.

Hvis du har et område som ligger i et lite nedslagsfelt, slik vi har i noen byområder i dag. Der er det nesten ikke en grønn flekk på hele tomten i et svært byområde. I dag er ikke overvann et problem da, når det bare treffer harde flater og det er direkte avrenning. Da ser vi at vi må suboptimalisere. Vi må lage et regnbed som ikke har funksjon som regnbed for å nå kravene til Oslo kommune. Da blir tiltaket mer suboptimalisert. Hvordan definerer man et regnbed? Hvor stort skal det være? Hvor dypt skal det være? Hvilke deler av tiltaket skal håndtere vann? Og hva skal vannet brukes til?

Jeg mener det også bør være obligatorisk med klimagassregnskap, som jeg nevnte tidligere.

Er det noe som er uklart? Eller har du noe spørsmål?
Egentlig ikke. Jeg synes det er en interessant problemstilling og lærerikt, med tanke på at det er mange kommuner som nå innfører blågrønn faktor, og at man også jobber med revisjoner rundt omkring. Det er veldig interessant. Det er også viktig å være poengtert. Det vil være noen funn som er tydeligere enn andre, og i den sammenheng tenker jeg det er viktig å ikke kun intervjue landskapsarkitektene, men også de dyktige biologene og de som jobber med overvann slik at man også får innsyn i deres erfaring og/eller synspunkter om verktøyet knyttet til overvannshåndtering og biomangfold.

5. Oppsummering
Oppsummering av spørsmål og svar

Intervjuobjekt 2

1. **Løs prat**
   Uformell prat. Jeg presenterer meg selv. Respondenten gir sine personalia.

   Navn: Intervjuobjekt 2
   Rolle/ansatt som: Landskapsarkitekt

2. **Informasjon**
   Dette prosjektet er den avsluttende masteroppgaven for studiet Landscape Architecture for Global Sustainability ved Norges miljø- og biovitenskapelige universitet (NMBU). Arbeidet gjennomføres våren 2023 og tilsvarer 30 studiepoeng. Temaet for oppgaven er kritisk gjennomgang av blågrønn faktor som verktøy knyttet til overvannshåndtering og biomangfold.
   Oppgaven blir belyst gjennom en teoridel og intervju med fagpersoner.

   Intervjuet skal kun brukes til min masteroppgave om blågrønn faktor. Prosjektet vil etter planen avsluttes 15 mai 2023. Notater fra intervjuet vil lagres på et sikkert sted. Etter prosjektslutt vil eventuelle lydopptak fra samtaler bli slettet etter bearbeiding av informasjon.

3. **Innledende spørsmål**
   Kan du fortelle om din erfaring og kjennskap til blågrønn faktor som verktøy?
   Jeg jobber litt overordnet, i plan og ikke nødvendigvis så mye på detaljnivå.
   Jeg ble kjent med verktøyet på studiet i faget blågrønne strukturer på NMBU.

   Jeg har ikke jobbet med BGF i noen prosjekter i Asplan Viak, men Bodø kommune har forespurt Asplan viak om å holde kurs for dem.
   Etter at Norsk Standard kom med sin versjon i 2020, er det mange kommuner som snuser på det. Mange kommuner kommer til å innføre det og er nysgjerrig på BGF og trenger kunnskap om dette.

   Jeg har vært i kontakt med en del kommuner, deriblant Øvre Eiker, Alver, Stavanger og Bergen i forbindelse med kurs/opplæring i blågrønn faktor. Det som går igjen, er at de ønsker å tolke Norsk Standard. Det er kommunen sin oppgave å si hvordan man skal stille krav om blågrønn faktor, hvilke faktor man skal sette og hvilke områder det gjelder. Dette trenger de hjelp til.

4. **Nøkkelspørsmål**

   Kan du fortelle litt om hensikten med å bruke BGF?
   I 2014 rett før de første kommunene innførte krav til åpen overvannshåndtering i Norge, og man snuste på det temaet i Norge og prøvde å innføre et verktøy som kunne favne den helheten som åpen overvannshåndtering er. Det er ikke bare klimatilpasninger, og det er ikke bare overvannshåndtering. Det er hele den grønne pakka som er vanskelig å sette ord på og sette krav til. BGF tror jeg er et

forsøk på å adressere den helheten, og har vært et vellykket forsøk synes jeg. Den er bygget på den tyske og svenske versjonen, så det kommer ikke bare ut av lufta. I dag er ikke dette med vann like viktig fordi det blir ivaretatt gjennom andre krav som kommunen har. Da er det dette med natur som er det andre hensynet.

Natur er veldig spesifikt, mens BGF er veldig lite spesifikt. Selv om natur er beskrevet som et hensyn som man skal prøve å sikre, klarer den i mindre grad å sikre hensyn til natur. Mens for overvann har det vært ganske positivt.

Hva har fungert bra med verktøyet?
Jeg tror BGF sikrer kvantitet, altså mengde blått og grønt, også vet vi landskapsarkitekter veldig godt hvordan vi kan gjøre dette til kvalitet.

BGF setter av areal, noe som er kjempeviktig, og setter til og med kanskje av penger til blågrønne verdier. Dermed er det opp til oss landskapsarkitekter å skape verdi ut av det.

Det er ikke slik at utbyggere har lyst til å betale for blått og grønt. Det har aldri før vært noe lov eller krav som sikrer blågrønne kvaliteter på denne måten.
Det er som regel alltid trær og vegetasjon som ryker når man kommer til det stadiet hvor prosjektet har lite penger på slutten. De kan ikke ta bort el-kablene eller fortauet. Hva kan vi kutte da? Jo, alt i landskapet kan vi kutte. Det at man ikke kan kutte det fordi man er bundet til det gjennom BGF, er kjempeviktig. Verktøyet oppfordrer kommuner og utbyggere til å sette av areal og penger blågrønne strukturer.

Er det noe mangler ved BGF?
Ja, det er noe mangler hvis BGF virkelig skal sikre naturmangfold. Naturmangfold handler om areal, men handler også veldig mye om hva de arealene inneholder. Det er mye som mangler knyttet til naturmangfold, men spørsmålet er om alt dette skal ligge i BGF eller om vi må få kommunen til å kreve det på en annen måte.

Noe av fordelene med BGF er at det er så enkelt. Det er et arealregnskap. Det kan godt hende at natur er et så stort tema at det skal ha en egen naturstrategi, f.eks. i kommunene. Uansett hvordan de innfører det så må de gjøre en jobb med å forstå det. Men jeg tror at det er en lang vei til alle kommuner har en egen naturstrategi, så det kan være at BGF kan ta oss et lite stykke på vei hvert fall.

Det største hullet synes jeg er det at den ikke tar hensyn til utgangssituasjon. Du kan fjerne masse natur, og få en høy BGF. Det går ikke an. Vi må stoppe naturtapet.

Hvis du går tilbake til Fremtidens byer sin versjon, synes jeg den er nesten bedre da den skiller på lokalt verdifulle arter. Ingen av versjonene til Oslo kommune og Norsk Standard gjør det. Dette er en kjempeviktig nyanse.

Trær har for liten verdi i BGF både for eksisterende og nye trær. Det er veldig ofte dette som kuttes. Oslo kommune har endret på dette, og gitt trær høyere verdi. Det synes jeg Norsk Standard også burde gjøre.

En annen ting BGF ikke tar hensyn til er plassering av elementer, men det kan den ikke ta hensyn til fordi det blir for komplisert. Men det har alt å si, hvis du f.eks. tenker deg at vegetasjonen skal bremse vinden, så må du sette de trærne der det er vind. Eller hvis du skal tenke at vegetasjon skal ta opp luftforurensning, så må du sette trærne ved siden av veien. Dette er de tingene som landskapsarkitekter kan.

Grønn kobling er veldig viktig, og er den av de tingene som virkelig har betydning for både naturmangfold og folk. Vurderingen av hva som er grønn kobling, er veldig skjønnsmessig. Grønn kobling er viktig spesielt med tanke på biomangfold. Denne vurderingen burde utføres av en biolog tenker jeg.
Det stilles ingen krav om hvem som skal gjøre vurderingene, og jeg vil tro at i mange mindre prosjekter er det kanskje ikke landskapsarkitekter som foretar vurderingene, og arkitekten tegner uteområdet, og sier hva som er grønn kobling og har egentlig ikke peiling på dette. Verktøyet kunne gått lenger med å spesifisere at enkelte fagpersoner skal foreta vurderingene. Biologier eller økologer burde vært spesifisert.

De store bykommunene ligger i et kystlandskap, og det er kanskje de som blir først på å innføre BGF. I en slik type natur eller landskap på tak der, vil det ha veldig stor verdi med en type eng som Vega Scene. Da trenger du kanskje 20 cm med jord, og kanskje er det dette som vil ha størst verdi for den naturen som er stedegen i det landskapet.
Jeg vet at mink som har spredt seg i norsk natur, tar ut mange sjøfugl-kolonier. De tar alle eggene, og de kan svømme langt så de kan komme seg til ulike øyer. Hvor skal da disse fuglene hekke?
Sjøfugler er en av de artsgruppene som sliter veldig i Norge. Det er bevist at disse fuglene kan finne seg til rette på grønne tak. Da er det å legge til rette for slik type natur på tak viktig.

De tingene som mangler i BGF, er stort sett inkludert i BREEAM og FutureBuilt-kriteriene. Den går litt lenger, men gjelder for de mest ambisiøse som velger seg BREEAM eller FutureBuilt. Det er ulempen med disse metodene.

Er det noe mangler knyttet til overvannshåndtering?
Vi har kommet til 2023, og overvann er stort sett håndtert gjennom andre krav. Dette gjelder selvfølgelig ikke alle kommuner. Mye av det som mangler i den norske blågrønn faktor (BGF), finnes i den svenske Gronytefaktor (GYF). De har en større GYF, og stiller mange bra krav. Der er det mer spesifisert hva som er viktig for naturmangfold. I Stockholm er de anleggene som har brukt GYF veldig bra. De er skikkelig bra prosjekter. Men de har en annen type administrasjon. Kommunene er mye mer på når det bygges ut. Uten at jeg kjenner den helt ut, virker det som den fungerer godt.

De har gått en annen vei enn oss. De har ikke gjort det så enkelt som mulig, men gjort det mer komplisert, men da tenker de at veldig mange av de tingene som man må tenke på er dekket innfor GYF.

Er det noe mangler knyttet til biologisk mangfold?
De viktigste manglene er at den ikke skiller mellom planteart. Man får like mange poeng for skadelige fremmede arter og norske arter. Den fremmer ikke mangfold. Får like mye poeng for ensartet eller flerartig planter. Den skiller heller ikke på hva som var på tomten fra før. Matjord er ikke omtalt. Det er problematisk hvis man skal få et prestisjeprosjekt på matjord.

Verktøyet gir ikke poeng for eksisterende landskap og tar ikke hensyn til den situasjonen som er på tomta fra før. Man kan bygge ned kjempeverdifull natur og likevel få en høy BGF.

Kan verktøyet forbedres? Hvordan?
Ja, da må man ta standpunkt i Norge, og man må gjøre den større og mer komplisert. Eller bør man holde det enkelt? Jeg tror at BGF vil løfte mange prosjekter og løfte kunnskap i mange kommuner bare slik det er nå. Bare det at mange kommuner innfører dette, og blir nødt til å forstå disse temaene tror jeg er veldig viktig.

Naturmangfoldet i Norge er truet, slik at hvis vi ikke har BGF som skal fremme naturmangfold, må vi ha noe annet. Vi tar ikke godt nok hensyn til det i utbyggingsprosjekter. Dette ser vi gjentar seg i flere tilfeller.

Det er fire bærekraftmål som vi i Norge gjør det veldig dårlig på. Det er blant annet liv på land (nr. 15) og liv under vann (nr. 14). Med andre ord, ta vare på natur. I tillegg til dette med ansvarlig forbruk og produksjon (nr. 12) og bærekraftige byer og tettsteder (nr.11). Dette kan blant annet skyldes at vi får mindre grønnstruktur i f.eks. byene, slik at det er de temaene som vi i stor grad kan påvirke gjennom hvordan uteområdene er og til en viss grad gjennom BGF.

Dette blir et øyeblikksbilde. Over tid, kan kvalitetene forringes uten at det fanges opp. Til syvende og sist er det beboerne som bestemmer over deres boligområde, og kan f.eks. felle trærne i området av ulike årsaker hvis de ønsker det. Anleggene må i tillegg skjøttes hvert år, og BGF fanger da ikke opp tidsaspektet.

Det nye BREEAM kravet tilsier at man skal ha en evigvarende skjøtselsplan som må følges. Det er viktig å tenke på hva som var i utbyggingsområdet fra før av. Og hvordan kan det forbedres? I stedet for å tenke at man alltid skal ha en viss BGF f.eks. 0.7. Eller at man klarer å vekte det inn bedre. Det vil jo komme enda flere erfaringer på det etter hvert.

Mange av de prosjektene vi har hatt som er ambisiøse, ville nok vært vanskelig å få høy BGF. F.eks. er det en bygård som skal rehabiliteres, får du kravet med en gang. Det er ikke mulig å ta på noe mer grønt på taket, og det er ikke noe på bakkeplan. Det er ikke noe areal til det. Hvordan skal man klare å oppnå kravet om

BGF da? Det er kanskje noe med å tenke forbedring fra eksisterende, og ikke alltid et forhåndsfastsatt minimums BGF-krav.

Er det noe som er uklart? Eller har du noe spørsmål?
Nei, du tar tak i et tema som vi i Asplan Viak er opptatt av. Hvordan vi skal klare å ivareta enda bedre de blågrønne verdiene i tidlig fase og at det ikke bare skal være opp til utbyggerens ambisjoner og vår retorikk. Vi skal snakke om de grønne verdiene, men vi trenger noen krav å støtte oss på og et av de er BGF. Kanskje er det også andre myndighetskrav og ting som kan støtte opp dette?

5. **Oppsummering**
   Oppsummering av funn

Intervjuobjekt 3

1. **Løs prat**
   Uformell prat. Jeg presenterer meg selv. Respondenten gir sine personalia.

   Navn: Intervjuobjekt 3
   Rolle/ansatt som: VA-ingeniør (Overvannshåndtering og klimatilpasninger)

2. **Informasjon**
   Dette prosjektet er den avsluttende masteroppgaven for studiet Landscape Architecture for Global Sustainability ved Norges miljø- og biovitenskapelige universitet (NMBU). Arbeidet gjennomføres våren 2023 og tilsvarer 30 studiepoeng. Temaet for oppgaven er kritisk gjennomgang av blågrønn faktor som verktøy knyttet til overvannshåndtering og biomangfold.
   Oppgaven blir belyst gjennom en teoridel og intervju med fagpersoner.

   Intervjuet skal kun brukes til min masteroppgave om blågrønn faktor. Prosjektet vil etter planen avsluttes 15 mai 2023. Notater fra intervjuet vil lagres på et sikkert sted. Etter prosjektslutt vil eventuelle lydopptak fra samtaler bli slettet etter bearbeiding av informasjon.

3. **Innledende spørsmål**
   Kan du fortelle om din erfaring og kjennskap til blågrønn faktor som verktøy?
   Jeg har jobbet med dette i flere prosjekter. Det er vanligvis landskapsarkitektene som gjør beregningene, men jeg har også gjort det i noen prosjekter.

   Hvilke oppgaver har/hadde du?
   Jeg gjorde beregninger og var rådgivende ingeniør (RIVA) i prosjektet. Gjorde også overvannsvurderingen.

   Hvilken versjon av veilederen for BGF bruker du/har du brukt? (Fremtidens byer (2014), Oslo kommunes veileder (2018) eller Norsk Standard (2020)?
   Jobbet med Oslo kommune sin versjon.

4. **Nøkkelspørsmål**

   Kan du fortelle litt om hensikten med å bruke BGF?
   Det er et krav om det, spesielt i Oslo kommune er det noe man må bruke. De håper at dette skal sikre en del kvaliteter i byggeprosjekter og sikre grønne kvaliteter i byrom. Verktøyet er hensiktsmessig der, men man må ikke dra inn overvannshåndtering f.eks. Dette blir sikret godt gjennom overvannsplan i kommunen fra før. Det er det Oslo kommune har landet på nå, når de har revidert sin versjon av BGF.

   De som har gjennomgått verktøyet har gjort et stykke arbeid og sett at det ikke er så hensiktsmessig at BGF skal sikre overvannshåndtering. Fordi det er den litt dårlig på. Der har man allerede kommunale krav som skal svares ut.

I dag er hensikten at den også skal sikre overvannshåndtering, men det fungerer den ikke så godt til. BGF er kanskje bedre på å sikre trinn 1 i tretrinnsstrategien. Det å sikre permeable dekker er verktøyet god på. Det tilsvarer trinn 1 i tretrinnsstrategien.

Hva har fungert bra med verktøyet?
Det er at den sikrer grønne kvaliteter. Når man jobber på utbyggingsprosjekter, har man ofte et absolutt krav man må klare. Det er lettere å få inn permeable dekker f.eks. i planen. De gode tiltakselementene for BGF som ellers ville viket for andre grunner, blir et krav i BGF. Det fungerer den bra på.
Det er mange kommuner som ikke har krav om overvannshåndtering som f.eks. sikrer permeable dekker.

Er det noe mangler ved BGF?
Med tanke på overvannshåndtering, er det ikke et godt verktøy for å sikre at vannet blir håndtert. BGF sikrer kun areal, og ikke hvor arealene ligger. Regnbedene kan f.eks. ligge overøst i nedbørsfeltet og man får like mye poeng. Da vil ikke tiltaket være hensiktsmessig. Det vil tørke ut, og kun stå igjen med negative sider. Da kunne man heller utnyttet arealet til noe mer nyttig. Det er kanskje den største svakheten som jeg kan komme på.

Regnearket favoriserer f.eks. regnbed, men de kan være plassert veldig rare steder. Det er litt synd. Det man også ser er at det kanskje er litt vanskelig å få sikret arealer i tidlig fase. Hvert fall i Oslo, skal du sannsynliggjøre at du klarer å oppnå det i tidlig fase, altså i detaljregulering. Men det er i realiteten vanskelig å få til, fordi man må ta hensyn til kjellerdekk og slikt. Spesielt i tettbebygde områder, er det veldig ofte kjellerdekker under planen. Da er det litt lett å bare si at det skal være regnbed f.eks. opp på kjellerdekket. Da må du ha en viss oppbygning. Så det er veldig mye BGF ikke sikrer.

Men det er veldig fint for å sikre biologisk mangold eller sikre grønnstrukturer, men den er ikke god på å sikre overvannshåndtering. Dette er min erfaring. Det går mye på det at du kan plassere tiltakene hvor som helst. Det er ikke noe krav om hvor tiltakene skal plasseres.

I tidlig fase ser jeg at man lett kan sette av arealer til terrengforsenkning med 20cm, men når man skal detaljere planene ser man at det ikke går. Da har man plutselig bare halve arealet. Arealer som blir satt av i tidlig fase kan bli fort halvert. Det er vanskelig fordi du skal sette av ganske detaljerte arealer på en veldig grov plan. Men det er veldig positivt at man setter i gang tankeprosessen så tidlig, men det er krevende.

Det kan være vanskelig å sette av nok jordvolum. F.eks. om du skal ha terrengforsenkning eller regnbed opp på kjellerdekket. Verktøyet sier ikke noe om hvor stor overdekning man må ha. Det kan være litt krevende, og da kan det bli stor variasjon i kvaliteten på tiltakene. La oss si at i et prosjekt, så har du kanskje bare 30 cm over kjellerdekket. Det blir ikke et bra regnbed.

Kan verktøyet forbedres? Hvordan?
Man kan foreta en grundig vurdering om overvannshåndtering er en del av dette, eller om den heller er mer for sikring av blågrønne strukturer. At det er det verktøyet, er best på. Og man kan heller optimalisere den delen.

Er det noe som er uklart? Eller har du noe spørsmål?
Ikke som jeg kan komme på.

5. **Oppsummering**
   Oppsummering av funn

Intervjuobjekt 4

1. **Løs prat**
   Uformell prat. Jeg presenterer meg selv. Respondenten gir sine personalia.

   Navn: Intervjuobjekt 4
   Rolle/ansatt som: Landskapsarkitekt

2. **Informasjon**
   Dette prosjektet er den avsluttende masteroppgaven for studiet Landscape Architecture for Global Sustainability ved Norges miljø- og biovitenskapelige universitet (NMBU). Arbeidet gjennomføres våren 2023 og tilsvarer 30 studiepoeng. Temaet for oppgaven er kritisk gjennomgang av blågrønn faktor som verktøy knyttet til overvannshåndtering og biomangfold.
   Oppgaven blir belyst gjennom en teoridel og intervju med fagpersoner.

   Intervjuet skal kun brukes til min masteroppgave om blågrønn faktor. Prosjektet vil etter planen avsluttes 15 mai 2023. Notater fra intervjuet vil lagres på et sikkert sted. Etter prosjektslutt vil eventuelle lydopptak fra samtaler bli slettet etter bearbeiding av informasjon.

3. **Innledende spørsmål**
   Kan du fortelle om din erfaring og kjennskap til blågrønn faktor som verktøy?
   Jeg jobbet med utarbeidelse av BGF-regneark i regi av Fremtidens byer ved bruk av de svenske versjonene som modell.
   Jeg har presentert dette forskjellige steder i Norge og fått innspill fra landskapsarkitekter.

   Hvilke oppgaver har/hadde du?
   Jeg har regnet på BGF og jobbet med prosjekter ved bruk av BGF, men da har jeg brukt Oslo kommune sin versjon. Jeg har også vært i ekspertgruppen i Standard Norge ved utarbeidelse av ny norsk standard for blågrønn faktor, og tillegg var jeg med å utarbeide den første versjonen av BGF i regi av Fremtidens byer.

   Hvilken versjon av veilederen for BGF bruker du/har du brukt? (Fremtidens byer (2014), Oslo kommunes veileder (2018) eller Norsk Standard (2020)?
   Jeg har kun brukt Oslo kommune sin versjon i ekte prosjekter, men brukt Fremtidens byer sin versjon i eksempelprosjekter.

4. **Nøkkelspørsmål**

   Kan du fortelle litt om hensikten med å bruke BGF?
   For å sikre minimumskvalitet på det grønne og overvann i prosjekter. Grønne kvaliteter og overvann er ikke lett å sette tall på. BGF bidrar med å sette krav på det blågrønne i prosjekter.
   Verktøyet motiverer til blågrønne løsninger for åpen overvannshåndtering, og bidrar til å heve blågrønne kvaliteter på uteområder. Det fungerer bra pedagogisk

for å kommunisere med oppdragsgivere og utbyggere, og det fremviser viktigheten med blågrønne strukturer med f.eks. jorddybde og jordvolum.

Kan du fortelle litt om hvordan du har brukt verktøyet?
Jeg laget eksempelsamlinger og regnet på BGF. Vi brukte BGF i et boligprosjekt i Oslo der det var krav fra kommunen om at man skulle regne ut BGF. Da brukte vi det ved detaljregulering av tomten for å vise at det var mulig å oppnå en tilfredsstillende BGF for det prosjektet.

Hva har fungert bra med verktøyet?
Det som fungerer er at det er pedagogisk, at man kan vise til viktigheten ved å ha mange trær eller variert vegetasjon. Eller at man har åpen overvannshåndtering. Det er viktig at man har godt med jordvolum på takene. Alt dette får man poeng for. Det gjør at man ikke kan fjerne disse elementene. Vi kan kreve at man trenger mer jord og uterom fordi dersom disse ikke blir tatt hensyn til, vil man ikke klare å tilfredsstille BGF.

Verktøyet bidrar rett og slett til å sette av arealer og prioritere blågrønne løsninger. Det er helt fra detaljreguleringsfasen. Det er i ganske tidlig fase at man er oppmerksom på det.

Med tanke på at jeg har regnet ut en del eksempler på BGF, ser vi at det ofte fungerer bedre på mindre tomter. Ved for store tomter kan det bli lite relevant å telle antall kvadratmeter med det ene og det andre, f.eks. hvis det er en stor skog i prosjektområdet. Det kan bli for mye av en kategori. Det fungerer best på mindre tomter. Gjerne på tomter som er i sentrum eller i by.

Er det noe mangler ved BGF?
Jeg tror det alltid vil være noe mangler. Når man skal utvikle disse metodene, må man alltid finne en balanse mellom det å sikre mest mulig kvaliteter og brukervennlighet. Det kan ikke bli for store kategorier og veldig komplisert å regne ut. Jo enklere det blir å regne ut, desto mindre detaljert blir det. Man må hele tiden finne en balanse på hva de viktigste kvalitetene er, og hva er det man kan gjøre noe med.
Dersom man har for mange kvaliteter eller kategorier, kan vinningen gå opp i spinningen. Da får man kanskje veldig mye av bare blått, og nesten ikke noe grønt. Med færre kvaliteter eller kategorier blir man oppfordret til å bruke både blå og grønne kvaliteter.

Frem til nå, er det ingen som sjekker om sluttresultatet av prosjektene ble bygget som antatt ved bruk av BGF. Man må ha planene godkjent av kommunen, men så vidt jeg vet blir det ikke sjekket om sluttresultatet av prosjektet ble som planlagt eller om det fortsatt står etter fem år.

Er det noe mangler knyttet til biologisk mangfold?
Blågrønne strukturer må ofte ses på i et større perspektiv, mens blågrønn faktor handler bare om en konkret tomt. Det er ikke alltid den ene tomten har så mye å si hvis ikke det knyttes opp til andre grønnstruktur.

Nå er det en kategori som går ut på å knytte eksisterende blågrønne strukturer, så den hjelper litt, men ofte så handler det om større områder.

I den første versjonen av BGF i regi av Fremtidens byer var biodiversitet et av målene. Det var grønne kvaliteter, overvannshåndtering og biodiversitet. Det var de tre målene. Vi så at biodiversitet falt litt. Det var kanskje det svakeste punktet fordi det er vanskelig å foreta konkrete målinger.

Stockholm sin versjon av BGF, Gronytefaktor (GYF) er mye mer kompleks, og de har flere punkter som handler om biodiversitet. Men der igjen valgte vi bare å forenkle det. Da tok vi ikke med så mange av de punktene.

Hvis man skal tenke at man skal forbedre delen om biodiversitet, går det an å vurdere å ta med flere av kategoriene fra GYF, f.eks. insekts-hotell og bevaring av gamle trær. Og dette med hvilke typer vegetasjon det er. I Fremtidens byer sin versjon av BGF, hadde vi stedegen vegetasjon som et punkt. Men dette er ikke medbrakt videre i verken Oslo kommune sin versjon eller Standard Norge sin versjon. Det har noe med at det er vanskelig å vurdere og bestemme det i praksis hva som er stedegen vegetasjon.
Man kan få masse poeng for å f.eks. ha et anlegg med bare masse lyng. I stedet for å ha et mangfold av stauder. Det er vanskelig å kontrollere. Jeg tror det kan forbedres.

BGF tar ikke hensyn til hvilket område man befinner seg i og hva som er på stedet fra før av.

Er det noe mangler knyttet til overvannshåndtering?
Jeg synes at det har vært ganske mye vekt på overvannshåndtering i forhold til de metodene som vi så på som modeller. Overvannshåndtering er blitt mer viktig. Vi var bevisst på å ha med blått i navnet på den norske versjonen av metoden, noe vi ikke så i noen av de andre versjonene vi tok utgangspunkt i, så vi endret navn på det fra "Grønytefaktor" til Blågrønn faktor.

Oslo sin versjon har veldig mye poeng for ting som angår overvann. Overvann tar litt over, fordi overvann er lettere å måle. Man må passe på å ikke glemme de grønne kvalitetene. Overvann kan man sette krav på ved andre måter, f.eks. overvannstrategi i Oslo kommune. Grønne kvaliteter og biomangfold er ikke like lett å sette av krav til på andre måter.

Man må huske på at grunnen til at man får poeng for vegetasjon og jorddybde i BGF ikke bare handler om evnen til å håndtere overvann. Vegetasjon gir mange andre kvaliteter som BGF skal være med å sikre.

Kan verktøyet forbedres? Hvordan?
Jeg tror at det alltid kan forbedres. Beste måten å finne ut om hvordan man kan forbedre verktøyet på er ved erfaringer. Jo mer det blir brukt, desto mer ser man svakheter med BGF.

Man må bare fortsette å bruke det og sørge for å BGF har en funksjon og ikke bare blir enda et ark som man fyller ut, men at man ser har en funksjon. Og det tror jeg at det har nå, så man må bare passe på at man fortsetter med det.

Det er snakk om å tilpasse det til forskjellige steder i Norge. Det er ikke alle steder som skal ha de samme kravene. F.eks. opp i Nord-Norge i Finnmark kan man ikke ha store trær. Da er den kategorien i BGF irrelevant. Da er det andre ting som spiller en større rolle, f.eks. snø-håndtering med tanke på overvann. Det blir andre kategorier som er mer aktuelle. Man må se på den lokale tilpasningen for at det skal være relevant. En annen ting kan være det å tilpasse verktøyet til hva slags type tomt det er. Noen tomter er store, og andre små.

Er det noe som er uklart? Eller har du noe spørsmål?
Nei, jeg synes det er bra at du skriver om blågrønn faktor.

5. **Oppsummering**
   Oppsummering av funn

Intervjuobjekt 5

1. **Løs prat**
   Uformell prat. Jeg presenterer meg selv. Respondenten gir sine personalia.

   Navn: Intervjuobjekt 5
   Rolle/ansatt som: Landskapsarkitekt

2. **Informasjon**
   Dette prosjektet er den avsluttende masteroppgaven for studiet Landscape Architecture for Global Sustainability ved Norges miljø- og biovitenskapelige universitet (NMBU). Arbeidet gjennomføres våren 2023 og tilsvarer 30 studiepoeng. Temaet for oppgaven er kritisk gjennomgang av blågrønn faktor som verktøy knyttet til overvannshåndtering og biologisk mangfold. Oppgaven blir belyst gjennom en teoridel og intervju med fagpersoner.

   Intervjuet skal kun brukes til min masteroppgave om blågrønn faktor. Prosjektet vil etter planen avsluttes 15 mai 2023. Notater fra intervjuet vil lagres på et sikkert sted. Etter prosjektslutt vil eventuelle lydopptak fra samtaler bli slettet etter bearbeiding av informasjon.

3. **Innledende spørsmål**
   Kan du fortelle om din erfaring og kjennskap til blågrønn faktor som verktøy?
   Jeg har jobbet med et boligprosjekt i Ås kommune ved bruk av Norsk standard sin versjon av BGF. Jeg har også arbeidet med innspill til Bymiljøetaten i forbindelse med forbedring av standarden for Oslo kommune sin versjon av BGF.

   Hvilke oppgaver har/hadde du?
   For Ås kommune jobbet jeg med forprosjekt og detaljprosjekt, mens jeg ledet prosjektgruppa i Asplan Viak i forbindelse med deloppdrag for Bymiljøetaten.

   Hvilken versjon av veilederen for BGF bruker du/har du brukt? (Fremtidens byer (2014), Oslo kommunes veileder (2018) eller Norsk Standard (2020)?
   Både Norsk Standard og Oslo kommune sin versjon.

4. **Nøkkelspørsmål**

   Kan du fortelle litt om hensikten med å bruke BGF?
   Håndtere overvann og få til flere permeable flater for overvannshåndtering. I tillegg til å bidra til bedre biologisk mangfold.

   Kan du fortelle litt om hvordan du har brukt verktøyet?
   Jeg har brukt verktøyet i forbindelse med boligprosjekt i Ås og oppdrag fra Bymiljøetaten.

Hva har fungert bra med verktøyet?

Det at oppdragsgiver/byggherre må strekke seg for å ha inn en viss andel av areal til vegetasjon, og større bruk av permeable dekker. Det å få inn flere trær har en stor verdi. I tillegg bidrar verktøyet til å motivere til løsninger for å håndtere overvann lokalt, f.eks. bruk av regnbed.

Er det noe mangler ved BGF?
Ved første utregning av blågrønn faktor, har man ikke detaljert informasjon om ulike elementer ferdig. Dette kan derfor endre seg utover i prosjektet, og man kan ende opp med å ha for lite areal til de tiltakene som er satt av i prosjektet.

Er det noe mangler knyttet til biomangfold?
Når det gjelder biologisk mangfold og det å ha med dette temaet på en god måte, tror jeg det er bra å ha med biolog og løfte blikket og se på omgivelsene. Hvilke koblinger er det behov for i de konkrete prosjektene? F.eks. danne korridorer for insekter. Temaet bør ivaretas av en biolog.

Er det nok at landskapsarkitekter med sin bakgrunn fyller ut dette? Eller er det behov for biolog? Biologer kan komme med forslag, men hvordan kan man fange opp og gi poeng? Jeg tenker man bør jobbe mer med punktet om koblinger i BGF og punktet for å sikre at man får til at de har verdi. Punktet om koblinger er i Norsk standard er vanskelig å tyde. Det er vag definisjon på koblinger i Standarden. Har det noe krav til arealer? Viss utstrekning? Jeg savner mer informasjon om disse type koblingene.

Det står lite om krav til hva slags type vegetasjon i BGF. Dette er betydelig med tanke på om det er flersjiktet, og om det er dyre- og innsekts vennlig. Et flersjiktet plantefelt når det forvokser seg stort fungerer bedre og bedre etter hvert som det forbedrer seg.
Det kan bli stort søkelys på å nå akkurat nok arealer i stedet for at kvaliteten blir god (selv om arealkravet er oppnådd).

Å buke BGF og en illustrasjonsplan i en detaljplanfase var litt utfordrende. Da har du ikke vært gjennom en prosjekteringsfase. Illustrasjonsplan er ofte en enkel plan. Det gir en indikasjon på hvilken vei man kan gå. Likevel vil jeg si at BGF har verdi fordi man får satt søkelys på temaet tidlig i prosjektfasen.

Kan verktøyet forbedres? Hvordan?
Punktet om koblinger kan forbedres. Det er rom for å dele opp punktet om koblinger. Man kan stille krav til plantefeltene og ha krav om variasjon i sjikt og hva slags type arter man bruker med tanke på biologisk mangfold.
Man bør få med biologer inn i arbeidet. RIVA (Rådgivende ingeniør vann, avløp og overvann) er med i prosjekteringsarbeidet, og er derfor lettere tilgjengelig, mens biologer har mer avgrensede, spesifikke oppgaver, gjerne i en tidlig fase.

Punktet om trær kan forbedres. Det står ikke spesifikt at det skal være stedegen art eller norsk art. Det bør gis mer poeng for eksisterende trær og vegetasjon

sammenliknet med nyplantede trær og vegetasjon. Det bør vurderes om det skal gis per poeng for spesielt store trær. Trearter som er definert som en fremmed art kan ha verdi for eksempel fugler med attraktive frukter etc. I de fleste prosjekt er det kun aktuelt å bruke arter som har lav risiko (LO). Mange kommuner og ved for eksempel BREEM sertifisering, er det ofte krav om å bruke stedegne arter i et større omfang.

Det bør også gis mer poeng for mangfoldig vegetasjon fremfor ensartet plante. Man bør bevare busker osv. som kanskje ikke er fint, men har en verdi for dyre- og planteliv.

Det er vanskelig å si hvordan borettslaget og andre som eier området vil behandle anlegget på sikt. Vadi og andre overvannstiltak må spesielt sikres for at informasjonen om hensikten og viktigheten med disse elementene blir videreført. Hvordan kan man sikre de kvalitetene videre?
Et eksempel er boligprosjektet i Ås som har veldig flat tomt med små hager inn mot midten. I midten av arealet er det planlagt en forsenkning som skal fungere som flomvei. Dersom man gjør endringer her, vil det kunne stuve opp med overvann ved en flom.

Er det noe som er uklart? Eller har du noe spørsmål?
Nei

5. Oppsummering

Oppsummering av funn

Intervjuobjekt 6

1. **Løs prat**
   Uformell prat. Jeg presenterer meg selv. Respondenten gir sine personalia.

   Navn: Intervjuobjekt 6
   Rolle/ansatt som: Landskapsarkitekt

2. **Informasjon**
   Dette prosjektet er den avsluttende masteroppgaven for studiet Landscape Architecture for Global Sustainability ved Norges miljø- og biovitenskapelige universitet (NMBU). Arbeidet gjennomføres våren 2023 og tilsvarer 30 studiepoeng. Temaet for oppgaven er kritisk gjennomgang av blågrønn faktor som verktøy knyttet til overvannshåndtering og biomangfold.
   Oppgaven blir belyst gjennom en teoridel og intervju med fagpersoner.

   Intervjuet skal kun brukes til min masteroppgave om blågrønn faktor. Prosjektet vil etter planen avsluttes 15 mai 2023. Notater fra intervjuet vil lagres på et sikkert sted. Etter prosjektslutt vil eventuelle lydopptak fra samtaler bli slettet etter bearbeiding av informasjon.

3. **Innledende spørsmål**
   Kan du fortelle om din erfaring og kjennskap til blågrønn faktor som verktøy?
   Har brukt det kun i ett prosjekt i Ås kommune.
   Min kollega jobbet med BGF først i reguleringsfasen, og jeg overtok det i byggeprosjektet.
   I det prosjektet vi har jobbet med er det parkeringskjeller som går over store deler av prosjektområdet. Det er derfor konstruksjoner under grøntarealene som går under blokkene i området. Det å få til god jorddybde har vært en tematikk. BGF har i dette tilfellet vært til hjelp for å få til god jorddybde og få til mest mulig vegetasjon. Det har vært veldig positivt.
   Det er stilt fra kommunens side om at det skulle være krav om BGF på minimum 0.8. Jeg føler BGF har vært en god dra-hjelp til å få inn vegetasjon og få til god jorddybde over konstruksjoner.

   Første beregning av BGF var for reguleringsplan i 2019, som min kollega har gjort. Da brukte vi versjonen til Fremtidens byer. Deretter beregnet vi BGF i forbindelse med rammesøknad/ detaljprosjektering ved bruk av Norsk standard sin versjon. Kravet var som sagt BGF på 0.8, men jeg beregnet meg opp til 0.9. Jeg ønsket å ha litt å gå på, noe som har vist seg å være veldig nyttig. Under bygging nå har det vist seg at vi ikke får den jorddybden vi hadde tenkt fordi konstruksjonen med tilhørende isolasjon osv. bygde mer enn byggingeniørene først oppga til oss.

   Det å ha litt høyere BGF enn kravet for å ha litt å gå på er lurt. Det er f.eks. alltid noen trær som ryker, enten om de er eksisterende eller nye fordi det ikke fungerer å ha de trærne der eller at det ikke går an å ha den og den jorddybden.
   Jeg har også regna på BGF to ganger under bygging. Siste versjon ble beregnet under bygging. I rammesøknaden var BGF på 0.9, mens i den nyeste og siste

beregningen er BGF litt lavere, på 0.85. Det skyldes blant annet litt redusert antall trær og litt mindre jorddybde over konstruksjon. Det var et område som var foreslått til å være grusdekke, som heller ble til asfalt og dermed ble det flere harde dekker. Nå er BGF sunket til 0.8. Det skyldes økonomiske innsparinger som gjør at vi må gjøre endringer som å redusere buskfelt og trær.

BGF har vært veldig positiv fordi byggherre har vært veldig opptatt av at dette er et krav vi må følge. Derfor har de også vært opptatt av at jeg må sjekke BGF underveis og i oppfølgingen. De er veldig påpasselige med at de vil tilfredsstille det kravet.

Hvilke oppgaver har/hadde du?
Jeg har tegnet landskapsplanene, planteplaner med plantelister, detaljtegninger og beregnet BGF.

Hvilken versjon av veilederen for BGF bruker du/har du brukt? (Fremtidens byer (2014), Oslo kommunes veileder (2018) eller Norsk Standard (2020)?
Norsk standard sin versjon.

4. Nøkkelspørsmål

Kan du fortelle litt om hensikten med å bruke BGF?
Det er et krav fra kommunen. Det er hensiktsmessig i form av å tallfeste det grønne. En fin hensikt er at man kan få inn mer grønt i prosjekter. Vi fikk inn flere trær og buskfelt i prosjektet som vi antageligvis ellers ikke hadde fått inn. Og dette med hensyn til åpen overvannshåndtering. Vi har satt på plass en del regnbed i prosjektet.

Kan du fortelle litt om hvordan du har brukt verktøyet?
Her var det rett og slett bare et krav fra kommunen, men jeg synes det har en hensikt i form av at man får tallfestet og verdsatt det grønne. Det er en fin hensikt å få inn mer grønt i prosjektene, og det at man sikrer lokal overvannshåndtering. Det har vi gjort i dette prosjektet, hvor vi har innført en del regnbed.

Hva har fungert bra med verktøyet?
At man sikrer gode jorddybder over konstruksjoner og sikrer mest mulig permeable dekker og unngår mest mulig faste dekker. Og implementering av regnbed.

Er det noe mangler ved BGF?
Det skiller ikke mellom busker og stauder, det går inn under punktet for plantefelt. Jeg vil tro at busker tar opp mer vann enn stauder. Det har vi savnet litt.
Det er ikke like lett å forstå de ulike punktene.

Det står vekstmedium med dybde over 60 cm. Hvis man har større jorddybde enn det, får man ikke mer poeng. Det stopper på 60 cm. Det kunne vært en fordel å ha flere dybder f.eks. over 80cm eller over 1 m og få mer poeng jo dypere det er.

Er det noe mangler knyttet til biologisk mangfold?
Det bør skilles på busker og stauder, og det kan være litt mer variasjon på type vegetasjon. Man kunne fått inn mer poeng for å ha flere sjikt med planter, og fått mer poeng for bruk av norskproduserte arter.

I det prosjektet vi jobber med hadde vi som landskapsarkitekter et mål og ønske om biologisk mangfold. Jeg har fulgt det opp med å ha ganske stor artsvariasjon og hatt flere sjikt, både stauder, busker og trær. Vi har også prøvd å bruke mest mulig norske arter, frøkilder og norske herkomster. Dette er beskrevet i plantelita. Dette har ikke blitt kommunisert så tydelig til byggherre som ikke har kunnskap om planter.
Det som er utfordringen nå, er at det viser seg at de plantene antageligvis ikke er blitt bestilt enda. Og når det gjelder det med norske planter, kreves det en bestillingstid på minst tre år for norske planter fra planteskoler. De har ikke noe særlig av norske planter på lager.

Det har vært en tradisjon i Norge over mange tiår å importere planter. Ifølge Norsk Standard er et tre norskprodusert hvis det har stått tre år i en norsk planteskole, og staude er norskprodusert hvis det har stått i et norsk staudegartneri i en vinter. Dermed får du importerte plantematerialer likevel. Det kan skade det biologiske mangfoldet mener jeg.

Er det noe mangler knyttet til overvannshåndtering?
Nei, ikke egentlig. Det er arealer for regnbed og arealer som går til avrenning. Det er tette flater med avrenning til åpne overvannstiltak. Selv om vi har noe tette flater med asfalt og slik, går alt vannet ned til regnbed. Jeg synes regnearket har fungert til formålet med tanke på åpen overvannshåndtering.

Kan verktøyet forbedres? Hvordan?
Når det gjelder trær, skilles det mellom to forskjellige størrelser på trær, men de har samme vektingsfaktor. Eksisterende trær bør få mer poeng kontra nyplantede trær. Og trær som blir større bør også vektes høyere. Dette var differensiert i den forrige versjonen. Det bør også gis poeng for bruk av norske arter i prosjektet.

Er det noe som er uklart? Eller har du noe spørsmål?
Nei, men jeg vil gjerne lese masteroppgaven din når den er ferdig.

5. Oppsummering
Oppsummering av funn

APPENDIX 3: Interview guides (translated version in English)

Interview guide for master's thesis on blue-green factor

Interviewee 1

1.Small talk

Informal conversation. I introduce myself, and the respondent gives their personal information.

Name: Interviewee 1

Role/position: Landscape architect

2.Information

This project is the final master's thesis for the Landscape Architecture for Global Sustainability program at the Norwegian University of Life Sciences (NMBU). The work will be conducted in the spring of 2023 and corresponds to 30 study points. The theme of the thesis is a critical review of the blue-green factor as a calculation method related to stormwater management and biodiversity. The thesis will be illuminated through a theoretical part and interviews with professionals.

The interview will only be used for my master's thesis on blue-green factor. The project is planned to be completed by May 15, 2023. Notes from the interview will be stored securely. After the project is completed, any audio recordings from conversations will be deleted after processing the information.

3.Introductory questions

Can you tell me about your experience and knowledge of the blue-green factor as a calculation method?

I have been a project manager and developed criteria for biodiversity and stormwater management for Futurebuilt. I have evaluated BGF in that context, as a knowledge base. Furthermore, I have assessed BGF for a complex residential and commercial area in Oslo with some historic buildings. I have also been a project leader for a large urban development project where we have assessed blue-green factor and possible goal achievement. We tested 40 different options by having different spreadsheets to look at different development options for the area and what it takes to ensure goal achievement according to Oslo Municipality's requirements.

I work mostly at the planning level, not the detailed level.

What tasks do/did you have?

I had various tasks. In one project, I have been the project manager for the large urban development project. I was responsible for the landscape architecture and impact assessment themes. In the other project, I am a hired consultant for the Futurebuilt secretariat.

Which version of the BGF guide are you using/have you used? (Framtidens byer (2014), Oslo Municipality's guide (2018), or Norwegian Standard (2020)?

I have used all the different versions of BGF in various projects.

4.Key questions

What is the purpose of using BGF?

The main purpose is to ensure space for climate adaptation. Greenery and vegetation are also important topics but come as subpoints after climate adaptation.

How have you used the BGF calculation method?

I mainly use BGF to see what opportunities for goal achievement exist in connection with the BGF requirements in Oslo municipality. And what measures are possible to ensure goal achievement for BGF 0.7 in the inner city (dense city).

What has worked well with the calculation method?

It ensures space for blue-green structures and good landscape architecture. That is a big advantage. It is an important awareness-raising tool for the various actors involved. It is essential to raise awareness among the different actors about the value of allocating space for blue-green structures.

Are there any shortcomings of BGF?

There are some shortcomings. It is primarily stormwater management that is not well taken care of through BGF. The sites have different characteristics regarding stormwater management, but the goal achievement and requirements are largely the same. Regarding stormwater management, the calculation method takes little account of the site's characteristics and what needs to be managed by stormwater.

Climate gas accounting is also an important topic to bring up when discussing BGF. As it is today, it is possible to create landscapes that will not be climate positive for several generations. A construction project that strives a little towards this will not be climate positive for several generations.

You can make a stormwater measure that appears to be good, but it may not be climate positive for perhaps several hundred years. These methods should therefore also consider the requirements for a climate gas account for the development of this landscape. If not, you may risk using a lot of plastic, concrete, and long-transported stone to achieve this. Then an action that is positive (in adapting to climate change) will be a driver for further climate change.

An Environmental Product Declaration (EPD) should be developed for all materials used in the development of blue-green structures. An EPD is a third-party verified documentation that tells how much climate gas emissions each component has.

Are there any shortcomings regarding stormwater management?

The missing aspect is that you want plots with different characteristics, for example, the Vega scene, a pilot project that was very successful. The project showed that it is possible

to manage stormwater on roofs for today's 200-year rain event. It is evident that this is achievable. This works very well, also in terms of biodiversity. However, even though the project solves stormwater management in an innovative way, sets a new industry standard, and establishes a nationally important habitat on a huge area, it would never reach the blue-green factor. Therefore, the calculation method is not well-suited for the task.

Does the fact that the measures are on rooftops mean that they do not meet the BGF criteria?

Yes, the fact that they are on rooftops is the reason why some projects do not meet the blue-green factor criteria. There are some sites that are only on rooftops today, especially in densely populated areas where it is difficult to implement ground-level measures.

In the new Futurebuilt criteria, we have worked to eliminate extra points for trees and bushes, and instead have placed greater demands on the number of species and local relevance to give designers greater freedom. We have not been as categorical. The pilot projects Vega Scene and Kristian Augusts Gate 13, with the use of green roofs are both great pilot projects that do not meet the BGF criteria. These projects meet the requirements for stormwater management and the desire to develop unique local nature, but they do not have a chance to meet the BGF criteria (only reaching up to 0.4 in BGF) because they do not consider innovation associated with the measures. A blue-green roof is a hybrid between an intensive green roof and a rain garden.

Are there any shortcomings regarding biodiversity?

Yes, there is. In such projects, in my opinion, there needs to be a clearer answer on what is locally valuable. And facilitate the use of a high proportion of locally valuable biodiversity, and a greater focus on locally produced Norwegian species, both in terms of plant diseases, hardiness, CO2 footprint, local production, and genetics (even though this may not have legal standing). There are few requirements for plant material, as I see it, in these projects where there is a requirement for BGF.

Can the calculation method be improved? And how?

The calculation method can be improved. To do so, we need to focus more on facilitating for more customized measures regarding stormwater management. What challenges do we face on the specific site? That is crucial. We must also actively work to map out what type of function this facility should have in terms of developing biodiversity, with particular focus on how the facility can help strengthen the ecology of the area.

If you have an area located in a small catchment area, as we have in some urban areas today, where there is almost no green space on the entire site in a highly urbanized area. Today, stormwater is not a problem when it only hits hard surfaces and is directly drained. Then we see that we must sub-optimize. We must create a rain garden that does not function as a rain garden to meet the requirements of the Oslo municipality. Then the measure becomes more sub-optimized. How do you define a rain garden? How big should it be? How deep should it be? Which parts of the measure should handle water? And what should the water be used for?

I also believe that it should be mandatory to have a greenhouse gas accounting, as I mentioned earlier.

Do you have any questions?

Not really. I think it's an interesting issue and educational, considering that many municipalities are now introducing blue-green factor, and that revisions are also being made around. It's very interesting. It's also important to be pointed out. There will be some findings that are clearer than others, and in that context, I think it's important not only to interview landscape architects, but also skilled biologists and those who work with stormwater so that they can also provide insight into their experience and/or opinions about the calculation method related to stormwater management and biodiversity.

5.Summary

Summary of questions and answers

Interviewee 2

1.Small talk

Informal conversation. I introduce myself, and the respondent gives their personal information.

Name: Interviewee 2

Role/position: Landscape architect

2.Information

This project is the final master's thesis for the Landscape Architecture for Global Sustainability program at the Norwegian University of Life Sciences (NMBU). The work will be conducted in the spring of 2023 and corresponds to 30 study points. The theme of the thesis is a critical review of the blue-green factor as a calculation method related to stormwater management and biodiversity. The thesis will be illuminated through a theoretical part and interviews with professionals.

The interview will only be used for my master's thesis on blue-green factor. The project is planned to be completed by May 15, 2023. Notes from the interview will be stored securely. After the project is completed, any audio recordings from conversations will be deleted after processing the information.

3.Introductory questions

Can you tell me about your experience and knowledge of the blue-green factor as a calculation method?

I work at a more general level, in planning and not necessarily in detail. I got to know the calculation method while studying the subject of blue-green structures at NMBU.

I have not worked with BGF in any projects at Asplan Viak, but Bodø municipality has asked Asplan Viak to hold courses for them. Since the Norwegian Standard came out with its version in 2020, many municipalities are considering it. Many municipalities are going to introduce it and are curious about BGF and need knowledge about it.

I have been in contact with several municipalities, including Øvre Eiker, Alver, Stavanger, and Bergen, regarding courses/training in blue-green factor. What they have in common is that they want to interpret the Norwegian Standard. It is the municipality's responsibility to say how to set requirements for blue-green factor, which factors to set, and which areas it applies to. They need help with this.

4.Key questions

What is the purpose of using BGF?

In 2014, just before the first municipalities introduced requirements for open stormwater management in Norway, there was interest in the topic and an attempt to introduce a calculation method that could encompass the entirety of open stormwater management. It is not just about climate adaptation and stormwater management, it's about the entire green package that is difficult to put into words and requirements. I think BGF is an

attempt to address that entirety and has been a successful attempt. It is based on the German and Swedish versions, so it didn't just come out of nowhere.

Today, stormwater management is not that important for municipalities when working with BGF, because it is taken care of through other requirements that the municipality has. It is the concern for nature that is the other consideration. Nature is specific, while BGF is very unspecific. Even though nature is described as a consideration that should be ensured, it is less able to ensure consideration for nature. Whereas for stormwater, it has been quite positive.

What has worked well with the calculation method?

I think BGF ensures quantity, meaning the amount of blue and green, and as landscape architects, we know very well how to turn this into quality.

BGF sets aside space, which is extremely important, and even allocates funds for blue-green values. Therefore, it is up to us landscape architects to create value out of it.

It is not like developers want to pay for blue and green. There has never been a law or requirement that guarantees blue-green qualities in this way. Usually, it is always trees and vegetation that are sacrificed when the project has little money left at the end. They cannot remove the power cables or the sidewalk. What can we cut then? Well, everything in the landscape can be cut. The fact that we cannot cut it because we are bound to it through BGF is particularly important. The calculation method encourages municipalities and developers to allocate space and funds for blue-green structures.

Are there any shortcomings of BGF?

Yes, there are some missing pieces if BGF is really going to ensure biodiversity. Biodiversity is about the amount of land, but it is also very much about what those areas contain. There are many missing pieces related to biodiversity, but the question is whether all of this should be included in BGF or whether we need to get the municipality to demand it in a different way.

One of the advantages of BGF is that it is so simple. It is an area calculation. It may well be that biodiversity is such a big topic that it needs its own nature strategy, for example, in municipalities. Regardless of how they introduce it, they must do a job of understanding it. But there is a long way to go before all municipalities have their own nature strategy, so it may be that BGF can take us a little way there, at least.

The biggest hole is that it does not take the starting situation into account. You can remove a lot of nature and still get a high BGF. That is not possible. We must stop the loss of biodiversity.

If you go back to the version of "Framtidens byer," I think it is almost better because it distinguishes between locally valuable species. None of the versions of Oslo municipality and Norwegian standard do that. This is a particularly important nuance.

Trees have too little value in BGF both for existing and new trees. This is often what is cut down. Oslo municipality has changed this by giving trees higher value, and I think Norsk Standard should also do this.

Another thing that BGF does not consider is the placement of elements, but it cannot take this into account because it becomes too complicated. However, it is crucial, for example, if you consider that vegetation should slow down the wind, you must put the trees where there is wind. Or if you think that vegetation should absorb air pollution, you must put the trees next to the road. These are the things that landscape architects can do.

Green connections are particularly important and are one of the things that really matter for both biodiversity and people. The assessment of what constitutes a green connection is highly subjective. Green connections are especially important regarding biodiversity. A biologist should conduct this assessment, I think.

There are no requirements for who should make the assessments, and I would imagine that in many smaller projects, it may not be landscape architects who make the assessments, and the architect designs the outdoor area and decides what is a green connection without having any knowledge about it. The calculation method could have gone further by specifying that certain professionals should make the assessments. Biologists or ecologists should have been specified.

The large urban municipalities are in a coastal landscape, and they may be the first to implement BGF. In such a type of nature or landscape on roofs, there will be extremely high value in a type of meadow such as Vega Scene. You need only 20 cm of soil, and this may have the greatest value for the native nature in that landscape.

I know that minks that have spread in Norwegian nature take out many seabird colonies. They take all the eggs, and they can swim far, so they can reach different islands. Where will these birds then nest? Seabirds are one of the species groups that struggle a lot in Norway. It has been proven that these birds can thrive on green roofs. Therefore, facilitating such type of nature on roofs is important.

The things that are missing in BGF are mostly included in the BREEAM and FutureBuilt criteria. They go a little further but apply to the most ambitious projects who choose BREEAM or FutureBuilt. That is the disadvantage of these methods.

Are there any shortcomings regarding stormwater management?

We have reached 2023, and stormwater is mostly managed through other requirements. Of course, this does not apply to all municipalities.

Much of what is missing in the Norwegian blue-green factor is found in the Swedish Green Area Factor (GYF). They have a larger GYF and have many good requirements. There, it is more specified what is important for biodiversity. In Stockholm, the projects that have used GYF are particularly good. They are good projects. But they have a different type of administration. The municipalities are much more involved when it comes to development. Without knowing it completely, it seems to work well. They have taken a different path than us. They have not made it as simple as possible, but made it more complicated, but then they think that many of the things that you must think about are covered by GYF.

Are there any shortcomings regarding biodiversity?

The main shortcomings are that it does not differentiate between plant species. One gets the same number of points for harmful foreign species and Norwegian species. It does

not promote diversity, and one gets the same number of points for uniform or diverse plants. It also does not differentiate based on what was on the site before. Agricultural soil is not mentioned, which is problematic if one wants to create a prestigious project on agricultural soil.

The calculation method does not give points for existing landscapes and does not consider the existing situation of the site. One can build on highly valuable nature and still get a high BGF score.

Can the calculation method be improved? And how?

Yes, then one must take a stance in Norway, and make it larger and more complicated. Or should we keep it simple? I believe that BGF will elevate many projects and increase knowledge in many municipalities just as it is now. Just the fact that many municipalities are introducing it, and are forced to understand these issues, I think is very important.

Biodiversity in Norway is threatened, so if we don't have BGF that promotes biodiversity, we need something else. We don't take sufficient account of it in development projects. We see this repeated in several cases.

There are four sustainable development goals that we in Norway do very poorly on. These include life on land (no. 15) and life below water (no. 14). In other words, take care of nature. In addition to this, responsible consumption, and production (no. 12) and sustainable cities and communities (no. 11). This may be due, among other things, to the fact that we are getting less green structure in, for example, the cities, so those are the issues that we can largely influence through how the outdoor areas are and to some extent through BGF.

This is a snapshot. Over time, the qualities can deteriorate without being captured. Ultimately, it is the residents who decide on their residential area and can, for example, cut down the trees in the area for various reasons if they wish. In addition, the facilities must be maintained every year, and BGF does not capture the time aspect.

The new BREEAM requirement states that there must be a perpetual maintenance plan that must be followed. It is important to consider what was in the development area before. And how can it be improved? Instead of thinking that one always has a certain BGF, for example, 0.7. Or that it can be weighted better. More experiences will come with time.

Many of the ambitious projects we have had would probably have been difficult to achieve a high BGF. For example, there is a building that needs to be renovated, and you get the requirement right away. It is not possible to add more green elements on the roof, and there is no space on the ground level. How can one achieve the BGF requirement then? Maybe it is something about thinking improvement from existing conditions, and not always a predetermined minimum BGF requirement.

Do you have any questions?

No, you are addressing a topic that we at Asplan Viak are concerned about. How we can better preserve the blue-green values in the early phase and not rely solely on the developer's ambitions and our rhetoric. We should talk about the green values, but we

need some requirements to support us, and one of them is BGF. Perhaps there are also other regulatory requirements and things that can support this?

5.Summary

Summary of questions and answers

Interviewee 3

1.Small talk

Informal conversation. I introduce myself, and the respondent gives their personal information.

Name: Interviewee 3

Role/position: Water engineer (stormwater and climate adaptation)

2.Information

This project is the final master's thesis for the Landscape Architecture for Global Sustainability program at the Norwegian University of Life Sciences (NMBU). The work will be conducted in the spring of 2023 and corresponds to 30 study points. The theme of the thesis is a critical review of the blue-green factor as a calculation method related to stormwater management and biodiversity. The thesis will be illuminated through a theoretical part and interviews with professionals.

The interview will only be used for my master's thesis on blue-green factor. The project is planned to be completed by May 15, 2023. Notes from the interview will be stored securely. After the project is completed, any audio recordings from conversations will be deleted after processing the information.

3.Introductory questions

Can you tell me about your experience and knowledge of the blue-green factor as a calculation method?

I have worked on this in several projects. Usually, it's the landscape architects who do the calculations, but I have also done it in some projects.

What tasks do/did you have?

I did calculations and was a consulting engineer (RIVA) in the project. I also did the stormwater assessment.

Which version of the BGF guide are you using/have you used? (Fremtidens byer (2014), Oslo Municipality's guide (2018), or Norwegian Standard (2020)?

Worked on Oslo Municipality's version.

4.Key questions

What is the purpose of using BGF?

There is a requirement for it, especially in Oslo municipality where it is mandatory. They hope that this will ensure certain qualities in building projects and ensure green qualities in urban spaces. The calculation method is appropriate in that context, but one should not include stormwater management, for example. This is already well ensured through the municipality's stormwater management plan. This is what Oslo municipality has landed on now, after revising their version of BGF.

Those who have gone through the calculation method have done some work and seen that it is not so appropriate for BGF to ensure stormwater management because it is not highly effective in that regard. There are already municipal requirements that must be met.

Today, the intention is for BGF to also ensure stormwater management, but it does not work so well for that purpose. BGF is better suited to ensure Step 1 in the three-step strategy. The calculation method is good at ensuring permeable surfaces, which corresponds to Step 1 in the three-step strategy.

What has worked well with the calculation method?

It is that it ensures green qualities. When working on development projects, there is often an absolute requirement that must be met. It is easier to include permeable surfaces, for example, in the plan. The good measures for BGF that would otherwise yield to other reasons become a requirement in BGF. It works well for that.

There are many municipalities that do not have requirements for stormwater management that for instance ensure permeable surfaces.

Are there any shortcomings of BGF?

Regarding stormwater management, BGF is not a good calculation method for ensuring that water is properly managed. BGF only ensures the area is allocated, not where the areas are located. For example, rain gardens can be in odd places and still receive the same BGF score. In that case, the measures will not be effective and will only have negative consequences. It would be better to use the space for something more useful. This is the biggest weakness that I can think of.

The spreadsheet favours rain gardens, but they can be placed in very odd locations. It is a bit of a shame. What we also see is that it can be difficult to secure areas in the early stages, at least in Oslo. It is challenging to achieve in the detailed planning stage because one must consider basement decks. Especially in densely populated areas, there are often basement decks below the plan. It is easy to say, for example, that there should be a rain garden on the basement deck, but then you need a certain structure. So, there is a lot that BGF doesn't ensure.

But it is particularly good for ensuring biological diversity or securing green structures, but it is not good at ensuring stormwater management. This is my experience. It has a lot to do with the fact that you can place the measures anywhere. There is no requirement for where the measures should be placed.

In the early stages, I see that you can easily set aside areas for terrain depression by 20cm, but when you start detailing the plans, you see that it doesn't work. Then you suddenly only have half the area. Areas that are set aside in the early stages can quickly be halved. It is difficult because you must set aside quite detailed areas on a very rough plan. But it is incredibly positive that you start the process of thinking so early, but it is challenging.

It can be difficult to set aside enough soil volume. For example, if you are going to have terrain depression or rain garden on the basement deck. The calculation method does not say anything about how much cover you need. It can be a bit challenging, and then

there can be a large variation in the quality of the measures. Let us say in a project, you may only have 30 cm above the basement deck. It will not be a good rain garden.

Can the calculation method be improved? And how?

One can make a thorough assessment whether stormwater management is part of this, or whether it is more for securing blue-green structures. That is what the calculation method is best at. And one can optimize that part instead.

Do you have any questions?

Not that I can think of.

5.Summary

Summary of questions and answers

Interviewee 4

1.Small talk

Informal conversation. I introduce myself, and the respondent gives their personal information.

Name: Interviewee 4

Role/position: Landscape architect

2.Information

This project is the final master's thesis for the Landscape Architecture for Global Sustainability program at the Norwegian University of Life Sciences (NMBU). The work will be conducted in the spring of 2023 and corresponds to 30 study points. The theme of the thesis is a critical review of the blue-green factor as a calculation method related to stormwater management and biodiversity. The thesis will be illuminated through a theoretical part and interviews with professionals.

The interview will only be used for my master's thesis on blue-green factor. The project is planned to be completed by May 15, 2023. Notes from the interview will be stored securely. After the project is completed, any audio recordings from conversations will be deleted after processing the information.

3.Introductory questions

Can you tell me about your experience and knowledge of the blue-green factor as a calculation method?

I developed BGF spreadsheets under the auspices of "Framtidens byer", using the Swedish versions as a model. I have presented this at different venues in Norway and received feedback from landscape architects.

What tasks do/did you have?

I have calculated BGF and worked on projects using BGF, but then I have used Oslo municipality's version. I have also been in the expert group in "Standard Norge" in the development of a new Norwegian standard for blue-green factor, and in addition, I engaged in the development of the first version of BGF in "Framtidens byer".

Which version of the BGF guide are you using/have you used? (Fremtidens byer (2014), Oslo Municipality's guide (2018), or Norwegian Standard (2020)?

I have only used Oslo municipality's version in real projects but used "Framtidens byer" version in example projects.

4.Key questions

What is the purpose of using BGF?

To ensure minimum quality of green spaces and stormwater in projects. Green qualities and stormwater are not easy to quantify. BGF contributes by setting requirements for blue-green solutions in projects.

The calculation method motivates for open stormwater management solutions and helps to improve blue-green qualities in outdoor areas. It works well pedagogically to communicate with clients and developers and highlights the importance of blue-green structures such as soil depth and volume.

How have you used the BGF calculation method?

I created collections of examples and calculated BGF. We used BGF in a residential project in Oslo where the municipality required the calculation of BGF. Then we used it in the detailed planning of the plot to show that it was possible to achieve a satisfactory BGF for that project.

What has worked well with the calculation method?

What works is that it is educational, that one can demonstrate the importance of having many trees or diverse vegetation. Or that one has open stormwater management. It is important to have enough soil volume on the roofs. All these aspects earn points, making it impossible to remove these elements. We can demand that more soil and outdoor space are needed because if these are not considered, BGF requirements will not be met.

The calculation method simply contributes to setting aside areas and prioritizing blue-green solutions. This is done as early as the detailed planning phase. Attention is paid to it quite early on.

Since I have calculated several BGF examples, we see that it often works better on smaller plots. On larger plots, it may be less relevant to count the number of square meters of one thing or another, for example, if there is a large forest in the project area. It can become too much of one category. It works best on smaller plots, especially in city centre or urban areas.

Are there any shortcomings of BGF?

I believe there will always be some shortcomings. When developing these methods, there must always be a balance between ensuring the highest possible qualities and user-friendliness. Categories cannot be too large, and calculations cannot be too complicated. The simpler it is to calculate, the less detailed it becomes. One must constantly find a balance between the most important qualities and what can be done about them. If there are too many qualities or categories, the gain can be lost. For example, there may be a lot of blue and almost no green. With fewer qualities or categories, one is encouraged to use both blue and green qualities.

So far, no one checks if the result of the projects was built as intended using BGF. The plans must be approved by the municipality, but, it is not checked if the result of the project was as planned or if it still exists after five years.

Are there any shortcomings regarding biodiversity?

Blue-green structures often need to be viewed in a larger perspective, while blue-green factor only applies to a specific plot of land. The impact of a single plot may not be significant if it is not linked to other green structures.

Now there is a category for linking existing blue-green structures, so it helps a little, but often it is about larger areas.

In the first version of BGF under “Framtiden byer,” biodiversity was one of the goals. It was green qualities, stormwater management, and biodiversity. Those were the three goals. We saw that biodiversity was a bit weak. It was the weakest point because it is difficult to make specific measurements.

Stockholm's version of BGF, “Gronytefaktor” (GYF), is much more complex, and they have several points related to biodiversity. But again, we chose to simplify it. We did not include many of those points. If one wants to improve the biodiversity section, it is possible to consider including more categories from GYF, such as insect hotels and preservation of old trees.

The types of vegetation are important. In Framtidens byer's version of BGF, we had local vegetation as a point. But this is not included in either Oslo municipality's version or Norwegian Standard’s version. It has to do with the difficulty of assessing and determining what is local vegetation in practice. One can get a lot of points for having a site with only heather, instead of having a variety of perennials. It is difficult to control. I think it can be improved.

BGF does not consider the area where the project is located and what is already present there.

Are there any shortcomings regarding stormwater management?

I think there has been quite a focus on stormwater management compared to the methods we looked at as models. Stormwater management has become more important. We were conscious of including "blue" in the name of the Norwegian version of the method, which we didn't see in any of the other versions we based it on, so we changed the name from "Grønytefaktor" to blue-green factor.

Oslo's version has a lot of points for things related to stormwater. Stormwater takes over a bit because it is easier to measure. One must make sure not to forget the green qualities. Stormwater can be regulated in other ways, for example through a stormwater strategy in Oslo municipality. Green qualities and biodiversity are not as easy to regulate in other ways.

One must remember that the reason why vegetation and soil depth are awarded points in BGF is not just about the ability to manage stormwater. Vegetation provides many other qualities that BGF is meant to help ensure.

Can the calculation method be improved? And how?

I believe that there is always room for improvement. The best way to figure out how to improve the calculation method is through experience. The more it is used, the more weaknesses in BGF become apparent. One must just keep using it and ensure that BGF has a function and is not just another form to fill out, but that it serves a purpose. I believe it does now, so one must just make sure to continue with it.

It's about adapting it to different places in Norway. Not all places should have the same requirements. For example, in northern Norway in Finnmark, you can't have large trees. Then that category in BGF is irrelevant. There are other things that play a greater role, such as snow management regarding stormwater. Other categories become more relevant. You must look at the local adaptation to make it relevant. Another thing could be to adapt the calculation method to the type of plot it is. Some plots are large, and others are small.

Do you have any questions?

No, I think it is great that you write about blue-green factor.

5.Summary

Summary of questions and answers

Interviewee 5

1.Small talk

Informal conversation. I introduce myself, and the respondent gives their personal information.

Name: Interviewee 5

Role/position: Landscape architect

2.Information

This project is the final master's thesis for the Landscape Architecture for Global Sustainability program at the Norwegian University of Life Sciences (NMBU). The work will be conducted in the spring of 2023 and corresponds to 30 study points. The theme of the thesis is a critical review of the blue-green factor as a calculation method related to stormwater management and biodiversity. The thesis will be illuminated through a theoretical part and interviews with professionals.

The interview will only be used for my master's thesis on blue-green factor. The project is planned to be completed by May 15, 2023. Notes from the interview will be stored securely. After the project is completed, any audio recordings from conversations will be deleted after processing the information.

3.Introductory questions

Can you tell me about your experience and knowledge of the blue-green factor as a calculation method?

I have worked on a housing project in Ås municipality using the Norwegian standard version of BGF. I have also worked on providing feedback to "Bymiljøetaten" regarding the improvement of the standard for Oslo municipality's version of BGF.

What tasks do/did you have?

For Ås municipality, I worked on preliminary and detailed project, while I led the project group at Asplan Viak in connection with a sub-assignment for "Bymiljøetaten."

Which version of the BGF guide are you using/have you used? (Fremtidens byer (2014), Oslo Municipality's guide (2018), or Norwegian Standard (2020)?

Both the Norwegian Standard and the Oslo municipality's version.

4.Key questions

What is the purpose of using BGF?

Stormwater management and creating more permeable surfaces for stormwater management, in addition to contributing to improved biodiversity.

How have you used the BGF calculation method?

I have used the calculation method in connection with a housing project in Ås and assignments from "Bymiljøetaten."

What has worked well with the calculation method?

The fact that the client/developer must try to include a certain proportion of the area for vegetation and increase the use of permeable surfaces. Having more trees has terrific value. Additionally, the calculation method contributes to motivating solutions for local management of stormwater, for example, the use of rain gardens.

Are there any shortcomings of BGF?

When calculating blue-green factor for the first time, detailed information about various elements is not yet available. Therefore, this can change during the project, and one can end up having too little area for the measures that have been allocated in the project.

Are there any shortcomings regarding biodiversity?

When it comes to biodiversity and incorporating this topic in an effective way, I believe it's good to involve a biologist and broaden the perspective to consider the surroundings. What connections are needed in the specific projects? For example, creating corridors for insects. The topic should be taken care of by a biologist.

Is it enough that landscape architects with their background fill out this information? Or is there a need for a biologist? Biologists can produce suggestions, but how can these be captured and given scores? I think we should work more on the point about connections in BGF and ensuring that they have value. The point about connections in the Norwegian standard is difficult to interpret. There is a vague definition of connections in the standard. Does it have any requirements for areas? Extent? I miss more information about these types of connections.

There is little information in BGF about requirements for the type of vegetation. This is significant considering whether it is multi-layered and friendly to animals and insects. A multi-layered planting area functions better as it grows and improves over time. There may be a lot of focus on reaching the required amount of area rather than ensuring excellent quality (even if the area requirement is met).

Using BGF and an illustration plan in a detailed planning phase was challenging. You have not gone through a design phase. An illustration plan is often a simple plan. It provides an indication of the direction to go. Nevertheless, I would say that BGF has value because it puts the focus on the topic early in the project phase.

Can the calculation method be improved? And how?

The point about connections can be improved. There is room to divide the point about connections. One can demand certain requirements for the planting fields and have requirements for variation in layers and types of species used regarding biodiversity.

Biologists should be included in the work. RIVA (Consulting Engineer Water, Sewer, and Stormwater) is involved in the design work and is therefore more accessible, while biologists have more limited, specific tasks, usually in an early phase.

The point about trees can be improved. It does not specifically state that it should be a native or Norwegian species. More points should be awarded for existing trees and

vegetation compared to newly planted trees and vegetation. It should be considered whether to give extra points for particularly large trees. Tree species that are defined as alien species may have value, for example, for birds with attractive fruits, etc. In most projects, it is only relevant to use species that have low risk (LO). Many municipalities and in, for example, BREEM certification, there are often requirements to use native species to a greater extent.

There should also be more points awarded for diverse vegetation rather than uniform planting. We should preserve bushes, etc. that may not look nice, but have value for wildlife and plant life.

It is difficult to predict how the housing association and others who own the area will treat the facility in the long term. Vadi and other stormwater measures must be secured to ensure that information about the purpose and importance of these elements is passed on. How can we ensure that these qualities are maintained?

An example is the residential project in Ås, which has a very flat plot with small gardens towards the center. In the middle of the area, a depression is planned to function as a floodway. If changes are made here, it could result in the accumulation of stormwater during a flood.

Do you have any questions?

No

5.Summary

Summary of questions and answers

Interviewee 6

1.Small talk

Informal conversation. I introduce myself, and the respondent gives their personal information.

Name: Interviewee 6

Role/position: Landscape architect

2.Information

This project is the final master's thesis for the Landscape Architecture for Global Sustainability program at the Norwegian University of Life Sciences (NMBU). The work will be conducted in the spring of 2023 and corresponds to 30 study points. The theme of the thesis is a critical review of the blue-green factor as a calculation method related to stormwater management and biodiversity. The thesis will be illuminated through a theoretical part and interviews with professionals.

The interview will only be used for my master's thesis on blue-green factor. The project is planned to be completed by May 15, 2023. Notes from the interview will be stored securely. After the project is completed, any audio recordings from conversations will be deleted after processing the information.

3.Introductory questions

Can you tell me about your experience and knowledge of the blue-green factor as a calculation method?

I have only used it in one project in the Ås municipality. My colleague worked with BGF in the planning phase, and I took over during the construction project. In the project we worked on, there is an underground multistorey car park that covers a large part of the project area. Therefore, there are structures under the green areas that go under the blocks in the area. Achieving good soil depth has been a theme, and BGF has been helpful in achieving good soil depth and maximizing vegetation. It has been incredibly positive. The municipality has required a minimum BGF of 0.8. I feel that BGF has been a good help in introducing vegetation and achieving good soil depth on constructions.

The first calculation of BGF was for the zoning plan in 2019, which my colleague did. We used the version from "Framtidens byer." Then we calculated BGF in connection with the application for building permission/detailed design using the Norwegian Standard version. The requirement was, as mentioned, a BGF of 0.8, but I calculated it up to 0.9. I wanted to have a little margin, which has proven to be extremely useful. During construction, it has turned out that we will not get the soil depth we had planned because the construction with the associated insulation built more than the construction engineers initially reported to us.

Having a slightly higher BGF than the requirement to have some margin is wise. For example, there are always some trees that are removed, whether they are existing or new,

because it does not work to have them there or it is not possible to have that specific soil depth.

I also calculated the BGF twice during construction. The latest version was calculated during construction. In the building permit application, the BGF was 0.9, while in the latest and final calculation, the BGF is slightly lower, at 0.85. This is due, among other things, to a slightly reduced number of trees and less soil depth over the structure. An area that was proposed to have gravel surface became asphalt, which resulted in more hard surfaces. Now the BGF has dropped to 0.8. This is due to cost savings, which require us to make changes such as reducing shrub areas and trees.

BGF has been incredibly positive because the client has been very concerned that this is a requirement we must follow. Therefore, they have also been concerned that I check the BGF during the process and in the follow-up. They are incredibly careful to meet the requirement.

What tasks do/did you have?

I have drawn landscape plans, plant plans with plant lists, detailed drawings, and calculated BGF.

Which version of the BGF guide are you using/have you used? (Fremtidens byer (2014), Oslo Municipality's guide (2018), or Norwegian Standard (2020)?

I used the version from Standard Norge.

4.Key questions

What is the purpose of using BGF?

It is a requirement from the municipality. It is useful in terms of quantifying the greenery. One nice aspect is that it allows for more greenery to be incorporated into projects. We were able to include more trees and shrubbery in the project that we would not have otherwise. Regarding open stormwater management, we have implemented several rain gardens in the project.

How have you used the BGF calculation method?

Here, it was simply a requirement from the municipality, but it has a purpose in terms of quantifying and valuing the greenery. It is a nice purpose to incorporate more greenery into projects, and to ensure local stormwater management. We have done that in this project, where we have introduced several rain gardens.

What has worked well with the calculation method?

To ensure good soil depths on constructions and ensure as much permeable surfaces as possible and avoid dense surfaces. And implementation of rain gardens.

Are there any shortcomings of BGF?

It does not distinguish between shrubs and perennials; it falls under the category of planting areas. I would assume that shrubs absorb more water than perennials.

It is not easy to understand the different criteria.

It says growth medium with a depth of over 60 cm. If you have a deeper soil depth than that, you do not get more points. It stops at 60 cm. It could be an advantage to have more depths such as over 80 cm or over 1 m and get more points the deeper it is.

Are there any shortcomings regarding biodiversity?

It should differentiate between shrubs and perennials, and there could be a bit more variation in the type of vegetation. You could earn more points for having more layers of plants and for using Norwegian-produced species.

In the project we are working on, as landscape architects, we had a goal and a desire for biodiversity. I have followed it up by having quite a large variety of species and having multiple layers, including perennials, shrubs, and trees. We have also tried to use as many Norwegian species, seed sources, and Norwegian origins as possible. This is described in the plant list. However, this has not been communicated clearly to the client who lacks knowledge about plants.

The challenge now is that it appears that the plants have not yet been ordered. When it comes to Norwegian plants, a minimum of three years' lead time is required for ordering them from nurseries. They do not have a large stock of Norwegian plants.

There has been a tradition in Norway for many decades of importing plants. According to the Norwegian Standard, a tree is considered Norwegian-produced if it has been in a Norwegian nursery for three years, and a perennial is considered Norwegian-produced if it has been in a Norwegian perennial nursery for one winter. Therefore, you can still get imported plant materials. I think this can harm biodiversity.

Are there any shortcomings regarding stormwater management?

No, not really. There are areas for rain gardens and areas that are dedicated to runoff. There are also impervious surfaces that drain into open stormwater management systems. Even though we have some impervious surfaces like asphalt, all the water flows down to the rain gardens. I think the spreadsheet has served its purpose well in terms of open stormwater management.

Can the calculation method be improved? And how?

Regarding trees, there are two different sizes of trees distinguished, but they have the same weighting factor. Existing trees should receive more points compared to newly planted trees. And trees that grow larger should also be weighted higher. This was differentiated in the previous version. Points should also be given for the use of Norwegian species in the project.

Do you have any questions?

No, but I would like to read your master's thesis when it's finished.

5.Summary

Summary of questions and answers

APPENDIX 4: Information letter and consent form

Vil du delta i forskningsprosjektet (masteroppgave)
" **Securing blue-green qualities in urban projects**

A qualitative case study of the calculation method in Asplan Viak"?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt (masteroppgave) hvor formålet er å snakke med fagpersoner i Asplan Viak som har benyttet seg av blågrønn faktor som verktøy i urbane landskapsprosjekter, og deres erfaringer med verktøyet knyttet til overvannshåndtering og biomangfold.

I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Dette prosjektet er den avsluttende masteroppgaven for studiet Landscape Architecture for Global Sustainability ved Norges miljø- og biovitenskapelige universitet (NMBU).

Arbeidet gjennomføres våren 2023 og tilsvarer 30 studiepoeng. Hele oppgaven skrives på engelsk. Temaet for oppgaven er kritisk gjennomgang av blågrønn faktor som verktøy i urbane landskapsprosjekter. Oppgaven blir belyst gjennom en teoridel og semistrukturerte dybdeintervju med fagpersoner.

Masteroppgaven har følgende foreløpige forskningsspørsmål for oppgaven (endringer kan forekomme underveis)

Main research questions

To what degree can the Norwegian standard for blue-green factor promote stormwater management and biodiversity, when applied in planning of urban landscape projects?

Sub- research questions

1. What are the strengths and weaknesses of BGF when using the calculation method to facilitate stormwater management and biodiversity?

2. How can the Norwegian standard of blue-green factor be improved for better stormwater management and biodiversity conservation?

Hvem er ansvarlig for forskningsprosjektet?

Norges miljø- og biovitenskapelige universitet (NMBU) er ansvarlig for masterprosjektet.

Hvorfor får du spørsmål om å delta?

Utvalget av fagpersoner er valgt ut basert på relevant fagfelt innenfor teamet for masteroppgaven.

Hva innebærer det for deg å delta?
Hvis du velger å delta i prosjektet (masteroppgaven), innebærer det at du har mulighet til å komme med innspill til bruk av blågrønn faktor knyttet til overvannshåndtering og biomangfold, og dele eventuelle spesifikke prosjekter for å belyse dette.

Jeg ønsker å ta notater og eventuelt lydopptak fra møtene.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene du gir til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

Tilgang ved behandlingsansvarlig institusjon er følgende:

Hovedveileder, biveileder, andre fra Instituttet ved Fakultet for landskap og samfunn på NMBU. Navnet og kontaktopplysningene dine vil jeg erstatte med en kode som lagres på egen navneliste adskilt fra øvrige data

Deltakere vil muligens kunne gjenkjennes i publikasjonen, men det er eventuelt kun personopplysninger slik som navn, arbeidstittel og arbeidssted.

Hva skjer med personopplysningene dine når forskningsprosjektet avsluttes?
Prosjektet vil etter planen avsluttes 15 mai 2023. Etter prosjektslutt vil datamaterialet med dine personopplysninger anonymiseres. Opplysninger om navn, arbeidstittel og arbeidssted vil bli kodet. Lydopptak fra samtaler vil bli slettet etter bearbeiding av informasjon.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Norges miljø- og biovitenskapelige universitet (NMBU) har Sikt – Kunnskapssektorens tjenesteleverandør vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:
- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:
- Norges miljø- og biovitenskapelige universitet

  Student: Say Kpaw Rustad (say.kpaw.chai@nmbu.no)

  Veileder: Tore Edvard Bergaust (tore.edvard.bergaust@nmbu.no)

Vårt personvernombud: personvernombud@nmbu.no

Hvis du har spørsmål knyttet til vurderingen som er gjort av personverntjenestene fra Sikt, kan du ta kontakt via:

- Epost: personverntjenester@sikt.no eller telefon: 73 98 40 40.

Med vennlig hilsen

Tore Edvard Bergaust
(Veileder)

Say Kpaw Rustad
(Student)

Jeg har mottatt og forstått informasjon om prosjektet [**Evaluation of the Norwegian blue-green factor framework**. A qualitative case study of the calculation method in Asplan Viak], og har fått anledning til å stille spørsmål. Jeg samtykker til:

- ☐ å delta i møte/samtale med studenten
- ☐ å meddele dokumenter og informasjon om prosjekter hvor BGF er benyttet
- ☐ at opplysninger om meg publiseres slik at jeg kan gjenkjennes (kun i masteroppgaven)

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

---

(Signert av prosjektdeltaker, dato)

APPENDIX 5: Term clarifications

Biological diversity: "The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

(Convention on Biological Diversity, 2006)

Blue- green infrastructure (BGI): "Strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem service."

(European Commission, 2021)

Nature-based solutions: "Actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously benefiting people and nature."

(Union of Government and Civil society organisations, n.d.)

Permeable surfaces: "Permeable surfaces (also known as porous or pervious surfaces) allow water to percolate into the soil to filter out pollutants and recharge the water table."

(University of Delaware, n.d.)

Rain garden: "Depressed area in the landscape that collects rainwater from a roof, driveway or street and allows it to soak into the ground."

(United States Environmental Protection Agency, 2022b)

Stormwater: Stormwater is surface water that is generated from rain and snowmelt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground.

(United States Environmental Protection Agency, 2022a)

Urban resilience: "The capacity of individuals, communities, institutions, businesses and systems within a city to survive, adapt and grow no matter what kinds of chronic stresses and acute shocks they experience."

Norges miljø- og biovitenskapelige universitet
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