Nordic Council of Ministers

Practical experiences with nature-based solutions in the Nordics

Summarising insights from eight pilot projects (2022-23)

Contents

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Preface

This report, commissioned by the Nordic Council of Ministers (NCM), represents an effort to advance the implementation of nature-based solutions (NBS) in the Nordic region. It has been guided by the urgent need to address societal challenges, such as climate change, biodiversity loss and pollution, through nature-focused strategies. An overarching aim of the project has been to uncover strategies for fostering impactful and sustainable NBS initiatives in the Nordics.

The report compiles insights from eight pioneering pilot projects funded by the NCM, each providing insights into the practical application of NBS within diverse Nordic contexts. We studied these NBS pilot projects while they were underway, in the period February 2022 to November 2023.

Our approach has been to capture experiences, learn and synthesize, rather than to evaluate the pilot projects. The insights and findings of the report are based on the contributions of the project leaders and other project contacts. Through interviews and workshops with the pilot project leaders and contact persons, we have compiled insights from the NBS projects as they unfold. Given that the projects are still ongoing, we strongly recommend that the capturing of these experiences continues, including monitoring of effects and post-evaluation of the projects.

We see this report as a contribution to future NBS discussions and research, aiming to enhance their effective implementation. Lessons from the national NBS pilot projects are relevant beyond the immediate practical application; they are relevant for strengthening the role of NBS as an integral part of the environmental policies in the Nordics.

The project report is written by Line Barkved, Caroline Enge, and Ingvild Skumlien Furuseth from the Norwegian Institute for Water Research (NIVA), and Leonard Sandin from the Norwegian Institute for Nature Research (NINA).

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Summary

In this report, we present the findings obtained from the project **Summarizing and sharing the experiences, knowledge, barriers and advices from nature-based solutions pilot projects in the Nordics** (**S-UMMATION**). The project is funded by the Nordic Council of Ministers' four-year programme on nature-based solutions (2021-2024). The objective of the programme is to encourage the Nordic countries to work together and enhance their knowledge of nature-based solutions (NBS) and to enable the effective and efficient implementation of NBS in the Nordics.

There is a growing international and national emphasis on NBS as an alternative, or complement, to more technical or "grey" solutions. There is also a recognition that we still need more knowledge about what and how NBS works in practice and "on the ground" and under which circumstances. In this study we present insights from eight ongoing NBS pilot projects funded by the NCM programme on NBS. These projects offer a diverse range of NBS types, societal problems addressed, and climatic and landscape variations across the Nordics. We have followed these projects over one and a half years (February 2022–November 2023). Our ambition was not to evaluate the pilot projects, but rather to harvest insights to support effective and efficient implementation of NBS in the Nordics and to enable transferability and upscaling. The information we gathered comes from interviews and workshops with the project leaders and team members, in addition to information from project descriptions and other written materials. S-UMMATION has not evaluated the performance or results of the eight pilot projects *per se.*

Our findings focus on shared key insights from the pilot projects, that are important for the development of NBS development in the Nordic region. We recognize that not all insights from these projects are universally applicable or equally relevant. Accordingly, the current report also highlights certain specific framing circumstances related to the individual projects. The NBS pilot projects serve as tangible demonstrations of the potential that NBS applications have in the Nordic region. The S-UMMATION project followed the NBS pilot projects about half-way or a little longer in their project period. From our findings, it is evident that they align with, and underscore previous research findings related to the implementation of NBS (Cohen-Shacham et al. 2019; Ershad Sarabi et al. 2019). Yet, the projects also offer some new insights and nuances relevant for NBS in the Nordics, showing that the framing conditions under which the projects develop also affects the NBS project process and potentially also the outcomes. The findings highlight the importance of involving landowners and land ownership aspects in NBS planning and implementation. An important observation is that the NBS projects and implementation to a large degree concerns people and interactions between people, both within the projects and stakeholders and actors in the area, as well as related to administrative processes. The pilot projects have had success in achieving their goals due to careful planning and by using processes which allow for broad involvement and collaboration.

The outcomes and learnings of the pilot projects provide knowledge to enable the advancement and implementation of similar projects. Therefore, studying the NBS projects after they are officially finished is something we highly recommend. As this is work in progress, these projects warrant follow-up, to gain insight from the complete project period and beyond. Furthermore, we recommend the ongoing sharing of experiences between the pilot projects and with other relevant stakeholders for the duration of the NCM's program on NBS. This will foster a collaborative environment to promote shared learning and educated risk-taking for the collective advancement of NBS in the Nordics and beyond.

Sammendrag på norsk

I denne rapporten presenterer vi funn fra prosjektet **Summarizing and sharing the experiences, knowledge, barriers and advices from nature-based solutions pilot projects in the Nordics (S-UMMATION)**. Prosjektet er finansiert gjennom Nordisk Ministerråds (NMR) fireårige program om naturbaserte løsninger (2021–2024), som har som mål å fremme samarbeid og øke kunnskapen om naturbaserte løsninger (NBL) i Norden for å muliggjøre effektiv implementering.

Naturbaserte løsninger (NBL) har fått økt oppmerksomhet som et alternativ eller supplement til teknologiske, eller «grå» løsninger både nasjonalt og internasjonalt. Det er også kjent at det fortsatt er behov for mer praktisk kunnskap om hvordan løsningene fungerer i praksis under ulike forhold. Vår studie er basert på innsikt fra åtte pågående NBL-pilotprosjekter finansiert av NMR programmet for NBL, observert over halvannet år (februar 2022–november 2023). De representerer en rekke ulike typer løsninger relatert til ulike samfunnsutfordringer og i varierte nordiske natur- og klimaforhold.

Det har ikke vært et mål å evaluere pilotprosjektene i seg selv, men heller å samle praktiske erfaringer som kan bidra til mer effektiv implementering og muliggjøre overføring og oppskalering av NBL i Norden. Informasjonen i rapporten er hentet fra intervjuer og workshops med prosjektledere og -medlemmer, samt prosjektbeskrivelser og annen skriftlig dokumentasjon.

Funnene våre viser hovedtrekk ved pilotprosjektene som er sentrale for utviklingen av NBL i Norden. Vi understreker at funnene fra pilotene ikke alltid er overførbare eller like relevante i andre sammenhenger. Vi beskriver derfor også konteksten for hvert individuelle prosjekt. Funnene samsvarer i stor grad med blant annet funn i et tidligere prosjekt, S-ITUATION, som også er en del av NMRs NBL-program, men tilfører også ytterligere nyanser. Pilotprosjektene viser hvordan ulik kontekst kan påvirke både prosjektprosessen og resultatene av NBL. De belyser også hvor viktig det er å involvere grunneiere og ta hensyn til grunneierforhold. NBL-prosjekter handler ikke bare om naturen, men også om mennesker, involvering av lokale interessenter og administrative prosesser. Prosjektene har lykkes med å oppnå målene sine ved å involvere og samarbeide bredt og gjennom nøye planlegging.

Resultatene fra pilotprosjektene bidrar til verdifull kunnskap for utvikling og gjennomføring av tilsvarende prosjekter knyttet til naturbaserte løsninger. Vi anbefaler at de åtte NBL-prosjektene blir studert videre, både i det som gjenstår av prosjektperiodene og i etterkant. Vi anbefaler også at det legges til rette for videre erfaringsutveksling mellom prosjektene og andre relevante aktører under Nordisk Ministerråds program for naturbaserte løsninger. Dette kan fremme felles læring og innovasjon i utviklingen av naturbaserte løsninger i Norden.

List of Acronyms

CBD	Convention on Biological Diversity
CWR	Crop wild relatives
IPBES	The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IUCN	The International Union for Conservation of Nature
NBS	Nature-based solutions
NCM	Nordic Council of Ministers
UNEA	The United Nations Environment Assembly
UNEP	The United Nations Environment Programme

1. Introduction

We are currently facing a biodiversity and climate crisis, which are globally interlinked. Nature-based solutions (NBS) are increasingly put forward as part of the solution as we move towards more climate adapted, ecologically viable and socially inclusive societies (Albert et al., 2021; Seddon et al., 2020) and Nature-based solutions are highlighted by both the IPBES – The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and Intergovernmental Panel on Climate Change (IPCC) as a cost-effective way of meeting the Sustainable Development Goals. The importance of NBS for providing cost-effective solutions to flooding and climate change is recognised in several international and national strategies (Seddon et al., 2021; Wamsler et al., 2020).

In order to address this important topic, the Nordic Council of Ministers (NCM) has initiated the S-UMMATION project to compile and synthesize experiences from eight NCM funded NBS pilot projects across the Nordic countries.[1]

S-UMMATION aims to give recommendations/lessons targeting both 1) those who implement NBS or lead NBS projects and 2) those who enable such projects and solutions to take place through policies and incentives at various governance levels. The project is part of the Nordic Council of Ministers' four-year programme on NBS (2021-2024) that aims to promote cooperation, knowledge exchange and efficient and effective implementation of NBS across the Nordic countries.

Nature-based solutions (NBS) are defined by the United Nations Environment Assembly (UNEA) on 2 March 2022 as "*actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human wellbeing, ecosystem services, resilience and biodiversity benefits.*"

The recent Kunming-Montreal Global Biodiversity Framework adopted at CBD COP-15 19th of December 2022, emphasises that climate mitigation and adaptation should not come at the cost of biodiversity. The agreement was signed by 188 countries, that have agreed to stop the degradation of biodiversity by 2030. The agreement also states that sufficient funds for financing "measures in nature" need to be in place. NBS are mentioned specifically in the targets 8 and 11 of the agreement:[2]

1. https://www.niva.no/prosjekter/s-ummation; https://nordicsituation.com/s-ummation-practical-knowledge-about-nbs-in-the-nordics/
2. https://www.cbd.int/article/cop15-cbd-press-release-final-19dec2022

- **Target 8:** Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions, including through nature-based solution and/or ecosystem-based approaches, while minimizing negative and fostering positive impacts of climate action on biodiversity.
- **Target 11:** Restore, maintain, and enhance nature's contributions to people, including ecosystem functions and services, such as regulation of air, water, and climate, soil health, pollination and reduction of disease risk, as well as protection from natural hazards and disasters, through nature-based solutions and/or ecosystem-based approaches for the benefit of all people and nature.

1.1 Challenges and opportunities for mainstreaming nature-based solutions in the Nordics

An important backdrop for this report is the recent studies that have mapped the current challenges and opportunities for nature-based solutions (NBS) in the Nordics (Sandin et al., 2022; Hansen et al., 2023). The interplay between climate, biodiversity and NBS points to the importance of addressing these areas jointly, and including their synergies in relevant laws, policies and management practices. In the EU Biodiversity Strategy for 2030 the Commission will "make the bridge between science, policy and practice and make nature-based solutions a reality on the ground".[3] However, the existing initiatives are not enough, and there are still a number of conflicting interests, lack of financing, sectoral fragmentation, and other challenges that act as barriers to these efforts (Hansen et al., 2023). The current revision of National Biodiversity Strategy and Action Plans (NBSAP) is potentially one way to handle some of these challenges.

In the S-ITUATION project current challenges in the Nordics regarding NBS implementation were identified (Sandin et al., 2022):

1. Natural-scientific and technical knowledge gaps
2. Shortcomings of long-term monitoring and evaluation of NBS
3. Lack of a clear definition of biodiversity net-gain
4. Technical and ecological knowledge gaps of practitioners
5. Economic shortcomings
6. Regulatory, governance and policy challenges
7. Weak stakeholder collaboration

This led to the following key messages and recommendations (Sandin et al., 2022):

- Clear political prioritization needed to mainstream NBS into policy and practice,
- Appropriate institutional structures, procedures and policy instruments at all governance levels essential to facilitate the implementation of NBS,
- Better funding structures for NBS needed,
- Common standards and guidelines needed to support increased adoption of NBS including setting clear biodiversity targets,
- Long-term monitoring and more comprehensive cost-benefit evaluation of NBS required.

3. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0380&from=EN

1.2 Eight nature-based solutions pilot projects in the Nordics

The eight national pilot projects forming the core of this study were selected by the Nordic Council of Ministers in 2021 in their open tender for nature-based solutions (NBS) pilot projects in the Nordics. The S-UMMATION project was funded under the same call for a project to follow and learn from the pilot projects. The projects offer a diverse range of NBS types, societal problems addressed, and climatic and landscape variations across the Nordics. The eight pilots are located in Denmark, Finland, Iceland, Norway, Sweden and Åland, providing a geographical span within the Nordic region and covering various habitats and contexts.

The pilot projects are:

- Pilot 1: More Nature - Less Waste (Denmark)
- Pilot 2: Planning for multifunctional land consolidation (Denmark)
- Pilot 3: Land restoration initiative (Faroe Islands)
- Pilot 4: Stream and watershed restoration in peatland and unproductive forest areas (Finland)
- Pilot 5: Crop wild relative biodiversity in urban green and coastal areas in Reykjavik (Iceland)
- Pilot 6: Protecting stream banks against erosion (Norway)
- Pilot 7: Floating wetland raft system for treating sea waters (Sweden)
- Pilot 8: Establishing multifunctional wetlands in agricultural areas (Åland)

The pilot projects are further described in Chapter 4.

1.3 Objective of this report

In this report we study the topics referred to above in a *place- and context-specific setting* through a case-study-based approach, following the eight nature-based solutions (NBS) pilot projects in the Nordics funded under the same program of the Nordic Council of Ministers.

Even with a growing international and national emphasis on NBS, there is also the recognition that we still need more knowledge about what works in practice "on the ground", in order to scale-up the use of NBS and to promote effective and efficient implementation of NBS. Understanding the factors that characterize the successful implementation of NBS, as well as gaps and barriers, is essential for successful NBS implementation and up-scaling. Despite this, research on real-life experiences of NBS implementation is still sparse and the existing examples are mainly urban. Even with a growing body of knowledge, there is still only modest empirical research conducted on the factors required for successful NBS planning, design and implementation on the ground, including governance aspects (Chausson et al., 2020).

This study aims to contribute to this field by providing insights from the eight Nordic NBS pilot projects in the Nordics. It addresses the following overarching research questions:

1. What has worked well, what challenges have the NBS projects met in the various project phases (so far), and how is the way forward perceived?
2. What conditions, tools, or circumstances did the NBS projects consider facilitating or supporting their project work? Additionally, what factors would they consider as factors enabling success, and what obstacles did they encounter?
3. What are key lessons learned (so far) in their NBS pilot projects?

The report is structured into six main chapters. Chapter 1 sets the scene, discussing the challenges and opportunities for NBS in the Nordics and the report's objectives. Chapter 2 provides a background on NBS. Chapter 3 presents the research methodology, including the case study approach and data analysis. Chapter 4 describes the eight Nordic NBS pilot projects that form the cases and showcase their diversity and the experiences gained. Chapter 5 synthesises insights and lessons from these projects, highlighting key findings. The report finishes with Chapter 6, offering concluding remarks and practical recommendations relevant to the future application of NBS in the Nordics.

2. Background on nature-based solutions

In this chapter we give a brief background on the concept of Nature-based solutions (NBS), the IUCN Global Framework for NBS and summarise the typical phases of an NBS project.

2.1 How is the nature-based solution concept defined?

There are different definitions of the nature-based solutions (NBS) concept, but the now most frequently used, and often referred to in the scientific literature, is the definition adopted by the United Nations Environment Assembly (UNEA) of the United Nations Environment Programme (UNEP) on 2 March 2022.

UNEA in 2022 adopted the first globally agreed on definition of NBS as "***actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human wellbeing, ecosystem services, resilience and biodiversity benefits***."[4]

Figure 1. IUCN defines NBS as "actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits" (source: IUCN, 2020; Cohen-Shacham et al., 2016).

4. https://www.unep.org/news-and-stories/press-release/un-environment-assembly-concludes-14-resolutions-curb-pollution

The UNEA definition builds on the earlier definition from the European Commission (European Commission, 2015) in 2015 and the IUCN in 2016 (Cohen-Shacham et al., 2016) (Figure 1). While IUCN and UN to a larger degree emphasize conservation and protection, sustainable management and restoration of existing natural and modified ecosystems, the EU includes solutions that are "inspired, supported by or copied from nature" including constructed solutions like green walls and roofs (Sandin et al., 2022).

Even though the various definitions of nature-based solutions have some differences, they all have in common that **NBS work *with* nature, *for* nature and *for* humans** (Sandin et al., 2022). They are solutions that protect, sustainably manage, use or restore ecosystems to solve societal challenges.

Nature-based solutions are highlighted by both the IPBES and IPCC as a cost-effective way of meeting the Sustainable Development Goals (SDGs) and they play an essential role in the overall global effort to achieve these. According to UNEP (2022), NBS are "*effectively and efficiently addressing major social, economic and environmental challenges, such as biodiversity loss, climate change, land degradation, desertification, food security, disaster risks, urban development, water availability, poverty eradication, inequality and unemployment, as well as social development, sustainable economic development, human health and a broad range of ecosystem services*".[5]

At the same time, there is a substantial body of evidence, scientific literature and practitioner experience that there are challenges when it comes to implementing NBS. These include issues such as participation and equity, economic valuation, scale and time effects, integration with existing infrastructure plus governance and policy issues (Nelson, Bledsoe, Ferreira, & Nibbelink, 2020).

2.2 The IUCN Global Standard for Nature-based Solutions

The IUCN global standard for NBS (IUCN, 2020) was developed to guide the work on NBS by clarifying the concept and what is needed to ensure successful implementation (Figure 2). The standard aims to equip the users with a robust framework for the planning and design of NBS, to ensure that implementation helps to solve some societal challenge(s) and to assess outcomes and success of NBS after implementation. The standard is a step towards mainstreaming nature-based approaches in policy and practice worldwide. It aims to ensure that NBS are effective, scalable, and sustainable. Such a framework is essential to increase the scale and impact of the NBS approach, prevent unanticipated negative outcomes or misuse, and to help funding agencies, policymakers and other stakeholders assess the effectiveness of interventions (Sandin et al., 2022; IUCN, 2020).

5. https://wedocs.unep.org/bitstream/handle/20.500.11822/39864/NATURE-BASED%20SOLUTIONS%20FOR%20SUPPORTING%20SUSTAINABLE%20DEVELOPMENT.%20English.pdf

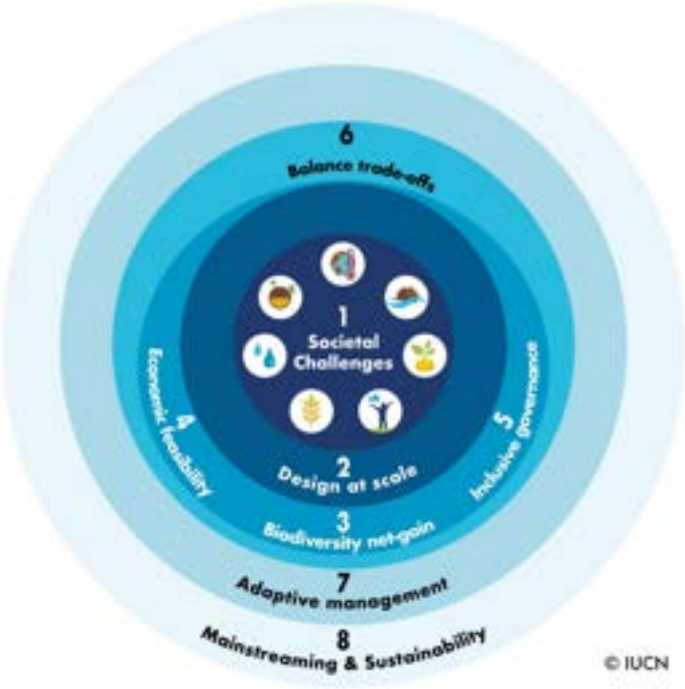

Figure 2. The IUCN global framework (source: IUCN, 2020).

The standard encompasses eight criteria and associated indicators that focus on biodiversity conservation, ecosystem integrity, and societal benefits. These criteria aim to ensure that NBS deliver benefits for both nature and people, address societal challenges effectively, are economically viable, and are governed by inclusive and equitable processes. These criteria are:

Criterion 1	NBS effectively address societal challenges i.e., the selection process of NBS is according to the societal challenges they are meant to address and includes their benchmarking and periodic assessment.
Criterion 2	The design of NBS is informed by scale i.e., the design of the NBS takes synergies and interactions beyond the intervention site into account.
Criterion 3	NBS result in a net gain to biodiversity and ecosystem integrity i.e., these gains need to be clearly defined and measurable.
Criterion 4	NBS are economically viable i.e., the economic viability of the NBS is evaluated in terms of the multiple benefits they can bring in comparison to alternative solutions.

Criterion 5	NBS are based on inclusive, transparent and empowering governance processes i.e., inclusive, transparent and empowering governance processes are integral to the planning, design, implementation and operational phases of the NBS and include the identification of all intended and unintended consequences, for all affected stakeholder groups and with the aim to "leave no one behind".
Criterion 6	NBS equitably balance trade-offs between the achievement of their primary goal(s) and the continued provision of multiple benefits i.e., the equitable balance between the trade-offs that arise from the multiple benefits of an NBS interventions to different stakeholder groups is maintained and, if needed, corrective actions to balance these benefits are implemented.
Criterion 7	NBS are managed adaptively, based on evidence i.e., adaptive management of the NBS is based on evidence gained by regular monitoring of the intervention throughout its lifecycle.
Criterion 8	NBS are mainstreamed within an appropriate jurisdictional context i.e., the implementation of NBS should be embedded in the appropriate jurisdictional context and trigger transformative change towards sustainability.

In their global standard, IUCN (2020) has also defined several indicators to assess the level of achievement of these eight criteria. Moreover, they developed a self-assessment tool in Excel, that can be used to evaluate the implementation of NBS (see Appendix 3).

2.3 Nature-based solutions project phases

Going from an idea to actual implementation of any intervention or project can broadly be divided into different phases: before, during and after. The same is true for nature-based solutions (NBS). It is important to note that this report is not about NBS *themselves*, but rather *NBS (related) projects*. This distinction is relevant for several reasons. First, it has to do with *scope and specificity*; NBS as a concept is broad, and it encompasses a wide range of approaches for using nature to address different societal challenges, both in practise and in the planning processes. In contrast, NBS-related projects are specific implementations such as restoration actions. It is important to also keep in mind, in line with the UNEA NBS definition, that NBS also includes the actions to protect and conserve already intact nature with its ecosystem functions, e.g. through spatial planning. If these functions are damaged or gone, actions can be taken to restore and repair or reconstruct nature and its processes.

By focusing on NBS projects, one can provide concrete examples of how NBS principles are applied in practice, offering context-specific, detailed insights. It concerns the *practical application* and allows for a deeper understanding of how NBS concepts are translated into

action. It highlights the practical aspects, including challenges and successes grounded in real-world situations. By examining projects, one can explore the entire *lifecycle of NBS implementation* – from the initial assessment, planning and design (before), through the execution and active management phases (during), to the post-implementation phase, where outcomes are monitored and evaluated (after). Such a lifecycle perspective is essential for understanding the effectiveness, sustainability, and scalability of NBS interventions. Focusing on NBS-related projects facilitates a discussion about *adaptive management and iterative learning*. It allows for assessing how projects evolve over time, how they respond to unforeseen challenges, and how lessons learned can inform future NBS initiatives. Analysing specific projects can provide valuable insights for policymakers and funders, as it can illustrate the types of *support and resources necessary* for successful NBS projects, as well as the potential barriers that need to be addressed.

The phases that go into the actual implementation of an NBS are typically (see Figure 3):

1) Assessment 2) Planning and design, 3) implementation, 4) Operation, maintenance, and ongoing management 5) Monitoring, evaluation and reporting. These can also be considered components rather than phases, as they might overlap in time and activities and be iterations within one project. Each component, however, could be seen as having its own distinct focus and key activities.

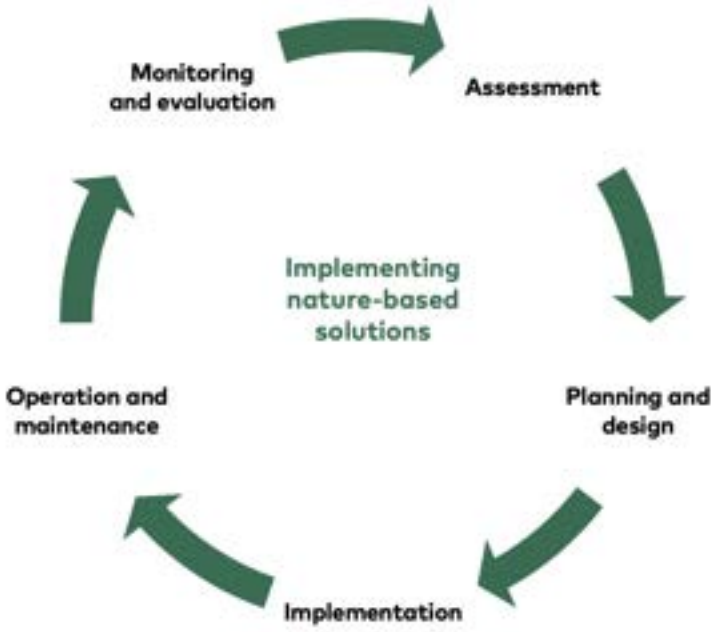

Figure 3. Phases/components of NBS projects. Inspired by FAO, SER & IUCN/CEM (2023).

This report does not include a full cycle analysis of the pilot projects as the projects were still ongoing and not yet completed when finalising this study. However, insights have been captured from the first phases.

During the study period, the pilots offered diverse insights; some focused especially on preparations and planning, while others engaged already in practical, on-the-ground implementation. In essence, while NBS as a concept provides the theoretical foundation, the focus on NBS-related projects offers a pragmatic view of how the concepts are operationalised, their real-world impacts, and the lessons learned from their implementation.

3. Methodology

In this chapter, we outline the approach taken for the study of the nature-based solutions (NBS) projects, including data collection and analysis. In the S-UMMATION project we followed eight pilot projects funded by the NCM (these are described in detail in Chapter 4).

3.1 Case study approach and pre-selected cases

With the eight Nordic NBS projects in different Nordic countries forming the core of this study, we adopted a case study methodology to investigate the practical aspects of the NBS projects and their implementation. In a case study approach, researchers collect detailed information using a variety of methods over a sustained period of time. We followed the eight projects from March 2022 to mid-November 2023.

The main contact and informant for each case study has primarily been the **project leader of the pilot project**. The project leaders had the opportunity to bring other partners along in workshops or interviews. This study is therefore limited to mainly the perspective of the project leader and implementor(s). The relevant persons are mentioned in the acknowledgement section of this report.

It is important to note that S-UMMATION is not about evaluating the pilot projects *per se,* but rather to capture experience-based knowledge relevant for planning, implementing, and running NBS projects while they are happening. This means that any knowledge and experience coming from the pilots, regardless of whether it was according to plan or not, has been considered relevant and valuable. It also means that choosing open-ended questions and letting the pilots tell their stories has been an important part of the approach, rather than conducting a formal assessment. We designed our study to allow for additional themes and non-predefined aspects to emerge.

3.2 Analytical framework

The study of the cases has involved capturing the experiences of the eight NBS projects and exploring enabling and constraining factors for practical and policy application. Beyond context-specific and place-sensitive findings, the study aimed to arrive at general recommendations applicable to NBS projects in the Nordic region. Based on the key factors in the literature for successful implementation, upscaling and mainstreaming the use of NBS and considering ICUN's global standard for NBS (IUCN, 2020), we studied the eight NBS projects with a particular focus on the topics listed below.

Topics addressed in our study:

- Purpose (aim), problem-focus of the pilot NBS
- Stakeholder involvement and communication
- Knowledge and evidence base
- Organisation, management, and institutional capacities/arrangements

- Financing and required resources
- Monitoring and documentation
- Policies and enabling factors
- Upscaling and mainstreaming
- Other aspects emerging from the pilot projects

The project leaders/representatives were specifically asked what they consider key learning points or key reflections from the work several times throughout the project (both in individual interviews and workshops).

Early in the study process of following the pilots, we asked to which extent the NBS pilots have used tools and guidelines in their planning, such as the IUCN Global Standard for Nature-based Solutions (IUCN, 2020). When we found that the framework was not actively used by the pilot projects themselves, we did not instigate any sessions where we actively worked with this but rather used it as a backdrop in our own study, as our role was more to follow rather than to guide the projects. Within the scope of this study, we were unable to follow up on facilitating an assessment following the IUCN framework, because the pilot projects are not yet completed.

Studying the projects as they unfolded, our research approach combined retrospective and real-time analysis elements. Through periodic interviews with project leaders, we aimed to capture reflections on recent and past events, decisions, and future plans. This method aligns with accompanying or parallel research, encompassing past experiences, present conditions and developments, adaptations, and future expectations. The approach has been proven beneficial for understanding complex and dynamic projects, where comprehending the process is as vital as assessing the outcomes (e.g. Christensen et al., 2016).

As researchers we maintained a non-interventionist stance, focusing on observing and documenting rather than actively participating in the pilot project processes and without direct interference. While recognizing the value of engaging with the project's wider stakeholders, we refrained from external intervention, as most of the pilot projects were in their early phases during the study period. The work has still also been rooted in participatory methodologies and collaboration between practitioners and academic researchers, inspired by e.g. Bergold and Thomas (2012). While we did not directly intervene in the pilot projects, we engaged in interactions with project leaders/contacts, providing insights and observations along the way, such as in our workshop discussions and as well as in meetings within the NCM's program on NBS, which includes all projects, including S-UMMATION.

3.3 Data collection

Data collection in this study was primarily conducted through online methods, including interviews, a questionnaire, and workshops, complemented by attending project status meetings and analysing written materials from the pilot projects and public sources. The study did not include field visits to the project's locations.[6] While it would also be relevant to involve the wider set of actors in each case, such as the stakeholders, the projects themselves carried out this contact, so it was not within the scope of the study. More details on the methodology can be found in Appendix 2.

6. Related to the physical workshop in Denmark, June 2023 one of the eight pilot project sites was visited, but this has not been possible to do for the rest of the pilot sites in the various Nordic countries.

It has been important to strike a balance between minimizing disturbance to the pilot project leaders and ensuring sufficient insights are captured. The following data collection activities were conducted (see Figure 4):

- A digital questionnaire in June–August 2022
- Digital workshop in November 2022 – discussing findings from the questionnaire
- A first set of interviews in February–March 2023
- Physical workshop in Denmark June 2023 – discussing findings so far as well as upscaling
- A second set of interviews in October 2023
- Digital workshop in late October 2023 – discussing findings from the last round of interviews and derived insights

Pilot project contacts received the draft report for review and quality assurance regarding their projects during November-December 2023

Figure 4 Timeline for key interactions with the pilot projects.

All interviews took place online using Microsoft Teams and were audio-recorded with the interviewees' consent. Two persons from the S-UMMATION team were present. The first set of interviews lasted for about 1.5 hour, while the second set of interviews lasted about 1 hour. The workshops lasted 2 hours. Not all pilots were represented at the second and third workshop, as it was hard to find a time suitable for all. The workshop material was shared with all the pilots. In addition to the activities arranged by this study, we also participated in status meetings within the NCM NBS program. Here each of the pilot projects (as well as the S-UMMATION project) gave 5–10-minute progress reports.

3.4 Data analysis

Recognising that the NBS projects are different, our analysis seeks to uncover both general trends and specific, context-sensitive findings. A qualitative data analysis software, NVivo, was used to analyse interview transcripts and documents to identify key themes and aspects. We coded and examined the data to find commonalities and unique insights across the pilot projects. The insights presented here are derived from observations across all the pilot projects. In formulating the insights, we based our findings on verified experiences or observations from at least one pilot project, usually several. We acknowledge that there is no one-size-fits-all and not all experiences from these projects are universally applicable or equally relevant for all. The diversity of the pilot projects, in terms of NBS types, societal challenges, and environmental contexts, adds to the robustness of the derived insights.

No identifiable project-specific information is published without prior consent and verification from the informant. To maintain the integrity of the information, the pilot projects had the opportunity to review their individual descriptions and the broader findings. However, the responsibility for the accuracy of interpretations and derived insights lies with the authors of this report, and any misinterpretations are our responsibility.

4. Eight pilot projects on nature-based solutions in the Nordics

In this chapter we present the eight NBS pilot projects that make up the basis for this report. As noted in the methodology, this is not a comprehensive description or evaluation of the pilot projects, rather an introduction to be able to provide insights relevant towards effective and efficient implementation of NBS in the Nordics.

The information about the projects comes from interviews with the project leaders, in addition to project descriptions and additional material (see Chapter 3). Concerning the primary type of NBS action (s) and the key societal challenge(s) listed for the various pilots in the respective pilot information boxes, these are based on the UNEA NBS definition and societal challenges provided in the IUCN Global NBS framework (see Chapter 2). The pilot projects are also presented, by the Nordic Council of Ministers and/or the pilots themselves, online on the NetworkNature Nordic Hub.[7]

All projects started in 2022 and run between two and three years, the last one terminating in summer 2025 (see Figure 5). The results and experiences presented in this report are therefore of mid-term character and are not final conclusions. An assessment of all projects shortly after they have officially finished and again at a later point in time is highly recommended. This would provide valuable additional insights, e.g., about the robustness of the chosen/built NBS, if and how long-term operation and maintenance of the NBS was achieved, how successful the upscaling of the solutions were.

7. https://networknature.eu/networknature-nordic-hub

Pilot project:	2022				2023				2024				2025			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Pilot 1: More Nature - Less Waste (Denmark)																
Pilot 2: Planning for multifunctional land consolidation (Denmark)																
Pilot 3: Land restoration initiative (Faroe Islands)																
Pilot 4: Stream and watershed restoration in peatland and unproductive forest areas (Finland)																
Pilot 5: Crop wild relative biodiversity in urban green and coastal areas in Reykjavik (Island)																
Pilot 6: Protecting stream banks against erosion (Norway)																
Pilot 7: Floating wetland raft system for treating sea waters (Sweden)																
Pilot 8: Establishing multifunctional wetlands in agricultural areas (Åland)																

Figure 5. Gantt chart showing the duration of the eight NBS pilot projects. Light green cells indicate that the initial official project period has been extended.

4.1 Pilot 1: More Nature – Less Waste with brush fences (Denmark)

Figure 6. Brush fences being filled up at a local school (Photo: Per Bille).

Project name (local language): More Nature – Less Waste (Mere natur - Mindre affald)

Location: Municipalities of Skanderborg and Odder, Denmark

Duration: 1 January 2022–31 December 2023/extended until end of 2024

Project leader: renosyd

Involved actors: The public waste management company renosyd, the two municipalities Skanderborg and Odder (that owns the waste management company), and 25 schools and 29 villages and organizations.

The project is a part of a larger cooperation with EU LIFE IP - Circular Economy Beyond Waste

Budget: 1,500,000 DKK (900,000 DKK NCM contribution)

Website: renosyd.dk/kvashegn

Primary type of NBS action: Sustainable use and management of natural resources

Key societal challenge(s) aimed to address: Climate change mitigation, Environmental degradation and biodiversity loss, Economic and social development (waste, resource use circular economy).

4.1.1 Background, concept and status

Aims: The project More Nature – Less Waste focuses on reuse and recycling of garden waste by building brush fences (see Figure 6). The pilot has three equally important objectives:

- Reducing waste, going from waste to value
- More biodiversity in urban areas
- Creating local communities around waste and the green transition

Challenge: The waste produced per capita in Skanderborg and Odder is increasing, and around 23 per cent of this is garden waste. The background for the pilot is a need to reduce the resources spent on handling and transport of this waste to the waste management company, in addition to building consciousness around how we as humans view waste and resources.

Concept: The concept is to engage school children and local communities in creating brush fences out of garden waste consisting of old branches and twigs. By reusing these materials locally, the amount of garden waste that transported to the recycling center is reduced. A brush fence is created by poles in two parallel rows where branches and twigs are placed between the poles (see Figure 7). The idea is also that the brush fences provide habitats for insects, birds, small animals and decomposing animals, which contribute to improving urban biodiversity. The solution can also reduce CO2-emissions as the garden waste can be managed locally instead of transported by citizens in cars and handled by the waste company in trucks and composted.

The locations and placement of the brush fences in this pilot has been on school and on private and municipal properties. In addition to being able to handle local branch clippings and brushwood, the brush fences at schools should also contribute to schoolchildren's learning about animals, plants and human interaction with nature. To enable this, various communication material and animation videos have been produced as part of the work, as well as an educational programme for the pupils is due in April 2024.

Figure 7. Brush fences before (left) and after (right) filled with branches and garden waste at the Knudsøskolen (elementary school). The width is typically 1,5 meter and height 1,2–1,7 meter. The poles are embedded 1 meter in the ground for the stability of the filled fence (Photos: renosyd).

Activities within the project:

- **Agreement on locations and ownership of the brush fences.** In this phase, the project leader worked on contacting collaboration partners and selected target groups to identify and obtain locations where the brush fences would be built. Extensive outreach activities were carried out with dialogue, meetings and marketing of brush fences to ensure sufficient commitment to implement and maintain the brush fences over their lifespan. The typical lifespan of a brush fence is 30 years. Inspections were also carried out to find the most suitable placements. In 2022 the brush fences were built on school sites and in 2023 built on various and diverse sites, owned by both private and by the municipality. All participants took part in the project voluntarily.
- **Preparations for the brush fences to be implemented.** This phase included obtaining necessary approvals and preparing the brush fence for it to be filled with garden waste, by purchasing and placing the posts. For the pilot, the project provided the poles and installed them at the sites, as part of both making sure that it is done in a robust way, making sure not to damage any underground structures e.g., water pipes, and making it easy for the schools, pupils and the local community to contribute with garden waste.
- **Implement 4500 m^3 (2 km) brush fences** in Odder and Skanderborg (initial original target). This included engaging the local community in filling the brush fences with garden waste. An important component was also developing information material and targeted marketing to engage citizens in the two municipalities. The information included storytelling about garden waste as a resource and information about the brush fences and how to fill them.
- **Document the effects of brush fences** on biodiversity in urban areas and reducing waste production while increasing carbon capture and reducing carbon emissions from waste transport and treatment.
- **Develop systematic methods for implementing brush fences at a larger scale**. Qualitative and quantitative outputs of the project will be synthesized in methods and recommendations.

Status: In the first phase of the project, a lot of groundwork took place in preparing for the locations and actors to be involved in the establishment of the brush fences. The infrastructure for the brush fences was put in place and garden waste has been delivered by citizens to the 21 schools where fences were constructed. This was kicked off in May 2022. The second phase has been about expanding the construction and use of such brush fences to other local communities, villages and landowners. As of end of October 2023, the project has established in total 2,5 km (6475 m^3) of 70 brush fences at 54 locations across Odder and Skanderborg. This achievement surpasses the original target of 4,500 m^3 of brush fences.

4.1.2 Organisation and involvement

The More Nature – Less Waste pilot project is an initiative by the public waste management company rrenosyd, which is owned by the two municipalities Skanderborg and Odder. The project involves civil society in building brush fences, while the fence owners and municipalities will be responsible for maintenance. At start up, the project team targeted two major groups: Schools in 2022, and local and green communities in 2023. To reach individual citizens and achieve broad outreach, efforts were made to carry out the project in cooperation with groups (schools and local green communities) that they presumed would be or already was engaged in green transition. Senior scientists at Aarhus University are involved in the evaluation of biodiversity aspects in the project.

The brush fence pilot is also one of several initiatives that Renosyd have included in the LIFE IP *Circular Economy Beyond Waste* initiative funded by the European

Commission.[8] The two funding sources for the pilot complement each other. Through the EU program the renosyds project leader gets 60 per cent of their salary covered. This does not include funds for materials, which are instead covered by the Nordic Council of Ministers. The project deliverables also complement each other, e.g. in the EU project renosyd, works on promoting children and young people as ambassadors for waste prevention.

Communication: The project has been well received locally and had extensive media coverage. Its goals and outcomes are effectively communicated through visual materials as a way of showing the progress and effects of the pilot activities. The project has created communication materials tailored to diverse audiences, with a focus on younger individuals. These materials include explanatory videos and other visual resources designed to enhance learning about natural resources and garden waste (see Figure 8 and Figure 9).

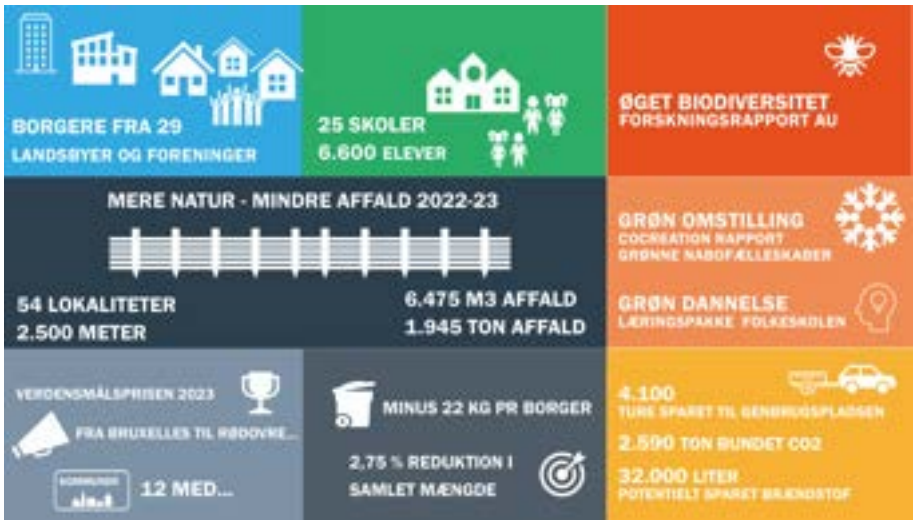

Figure 8. Example of how the project has presented and conveyed results. Here results by November 2023 (source: renosyd).

Figure 9. The project has made an explainer video about the project topic targeting children (source: screenshot of animation video by renosyd).[9]

The most demanding aspect, according to the project leader, has been the participation, coordination, and engagement of various stakeholder groups and interests. Working with new

8. https://webgate.ec.europa.eu/life/publicWebsite/project/details/5809
9. https://www.youtube.com/watch?v=OukZ3SIfyEc

partners and forging partnerships requires a significant amount of effort, adaptability and communication time. However, this has also been key to the project reaching its goals. This achievement was realized through proactive and strategic collaboration, as well as "bridge-building", between the involved organizations (local communities, municipalities etc.). The project leader reflected on the fact that there are limits to how far the waste company can extend its activities, when their primary activity is handling waste. To go beyond that requires extra funding and engagement from other people.

For the development of the learning and education materials, the project has worked with education professionals from a "learning house". The experts have been working with selected teachers to develop the learning material that they aim to further develop into an educational program. The project leader hopes to secure further funding to upscale the learning program after this first volume.

4.1.3 Effects of the NBS intervention – monitoring

The project leader has engaged University of Aarhus (Institute for Ecoscience) to study and report on the biodiversity in the brush fences. The report, due by end of 2023, is to report on how and how much biodiversity has increased or changed due to the brush fences and which methods have been used for the documentation. The idea is also to engage the schools in the biodiversity surveys at the established fences.

The scientists have discovered that the fences attract bumble bees. Preliminary results indicate that the density of bumblebee nests was higher than previously recorded for other favourable habitats (earth and stone dykes, hedgerows). In addition, spiders and birds have been observed using the brush fences and a decomposer fauna has developed on the soil surface, including ground beetles and millipedes. A question the project leader has been asked a lot is whether the fences will attract rats. The observations show this has not been an issue and the scientists have pointed out that the rats mainly comes when there is something that they can eat and that the fences do not provide an attractive food source to them.

Besides documenting biodiversity-related effects for this specific pilot, the project leader also sees this reporting as an important for informing further initiatives. It has the potential to serve as a template and inspiration in relation to NBS and how to document effects. The project leader also believes that the documentation can support public sector employees or others, such as e.g., green neighboring communities, who want to see such an idea adopted in their municipality and local area.

4.1.4 Next steps and potential for upscaling

The pilot has received a lot of media attention and many municipalities have expressed their interest in doing something similar. Furthermore, the collaboration with NCM has enabled collaboration with scientists and lead to dissemination materials such a book, master classes, teaching politicians and more.

In its last phase, the project is now focusing on how brush fences can be spread to other municipalities. As of autumn 2023, there are 12 other municipalities in Denmark that have either adopted or are in the process of adopting the concept of building brush fences in their local communities. The project is also developing guidance on how to co-create such solutions together with citizens and other actors, based on the pilot experiences.

The project leader also reflected that it is now, as the pilot enters its final phase, that the process of harvesting experiences and synthesizing results into reports on biodiversity, co-creation, and

other aspects is coming to fruition. The project has engaged an expert[10] in citizen engagement and co-creation to jointly craft a paper exploring the diverse elements that facilitate citizen involvement in NBS, based on the pilot experiences. The project got extended funding from the NCM for 12 months and will use most of the additional funds for this.

4.1.5 Key lessons learnt and reflections relevant for nature-based solution projects

- **Building a compelling narrative** about the project, already before there are actual outcomes to show, has been key for the pilot project to create interest and support.
- **Emphasizing positive expected outcomes, defining clear goals and establishing a win-win agenda** across actors have been important for building partnerships and collaboration. While it may be time-consuming, the potential impact is significant.
- **Acknowledge that a bit of frustration is part of the process**. Given the often dynamic nature of multi-actor initiatives, the project leader reflected that this is only natural. Time is a critical factor, and while maintaining momentum, accepting that things take time is also part of the process. Leadership support is essential when navigating through such challenges.
- **Providing people with opportunities to contribute** is important. The project experienced a genuine desire among citizens to act and "do good things". Facilitating this involvement is crucial, and a focus should be on understanding what it takes to engage citizens effectively.
- **Meticulous planning and preparations** have been fundamental for the project to reach its goals, such as awareness raising about NBS and involving the local communities in the activities.

10. https://centerforborgerdialog.dk/

4.2 Pilot 2: Planning for multifunctional land consolidation (Denmark)

Figure 10. The Holmehave area (Photo: Troels Kærgaard Bjerre, VandCenter Syd).

Project name (local language): Strategic plan for Holmehave (Strategisk helhedsplan for Holmehave)

Location: Assens, Denmark

Duration: 1 February 2022–31 December 2023

Project leader: Assens Municipality

Involved actors: Assens Municipality (project leader), Hedeselskabet (an association working with long-term development, use and protection of nature), VandCenter Syd (VCS) Denmark (water and wastewater utility), University of Copenhagen, local landowners.

Budget: Total 1,040,000 DKK (890,000 DKK, NCM contribution)

Primary type of NBS action: Restoration, Sustainable use and management of terrestrial and freshwater ecosystems

Key societal challenge(s) aimed to address: Environmental degradation and biodiversity loss, Climate change mitigation and adaptation, Water security.

4.2.1 Background, concept and status

Aims: The aim of the Holmehave nature project is to convert around 500 hectares of currently cultivated agricultural land to forest and nature areas, and to establish a new wetland of 150 hectares close to these areas (see Figure 10).[11] The Holmehave area has one of Denmark's largest wellfields, with need for protection of groundwater as well as high potential for wetland restoration. The goal is that the afforestation and rewilding of natural areas and the establishment of the wetland will benefit groundwater protection, improve water quality, increase biodiversity and reduce CO2 and nitrogen emissions. To improve recreational opportunities, the aim is to establish new paths, integrate them with existing paths, and create viewpoints along them. If successful, the project area will eventually become a mosaic landscape of open nature, forest and agriculture, benefiting also recreational activities. An important part of the project is land consolidation for agriculture, as the pilot aims to improve the zoning of agricultural areas to locations and sizes which will provide better value for farmers. In order to organize and co-ordinate these efforts for multifunctional land consolidation, the pilot project will develop a strategic masterplan for the Holmehave area.

Challenge: Land use pressures and the need to accommodate many land use types and competing land use interests, within a constrained area, is increasingly challenging. Balancing the needs for nature protection, enhanced biodiversity, urban development, infrastructure and food production requires multifunctional land use. However, much of current land use is monofunctional, necessitating a shift towards multifunctionality to accommodate the varied needs. Achieving comprehensive land use change and land use management calls for improved collaborative approaches to find effective solutions to the multifaceted societal challenges.

Concept: The Holmehave project area of about 800 hectares is located between Odense and Assens. Through multi-functional land consolidation, the goal is to create a nature area of up to 500 hectares, where 300 hectares will be acquired for afforestation and 150 hectares will be converted to wetlands. This involves, first and foremost, multifunctional land consolidation to pave the way for wetlands and afforestation in close cooperation with the landowners. The terrain in the area is very varied, but the majority of the area is intensively cultivated with small areas of forests and bogs. Assens Municipality has also implemented a wetland initiative that will be further developed during the project period.

Figure 11. Multifunctional land consolidation is a jigsaw of various components and land use components and needs (source: Danish Agricultural Agency).

11. https://networknature.eu/pilot-project-multifunctional-land-distribution-denmark

During 2021–22, the Danish Agricultural Agency had a call for pilot projects on multi-functional land consolidation (Figure 11),[12] for which Holmehave was one of the pilots that received support. In the first step towards achieving successful land use multifunctionality, a strategic masterplan for the Holmehave area was co-developed with the people in the area. The comprehensive process to develop the strategic master plan for Holmehave has enabled the funding from the NCM NBS program as part of the overall Holmehave project. The project will also contribute to reaching two other targets, a biodiversity-friendly afforestation plan and a plan for obtaining biodiversity due too grassing in wetlands.

Status: In the first phase of the project, planning the involvement of local landowners and citizens was a key focus. The first public meeting about the strategic master plan for the Holmehave area was held in October 2022, followed by several workshops. As of October 2023, the strategic masterplan for Holmehave is finalised (Figure 12); It has been through internal review with the strategy group, and subsequently, it has been politically processed and approved. It is now going for external review (with all citizens, etc.) and an open house event will be held during this phase, so that everyone interested can come, learn more, and ask questions. This review will take place in December 2023 and January 2024.

Furthermore, during late autumn 2023, land consolidation has actually taken place in the Holmehave area. Forty landowners have agreed to change ownership, buy and sell a total of 600 hectares of land to create approximately 300 ha of space for the Holmehave Nature Project and the agreed new forest and wetland areas as envisioned in the strategic master plan.[13]

Figure 12. Screenshot of the front page of the strategic master plan and an example from the working document (source: Assens Municipality).

4.2.2 Organisation and involvement

The Holmehave project is carried out as a partnership, with tasks divided amongst various organisations. Assens Municipality is responsible for the overall project management and leads the wetland restoration (target 3). Hedeselskabet leads the afforestation target (target 2), and the University of Copenhagen leads the strategic plan for Holmehave (target 1). All the actors also participate in the targets they are not leading. Civil society and NGOs are also strongly engaged in the development of the strategic plan for Holmehave (target 1). Stakeholders are involved through meetings and workshops. Stakeholders were involved very early in the process, before important decisions had been made about the land use in the area, to avoid conflicts of interest.

12. https://lbst.dk/landbrug/arealer-og-ejendomme/jordfordeling/multifunktionel-jordfordeling-mufjo
13. https://www.danskskovforening.dk/skoven/40-lodsejere-bidrager-til-stort-skov-og-naturprojekt/

The development of the strategic master plan has involved many meetings and workshops, both out in the field and indoors (see Figure 13). A strategic working group was established, consisting of citizens and stakeholders from the area. The plan has during summer 2023 been on a consultation with this group, which was involved in preparing the master plan to receive the last feedback before finalisation. It was then shared and anchored with the politicians in the Municipality.

The project leader reflects that there is now a citizen-driven, landowner-driven plan, about which there is consensus and which the politicians support. A key factor enabling this achievement has been that the funding for land acquisition and implementation of measures was in place before the start of the collaborative planning process. This was important, according to the project leader, because it made the project real and tangible and respected people's time and effort by not asking them to take part in a fanciful project. It's not just about visions or dreams; the emphasis is on planning something genuinely achievable that can actually be implemented.

Figure 13. The strategic group out in the field working with the co-development of the plan for the area (Photo: Troels Kærgaard Bjerre, VandCenter Syd).

In multifunctional land consolidation, agricultural areas are taken out of use to make room for nature, improve the state of the environment and give citizens access to and improved recreational opportunities in the open countryside. Land distribution is solved as a jigsaw puzzle among the area's landowners, where participants buy and sell land simultaneously. As a result, landowners who let land go out of production are offered agricultural land as compensation and for participating landowners, the goal is to consolidate their fields into larger blocks or in locations that make sense for their farm.

The project has benefitted from several financing schemes and policies, besides the funding from the NCM, namely EU-funding for wetland restoration, which is a monofunctional scheme according to the project leader, and the national government funds for multifunctional land

consolidation. There are major groundwater interests in the project area, and a partnership has been formed to find solutions that utilise potential synergies. For example, Holmehave has Denmark's largest groundwater reservoir, which can supply up to half of all the water for VCS Denmark consumers in Odense, Denmark's third largest city. Solutions that protect groundwater are therefore vitally important. In close cooperation with the landowners, land use synergies have been developed through the process of land use consolidation, which will allow wetland restoration and afforestation. The land consolidation has been carried out with assistance from the Danish Agricultural Agency via the subsidy programme for multifunctional land consolidation, as well as the wetland schemes.

The responsibility for maintenance of afforestation in the Holmehave project area lies with Hedeselskabet. Landowners will be responsible for maintaining the wetland area, and it is the landowner's responsibility to adhere to the requirements specified by the support schemes. In addition, the municipality can make individual agreements that support NBS. That's why they have aimed at finding a 'common starting point' for future land use through the three project activities, especially through target 1 – the strategic plan for Holmehave.

4.2.3 Effects of the NBS intervention – monitoring

For the impact of the co-created strategic masterplan for Holmehave, evidence of success is that 300 hectares have been made available for NBS, including wetlands and afforestation through multifunctional land consolidation. This is quite unique, according to the project leader. Many landowners, typically farmers, are interested in contributing to the collective effort. However, the process is complicated, involving meetings with several actors and includes land negotiations. The principle of voluntariness in multifunctional land consolidation can be challenging because local considerations, private interests and political ambitions need to come together and find common ground. The planning and involvement of landowners and citizens has been the most challenging task as well as being an absolutely crucial part of the Holmehave project.

The goal is that the afforestation and rewilding of natural areas and the establishment of the wetland will benefit groundwater protection, improve water quality, increase biodiversity and reduce CO2 and nitrogen emissions. Additional funds are required to monitor the implemented measures, so extra funding would be needed beyond the project period for this.

4.2.4 Next steps and potential for upscaling

The Holmehave project area can be seen as a microcosm of the challenges in the open countryside; it is described by the project leader as a large nature project in a landscape where space is limited. With a politically accepted strategic masterplan and with multifunctional land consolidations taking place, the Holmehave project is an example of how challenges can be translated into local action. According to the project leader, the pilot project has been very positively received by local politicians, and the topic is of national interest, which has also helped the process at the local level.

The multi-functional land use consolidation program from the government was a pilot scheme during 2020–21 and has been discontinued. According to the project leader it was expected to continue, but reportedly there have been few results thus far. The Holmehave project has been one of the successful projects, succeeding in making multi-functional land consolidation.

Multifunctional land consolidation can ensure collective landscape planning and broad, local support to meet societal challenges through NBS such as wetland restoration. However, no land changes can be made without landowner agreement. Such projects require collaboration between all parties. Therefore, an important part of future multifunctional land consolidation is

establishing models for how this can be best achieved. The 'Assens method' springs out of the work done in Assens Municipality, including the work done by the partners within the Holmehave pilot, as an approach to develop a strategic land use plan together with the local people. The method has the potential to be adopted by and used in other municipalities.

4.2.5 Key lessons learnt and reflections relevant for nature-based solution projects

- **Securing funding for the implementation of physical measures and other actions before starting the collaborative planning** for the area has been crucial. The project experienced that it made the process of developing the strategic master plan more meaningful and tangible, and it also created commitment among actors involved.
- **Involving the landowners first, and then other citizens, before starting the spatial planning of the area** is a central strategy in multifunctional land use projects. Whether a small wetland project or a larger-scale landscape project, stakeholders should be involved before the area planning and design starts. The content and details of the process might vary, but the sequence is crucial.
- **Leadership in collaborative planning processes requires an open mind,** stress endurance, and the ability to engage in dialogue with diverse opinions. In particular, when involving many actors, citizens and other stakeholders, the project should start by asking many questions, rather than coming with predefined answers. As experienced by the project leader, it is rewarding, yet hard work. It required significant personal investment, meaning this role is not suitable for everyone.
- **Enabling mechanisms supporting diversity instead of mono-functionality** is highlighted by the project leader as necessary to truly establish multifunctional landscapes. This includes funding sources like the governmental multifunctional land use consolidation program, together with meaningful processes for collaborative planning, as has been tested in this pilot.

4.3 Pilot 3: Land restoration initative (the Faroe Islands)

Figure 14. The pilot project in the Faroe Islands as part of the activities develops and implements nature restoration measures for a landslide located on the island of Kalsoy (Photo: Tjóðsavnið).

Project name (local language): The First Large Land Restoration Initiative in The Faroe Islands (Lendisbati)

Location: The Faroe Islands

Duration: 1 May 2022–1 May 2025

Project leader: Tjóðsavnið (the Faroe Islands National Museum)

Involved actors: Tjóðsavnið (the Faroe Islands National Museum), NIBIO (The Norwegian Institute of Bioeconomy Research), Landgræðslan (the soil conservation service of Iceland), Gróðurstøðin (plant nursery station), Vestmanna high school (rector and students), local farmers.

Budget: 1,005,300 DKK (800 000 DKK, NCM contribution)

Type of NBS action: Restoration, Sustainable use and management of terrestrial ecosystems

Key societal challenge(s) addressed: Environmental degradation and biodiversity loss, Climate change mitigation and adaptation.

4.3.1 Background, concept and status

Aim: The project aims to work towards restoring the degraded landscapes in the Faroe Islands, with a focus on preventing soil erosion and improving biodiversity, as well as restoring wetlands for carbon storage. As this pilot project is the first large-scale land restoration project in the Faroe Islands, the goal is to test different approaches and measures appropriate to Faroese conditions, to increase knowledge and enable future restoration projects in the country. Specifically, the pilot project develops and implements nature restoration measures for a landslide located on the island of Kalsoy (see Figure 14). The location was picked as the local farmer and landowner in this area is very interested in collaboration for restoration and to prevent erosion of agricultural land. There is also a second test area in a field that was previously grazed by sheep, but which is now fenced off, so that the project can monitor any changes here.

Challenge: Erosion is a common problem in the Faroe Islands, that will likely increase due to climate change, increasing precipitation and wind. The harsh climate in the region also continuously impacts the land. Although humans have always been closely attached to nature in the Faroe Islands, there is a need to increase understanding and consideration towards the sustainability of natural resources. Animal life and plant life are at risk because human activities do not always take nature into consideration. The purpose of the pilot project Lendisbati is to improve these conditions.

The experiences from the pilot will be the basis for other projects to reduce and prevent environmental degradation. The pilot also aims for social interaction, inclusion and learning by involving the local community. The pilot includes efforts to raise general awareness about soil erosion, biodiversity loss and nature restoration, by including students in field work and in the development of educational material. In the future, the initiative also aims to restore wetlands. This will happen after the pilot project period.

Status: In the first phase of the project, the landslide area at Kalsoy was fenced off to prevent sheep from grazing there. The pilot conducted a baseline assessment to be able to compare and assess the results of the restoration. During the summer 2022, the first botanical sampling was conducted, and vegetation mapping has continued in 2023 and will also be done in 2024.

Nature restoration experts from the Icelandic institute Landgræðslan visited the site of the landslide in august 2022 to contribute to a plan for the restoration measures at Kalsoy. The Norwegian Institute of Bioeconomy Research (NIBIO) came to study the test field and map its vegetation in august 2023. In September 2023, restoration activities started in the landslide area. With the help of high school students, the edges of the landslide were treated with different methods for stabilisation to prevent the landslide from expanding. There was also an area where the edges were just evened out to control for any differences. So far, the efforts to restore the landslide area at Kalsoy have shown that the work needs to start from the top of the affected area and work downwards to prevent further erosion and also potential risks when working on the site. The area is very steep with a lot of debris. The restoration efforts are therefore focussing on the edges in the first phase, leaving the barren area as it is but monitoring any changes. The pilot collaborates with experts from other countries but is conscious about local conditions. By digging and adding different materials such as wool, hay and seeds, the pilot project is testing what works best to facilitate new growth in the landslide test area. The seeds are for 3–4 typical local grass-types that have been collected in the area by students. When testing out the different methods, the pilot will also learn more about practical issues such as how many people, how much materials, equipment, and time is needed. The final restoration activities are planned for the summer of 2024. when the different methods will be applied to the landslide area with control areas as an experiment. The results will be monitored for at least two more years.

4.3.2 Organisation and involvement

Organisation: The pilot is initiated and led by Tjóðsavnið, the Faroe Islands National Museum. It involves collaboration with several partners: NIBIO (The Norwegian Institute of Bioeconomy Research) is responsible for mapping the vegetation in the area. They are also involved in developing the restoration measures together with Landgræðslan (the soil conservation service of Iceland, SCSI). The plant nursery station Gróðurstøðin contributes with native grass and plant species for the restoration measures. Vestmanna high school is involving students in carrying out the restoration measures and future monitoring of the area. A local farmer is responsible for building and maintaining the fence for the area around the land slide and is also involved in the implementation of the restoration measures. It was highlighted that a good working group with different competences has been very important.

Involvement: The pilot has signed a 10-year contract with the farmers included in the project for use of their land for testing that may be extended further. The project has deliberately designed the pilot work as a collaboration with farmers and landowners to avoid conflicts. Some of the farmers, have already tried local experiments to regreen areas with new vegetation, but the use of non-native seeds in such initiatives has been a challenge. The pilot has encountered some challenges with landownership and permits, it takes time and effort to get in place. In some areas, farmers own the land, in other areas it is owned by the state and in some cases, there is a "co-ownership" where farmers rent the land long-term from the agricultural agency.

The students in Vestmanna high school have been a central part of the project, with participation in the restoration activities as an integrated part of a class on resource management. The students have been involved in the project since the beginning and have also been interviewed in the local news about it. During the summer of 2023, the project arranged a "Lendisbati day" with the high school students and a biology class from another school in Klaksvík visiting the site, which included both lectures and practical work on the edges of the landslide. Local inhabitants and farmers have also been invited to the restoration activities and lectures together with the students. There is also a Facebook group where news about project activities is posted. The project plans to involve both students and the local farmer even more in 2024.

Figure 15. Lendisbati day during summer of 2023 (Photos: Tjóðsavnið).

Communication: The project has communicated about the activities actively in the media and plans to present results to the public and NGOs at a conference at the end of the project period. The pilot project manager has also networked with other actors through conferences and meetings on NBS abroad. The project has received attention in the local news media and on social media, and has found that information spreads easily since the Faroe Islands is a small country.

The project leader found that the most effective way of communicating is "*show, don't tell*" and raise awareness by demonstrating and explaining why they do what they do. It was also reasoned that restoring a landslide is something people can easily understand as they can see the "wound" in the landscape and it may therefore be easier to communicate than restoration of a wetland. The idea has been to start with landslides as it is a tangible visible challenge in the landscape as a way to start the conversation and actions on how to better manage the land.

4.3.3 Effects of the NBS intervention – monitoring

The landslide area has been documented by drone images that have also been used to create a 3D model to be used for long-term monitoring of succession of the vegetation. The Norwegian institute NIBIO has helped with vegetation mapping before the intervention so the project can follow the development.

Monitoring will continue after the pilot period ends through annual drone photos and measuring the percentage of vegetation cover. The funding for monitoring and maintenance is not clear yet, but it the project leader foresee that it will be part of the museum activities and say that they will definitely find time within the activities to go and monitor the landslide once a year. Monitoring of effects will also continue to be carried out by students.

4.3.4 Next steps and potential for upscaling

The restoration actions have been tested in smaller scale and will be further implemented through a larger scale final restoration of the area in 2024. The pilot project is planning to arrange a conference at the end of the project where the involved actors, including students, will present the project and results.

The external funding has been instrumental for the project's existence, as it is the first large land restoration initiative in the Faroe Islands. The Lendisbati initiative aims to continue beyond the pilot project period funded by the NCM. The pilot leader also talked about possibilities for making a user manual or guidance for restoration of landslide areas and is hoping that other similar initiatives will ask the Lendisbati initiative for advice in the future. Another potential area for upscaling and expansion of the initiative involves analyzing the soil at new sites before restoration to better understand the conditions for new seeds and plants.

The national museum who leads the pilot is working on four areas for restoration in total. They are also planning to further extend the areas restored with funding from private sector actors and/or nature funds. There is already funding granted from the Faroese ministry of environment to fence off another field area from grazing. The agricultural fund in the Faroe Islands has also contributed to the landslide restoration and student activities. In the future, the Lendisbati initiative wants to expand activities to also include wetland restoration in the Faroe Islands. The project will continue to apply for funding from different grants, and there is hope that the government may also support the initiative in the future.

4.3.5 Key lessons learnt and reflections relevant for nature-based solution projects

- **Farmers and the agricultural agency are important stakeholders in the Faroe Islands, and important to involve from the start** in land restoration projects. It has been key for the success of the pilot to raise awareness and create acceptance of the need for action among key actors before the actual on-site restoration began. Collaborating with farmers has been a positive experience and the farmers also spread the word about the project in other arenas.
- **Working by a "show, don't tell" approach** has been beneficial for the pilot. Rather than telling people what to do, demonstrating results as well as how to restore the land in practice brings the topic to life and can motivate others to join. The project leader is optimistic that the visible greening of the landslide area in the future, will show the purpose of the intervention.
- **It is important not to underestimate the planning phase.** The pilot project experienced that paperwork and permits may take a long time and recommends starting such processes as early as possible.
- **Close collaboration with international experts and institutions** to learn about methods, approaches, and network with like-minded individuals has been crucial for the project due to a very small team and to overcome challenges with hiring.
- **Adapting advice and implementation examples to local conditions**, such as varying soil types and the protection of native species, is essential when exploring approaches and methods from other regions.

4.4 Pilot 4: Stream and watershed restoration in peatland and unproductive forest areas (Finland)

Figure 16. A filled ditch at the edge of a restored peatland (Photo: Antti Karppinen, Metsähallitus' Wildlife Service of Finland).

Project name (local language): Mätäsoja Stream and Watershed Restoration Pilot Project (NbS Mätäsoja – Mätäsojan ja valuma-alueen ennallistamisprojekti)

Location: Taivalkoski in Northern Ostrobothnia, Finland

Duration: 1 June 2022–31 December 2024

Project leader: Metsähallitus Wildlife Service of Finland

Involved actors: Metsähallitus Wildlife Service of Finland, Metsähallitus Forestry Ltd., The University of Oulu, Natural Resources Institute Finland (Luke), Jurmu II membership of the local fishing area, local landowners, excavation contractor.

Budget: Total 615,000 DKK (499,000 DKK, NCM contribution)

Main type of NBS action: restoration, protection, conservation, sustainable use and management of terrestrial and freshwater ecosystems

Key societal challenge(s) aimed to address: Environmental degradation and biodiversity loss, Climate change mitigation and adaptation.

4.4.1 Concept, background and status

Aim: The aim of the pilot project is to restore the Mätäsoja stream and watershed near Taivalkoski municipality in Northern Ostrobothnia region, Finland. The pilot will carry out stream restoration together with restoration of the peatland and unproductive forest land in the watershed area (see Figure 16). The project aims to improve the region's biodiversity, by improving conditions for habitats and species, including game and salmonid fish species, and as well to mitigate climate change by improving carbon storage in the restored peatlands.

Challenge: Reversing biodiversity loss, both at the global and local scale, is the starting point of the project. Establishing protected areas alone is not enough to halt biodiversity loss, and the project sees a need for a more ambitious restoration of nature. Nature regulates the climate. The restoration and protection of wetlands, peatlands, and small-water ecosystems as well as sustainable forest management are essential for reducing emissions and adapting to climate change.

Peatlands are important carbon-rich ecosystems, and the pilot project aims to help the partially destroyed and degraded nature in the Mätäsoja watershed area (see Figure 17) recover from the adverse effects of human activities and limit the fragmentation and destruction of habitats. Using ditches to drain peatlands degrades the natural state of the habitat and lowers the water table. Due to ditches, the natural forest structures of the peatlands have changed as the initially open peatlands have become swampy, tree growth patterns and the condition of the original peatland species and their habitats has been severely degraded. The draining of the peatland was done for forestry approximately during the years 1950-1970. The project leader further explained that many of the drainages have not been successful from a forestry point of view, so some of the areas have become unproductive or poorly productive forest lands.

Figure 17. Red dashed line = the watershed of Mätäsoja stream. Dark blue dashed areas = restored peatland and unproductive/poorly productive forestland target areas. Dark blue areas = planned peatland/unproductive forestland restoration areas. Pink lines = restored stream / spring brook areas. Brown color= restored 2022. Black color = restored 2023. Red color = will be restored 2024. Source: Map and information by Metsähallitus, Base map by Land Surveying Office.

Finland is increasingly restoring ditched peatlands and unproductive forest. However, according to the project leader restoration work covering the entire watershed area of a stream has not been carried out much before in Finland. Monitoring the effects of peatland restoration has yet to study the function and diversity of the water ecosystem in streams.

Concept: With the restoration of the Mätäsoja stream and watershed area (15,79 km^2), the pilot aims to cover the entire watershed area within the project period. The restored areas will become part of a regional ecological network of protected areas,[14] meaning that they will be kept out of commercial forestry. The watershed was chosen for the pilot as restoration plans for the area already been developed that fitted the Nordic NBS program.

Key project activities are:

- Restore 170 hectares of peatlands and poorly productive and unproductive forest land and 5 km of streams in the Mätäsoja watershed,
- Develop monitoring methods for streams, together with research organisations,
- Share best practices of watershed restoration as a nature-based solution based on the project experiences.

Status: During the first phase of the project, steps were taken to involve local stakeholders and to enter into contracts with local landowners for permission to implement the restoration activities on their land. The restoration itself started in October 2022 and is planned to be completed by the end of 2024. The project has carried out pre-investigations to be able to monitor the effects of restoration implementation in cooperation with the University of Oulu and Natural Resources Institute Finland (Luke). Before the implementation of the restoration measures, photos and videos were recorded to document the area. Other early monitoring actions, such as electrofishing and biological and chemical monitoring, have also been carried out by the research partners.

There were already restoration plans for the area in place prior to initiating this pilot project. The plans were finalized and supplemented at the beginning of the project. The project leader had learned a key lesson in a previous restoration project concerning the importance of dedicating time for the planning of the restoration, including cost estimates and time requirements, to achieve success within a limited timeframe. In the previous project, the timeframe for the restoration was only two years in total and the project did not reach all the targets because of the time taken for planning. According to the project leader, it is not possible to take into account the uncertainties of the various restoration activities' phases, such as weather conditions and contractor availability over a short timeframe.

As of October 2023, the pilot project had restored 131 hectares of peatland (22 peatland areas, 50 springs, 6.9 km of stream/spring brooks, and made 28 gravel beds in the streams for brown trout spawning habitat. This means the project has exceeded the restoration targets set for streams and springs. The project is carrying out implementation activities following best practice using peatland restoration knowledge gained from over 30 years of experience within Metsähallitus Parks and Wildlife. In this project, they combine peatland restoration and stream restoration which is carried out in combination in the same area.

14. Protected areas are areas to conserve the unique features and diversity of Finnish nature as a part of an international network, https://www.metsa.fi/en/nature-and-heritage/network-of-protected-areas/

During the process of restoring the peatland area, the contractor uses an excavator to allow water back into the channels of old, dried-up spring brooks, by digging out the channels, removing blockages, or reshaping the land to allow water to flow back into former brook paths (See Figure 18). There are several springs and spring brook channels in the Mätäsoja watershed area. Because of ditching the peatland, also their state has degraded. So, when restoring the peatland areas where also spring brooks needs to be restored, the contractor is focusing also rewatering the spring brooks channels while filling the ditches. For the stream restoration, the project added more large wood, boulders and rocks and salmonid spawning habitats to the streams. This project has been using the *Hartijoki method,*[15] developed in Sweden at the end of the last century, which involves excavating existing stone and gravel manually and then reusing it in future additions, such as spawning material for the fish (See Figure 18). This has been done jointly by the project leader and two colleagues. For 0,4 km of stream areas, it took about four days during autumn 2022, the project leader furthermore made some more spawning habitats during summer 2023.

Through tree-felling management, the project is trying to restore the natural state of the peatland's forest structure that was present before the ditches were made a few decades ago. Some tree-felling needs to be done before the excavator can start to fill the ditches. An excavator is used to chops trees with a guillotine grapple, trying to imitate the natural tree structure of the peatland before draining. This work can also be done with a forestry machine. In the pilot project both approaches have been used. As of November 2023, this management to restore the natural forest structure had been done in 18 peatland target areas. The remaining forest management is planned for winter 2023-2024 in six peatland target areas. So far, the experience of the pilot and the project leader, is that this is a good way to enable sustainable management of drained, unproductive forestry lands.

Figure 18. a) Excavations in the field for peatland restoration and b) use of the manual Hartijoki method in the stream restoration. This kind of restoration work starts with a hoe, a scraper to open up the impacted bottom and continue with adding and/or rearranging gravel in the streams (Photos: Antti Karppinen / Metsähallitus' Wildlife Service of Finland).

15. https://vaelluskala.net/puhdistavia-virtauksia-kutusoraikkojen-yllapitoon/ , https://www.havochvatten.se/download/18.64f5b3211343cffddb2800022567/1708690133550/ekologisk-restaurering-av-vattendrag.pdf (s.203-204)

4.4.2 Organisation and involvement

The project is led by Metsähallitus Wildlife Service Finland, which is responsible for coordination of the pilot, planning the stream restorations, as well as providing dissemination materials, sharing experiences and results. They are part of the state-owned enterprise Metsähallitus which manages and protects state-owned land and water areas.

The Metsähallitus Wildlife Service is part of the public administration services together with the National parks Finland, together making up Parks & Wildlife Finland. The two organisations' tasks include managing nature conservation areas, protecting endangered species, selling hunting and fishing permits, and conducting wilderness supervision in state-owned areas. Funding for the public administration services comes from state budget allocations and permit sales income.

The Metsähallitus Wildlife Service's main partner in the project is Metsähallitus Forestry Ltd, which is responsible for implementing the restoration measures in the field and informing about the progress of the work to the project leader. They are a subsidiary of Metsähallitus, managing the business operations. Business activities involve the management of state-owned forests, production and sales of forest tree seeds, leasing, sales, and property development in state-owned land and water areas.

Parks and Wildlife Finland manages approximately one third of Finland's land and water resources and they are the primary landowner in the pilot watershed, so there was only a limited number of private landowners (around five), from whom permission was needed to restore the areas. The pilot project is implementing restoration activities, with the project funding, both in state-owned areas and the local landowners' areas. To avoid conflicts of interest, the project leader discusses the methods of operation with the landowners on a case-by-case basis. The project leader reflected that such restoration is likely easier when one or a few landowners already manage almost the whole area, compared to if there were 20-30 different private landowners. Even with the limited number of landowners in this project it took some time to get official agreements in place.

In addition to the landowners, other local stakeholders were involved. The local fishers' organization Jurmu II has contributed financially to the restoration activities in the stream watershed through income from fisheries fees collected by the area's fisheries authority.

The company contracted to do the excavation work has previously worked with the project leader and has over 10 years of expertise in peatland restoration and has demonstrated a high level of competence. These skills, according to the project leader, include understanding where it is and isn't possible to drive the excavator and the correct technique for blocking peatland ditches. Metsähallitus have an arrangement with most of the excavation contractors they work with, that makes it possible to follow the work digitally, to see on the map where excavation is currently being done in the field, which areas that have been covered and so on.

Communication: The project is using social media and publications to make informative posts about relevant topics related to the restoration. For example, they posted on Instagram about how to do spawning area restorations and share what they are doing in this pilot project.

4.4.3 Effects of the NBS intervention – monitoring

The pilot project has already restored several hectares of peatland and km of stream (see Section 4.4.1 and Figure 19). For monitoring of the effects of the restoration of Mätäsoja, Metsähallitus is cooperating with the University of Oulu which has been collecting biological and chemical data and doing research to monitor the effects. In addition to leaf bags and algal tiles, the monitoring of the effects of the restoration activities includes: 1) water mosses, 2) benthic invertebrates, 3) whether the structures of the stream bed have been mapped to verify the morphological effects of the restoration measures, 4) the measurement of the chemical quality of the parameters used in water body monitoring (TP, TN, DOC, pH, Alk., etc.). This aims to contribute to the future development of NBS and the work is funded by the university themselves and not the pilot project.

The Natural Resource Institute Finland is also doing electrofishing, using their own funding, to evaluate the impact of restoration on brown trout populations in the stream. Initially, the state of the stream will be evaluated by data on the presence of significant fish species and their population dynamics. The full results of the restoration will take a while to show in the fish data and the same is true of invertebrate data, which is also more difficult to collect compared to fish data.

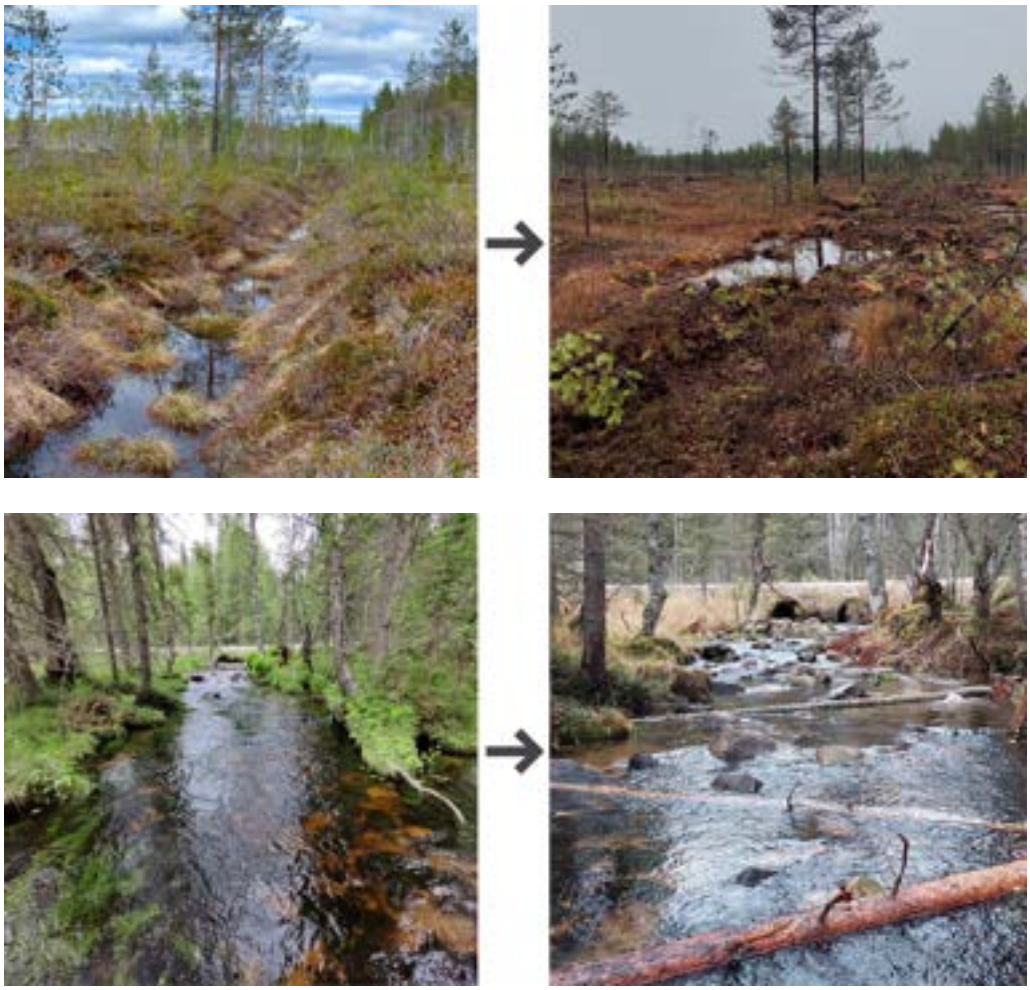

Figure 19. Restored areas before and after restoration. Peatland dries up because ditches have been dug (upper left) and the peatland has been restored by filling the ditches (upper right). The natural state of the stream has deteriorated when stones and wood have been removed from the stream (lower left) and the stream has been restored by adding boulders, stones, spawning gravel and wood (lower right). All photos: Antti Karppinen/ Metsähallitus.

There is no required ongoing maintenance needed for the restored streams and peatlands if the implemented measures are working as planned. Initial and periodic checks may be necessary to identify overly wet areas that could potentially cause any damage or e.g., harm to forestry. But overall, the project leader emphasised that there are minimal maintenance requirements. During autumn 2023 the project leader was contacted by a landowner about increased moisture level on one cabin road, potentially tied to the restoration activities. While the project anticipated some water level rise, the heavy rainfall in the weeks before, may have contributed to it rising in that specific area. The project leader noted that in such instances it is important have a dialogue with the landowner and investigate the causes. The case has been solved during a field trip with the local landowner in the problem area. One dam has now been removed with a shovel, which solved the problem.

There is no specific plan for maintenance or supplementary actions after the project period ends, but the project considers the need for Metsähallitus and the research organisations to continue their monitoring efforts beyond the project.

4.4.4 Next steps, potential for upscaling

Finland has been restoring both peatlands and streams for quite a long time, but commonly not simultaneously over an entire watershed. Metsähallitus aims to continue with this after the end of the pilot project. In the last phase, the pilot project will also develop a guide for sustainable management of forested areas and forestry land.

When it comes to further restoration work, funding like from the NBS program of the NCM is considered very important to Metsähallitus Wildlife Finland. There are still many streams and peatland areas in Finland to restore, and, according to the project leader, it is hard to find funding for this kind of work. The project leader is currently preparing some project proposals for EU funding, for continued and further restoration activities, but the competition is tough.

4.4.5 Key lessons learnt and reflections relevant for nature-based solution projects

- **Early communication has contributed to effective teamwork**. The collaboration between the partners has been going well because the team members already knew each other and started communicating early. Ongoing cooperation with local stakeholders, such as the university and the local fishers' association, has also enhanced project outcomes.
- **Developing the restoration plan for the area before raising funds** for the practical restoration activities has been useful in this case, as planning is time-consuming. Developing the plan for the area took two to three years and was ready just when the NMC's call for NBS pilot projects came out. Having a plan already in place from the onset has enabled the team to reach more restoration targets within the pilot project period, as the main time available could be spent on practical implementation rather than planning.
- **Maintaining communication with team members and equipment operators**, such as excavator operators, has been essential for the progress of the project. Keeping individuals informed and reminded about upcoming plans and target areas is a central part of the restoration activities.
- **Securing sustainable funding sources is crucial**, given the scale of peatland and stream restorations needed in Finland. While the NCM program has been instrumental in funding the pilot, there is a need for reliable long-term funding opportunities. The project leader stresses the need for permanent funding sources to ensure long-term success and effective planning, especially for large-scale projects.

4.5 Pilot 5: Crop wild relative biodiversity in urban green and coastal areas in Reykjavik (Iceland)

Figure 20. Populations of *Carum carvi* (a CWR to cultivated caraway) and *Leymus arenarius* (a CWR to wheat) on the island Viðey, with Reykjavik in the background (Photo: Magnus Göransson).

Project name (local language): Crop wild relative biodiversity in urban green and coastal areas in Reykjavik

Location: Reykjavik, Iceland

Duration: 1 May 2022–1 April 2024

Project leader: Reykjavik Botanic Garden

Involved actors: Reykjavik Botanic Garden is part of the Nature and parks division in the department of Environment and planning within the City of Reykjavik and leads the pilot. NordGen and Icelandic Institute of Natural History are included in the project reference group.

Budget: Total 815,000 DKK (650,000 DKK, NCM contribution)

Primary type of NBS action: Conservation and sustainable use and management of terrestrial ecosystems

Key societal challenge(s) addressed: Environmental degradation and biodiversity loss, Climate adaptation.

4.5.1 Background, concept and status

Aim: The pilot project aims to increase biodiversity and resilience of Reykjavik by conserving biodiversity and genetic resources while also making the genetic resources accessible for research, plant breeding and innovation. More specifically, the pilot aims to improve the knowledge of crop wild relatives (CWR) in a coastal urban setting (see Figure 20), collaborate with policymakers and managers in municipalities and local institutions to increase awareness and strengthen the management of CWR, and conduct a feasibility study on the concept of genetic reserves. Crop wild relatives (CWR) is a concept for wild plant species that are closely related to cultivated crops, with traits that have been lost during plant breeding (see Figure 21).

Challenge: The effects of climate change are challenging for agriculture and food production, and there is a need to develop crops that are resilient to future climate scenarios. Limited diversity in crop species decreases the potential for them to adapt to changes in climate, pests and diseases.

Concept: Many CWR are adapted to cultural landscapes and are often found where humans have historically cultivated the land, including cities built on former agricultural land. Since the CWR have adapted to the geographical area in which they grow, it is important to conserve them in their natural environment (*in situ* conservation). This is the aim of this pilot study.

The first step to achieving this goal is to map the distribution of CWR and then to assess threats to these populations. If threats are found, management plans will be developed together with the City of Reykjavik. Conservation in genebanks (*ex situ* conservation), on the other hand, is a backup option and a way to make the plants available for plant breeding and research, as well as reintroductions if the wild populations should go extinct.

Figure 21. Kale on the left, and its CWR, *Capsella bursapastoris*, growing in Reykjavik. (Photos by: Rasbak, CC BY-SA 3.0 DEED (left) and Magnus Göransson (right)).

Activities within the project include:

- **Developing a national CWR priority list in Iceland:** Several crop wild relatives have been found in Iceland (forage grasses, wheat and berries). The list will be developed and prioritized using the existing CWR priority lists for Nordic countries (Fitzgerald, et al. 2018), and through discussions with botanists and crop experts.
- **Developing a CWR inventory for Reykjavik:** Suitable areas within Reykjavik (islands and green areas along waterways) will be selected and inventoried for species on the national CWR priority list.
- **Identification of suitable CWR populations for long-term monitoring and conservation:** One or two populations in Reykjavik will be selected as case studies to investigate the feasibility of creating genetic resources for the species. Then, management plans for these species will be developed in collaboration with the municipality, aiming to conserving the genetic diversity and increase overall biodiversity (supporting pollinators and birds) while providing recreational areas.
- **Feasibility study for establishing genetic reserves for specific populations:** This includes assessments of local, national and international legal frameworks for regulating the access of the genetic resources in the reserve.
- **Outreach to municipalities and the public** throughout the project, aiming at increasing awareness of CWRs, their importance for food security and local sustainable agriculture. The project outcomes will also be communicated to relevant Nordic and European networks.

Status: As of autumn 2023, the team is in the phase of developing a CWR inventory for Reykjavik (Figure 22). The pilot has postponed publishing the national CWR priority list until after the fieldwork because they found that it would make more sense to develop the list after completing the fieldwork, so that this could concretely inform the work with the priority list. Field inventories of the crop wild relatives were carried out on 14 locations in urban areas along waterways and islands in Reykjavik municipality during the summers of 2022 and 2023 and the project team is now compiling the fieldnotes and comparing the findings with earlier inventories, which were done 40 years ago.

Figure 22. Hjörtur Þorbjörnsson from Reykjavik Botanic Garden doing field inventory of crop wild relatives (CWR) on Engey with Reykjavik in the background (Photo: Magnus Göransson).

4.5.2 Organisation and involvement

The pilot is managed by Reykjavik Botanic Garden (part of Reykjavik City) in collaboration with an independent researcher. The steering group consists of representatives from the City of Reykjavik (nature and parks division) in addition to the representative from Reykjavik Botanic Garden and the independent researcher. They also established a reference group with people from the City of Reykjavik/Ministry for the Environment and Natural Resources, NordGen and the Icelandic Institute of Natural History. The pilot was inspired by the Nordic Genetic Resource Center (NordGen), which is the joint genebank and knowledge center for genetic resources in the Nordics, funded by NCM. Several people involved in the pilot are also involved in NordGen which the pilot benefits from and vice versa.

Initially, the idea was to have regular meetings with the steering group, but the collaboration evolved in a more organic way in which the project managers reached out to people from the steering group when needed. According to the project managers, this has turned out to be a very useful way of cooperating.

As for stakeholder involvement, the project's plan and hope is to actively involve the City of Reykjavik in creating the management plans for selected CWR species, as they are responsible for management of the green areas in Reykjavik. Increased awareness of the importance and value of CWR among these people will, according to the project manager, increase the likelihood of successful long-term conservation with the potential to last long after the project period.

The pilot has arranged several outreach activities like a travelling exhibition visiting several places in Iceland, held a talk at a conference in Reykjavik, taken part in a radio interview, and presented to the academic community at a conference in Melbourne, presented to urban planners and academia at a conference about ecology in urban areas, and a meeting with international researchers at NordGen.

The project team has experienced that people quite easily connect to the topic of food security and resilience and understand why the question is being raised and the importance of genetic diversity in this regard. They feel that the main objective of the project, which is to conserve CWR populations mainly in unmanaged nature within the municipality, is easy to communicate. At the same time, they reflect that changing people's mindset can be challenging. An example is when they also want to plant the idea in people's minds that they can make a difference by leaving their own garden a bit messy (and weed away less of the local CWR flora) and thereby conserve both CWR and help local biodiversity (insects, plants, birds). They found that this applies not only to the public, but also to the municipal gardeners maintaining public gardens and spaces in the city.

4.5.3 Effects of the NBS intervention – monitoring

An important part of the pilot is to conduct inventories of CWRs and compare them with previous inventories (developed 40 years earlier). This is done to study species distribution ranges and to link this to any management changes for the respective area.

The subsequent activities in the pilot are aimed at conserving CWR and improving the management of areas with CWR; one or two populations of CWR will be selected as case studies and management plans for these species and locations will be developed in collaboration with municipal employees managing green areas. The effects of this will be documented. However, documenting the effects of the intervention, namely the management plans and outreach, will require new additional funding, as the funding from the NCM ends in 2024.

4.5.4 Next steps and potential for upscaling

The next steps in the pilot are to choose plant populations suitable for long-term monitoring and conservation and to publish management plans for these populations and locations. Thereafter, it will be to develop a national CWR priority list for Iceland and to conduct a feasibility study of establishing genetic reserves for these specific populations by assessing different legal frameworks for regulating the access of the genetic resources in the reserve.

The project team foresees that the management plans will improve the chances for a long-term conservation of CWR, while the assessment of the legal framework will provide a foundation for the sustainable use of the CWR genetic diversity in the future.

4.5.5 Key lessons learnt and reflections relevant for nature-based solution projects

- **Securing enough funds and utilising them carefully** enabled the team to spend enough time on the fieldwork, without rushing. The team experienced that doing field inventories over rather large areas is time consuming, and they were dependent on others to be able to travel to different islands. As an example, booking a designated boat and driver for their fieldwork instead of just joining another group, turned out to be very valuable.
- **A reference group supporting the project enabled the team to benefit from their knowledge and network**. By establishing this group in the beginning, the members were more invested in the project, and as such more likely to respond than if people not associated with the project are contacted ad-hoc at a later stage.
- **Crop wild relatives have traits making them a valuable resource** when breeding crops for local adaptation. By preserving these species, we secure this resource for future generations. Some of the species are seen as weeds and there is a need for a mind shift to preserve them.

4.6 Pilot 6: Protecting stream banks against erosion (Norway)

Figure 23. Gjødingelva (in Hurdal municipality) 19 April 2023 (Photo: D. Krzeminska, NIBIO).

Project name (local language): Environmentally friendly measures (NBS) for slope/stream bank stability (N4S: Naturbaserte løsninger for stabilisering av skråninger/bekkekanter)

Location: Three River Basin Sub-Districts in Norway: Hurdalsvassdraget/Vorma (Huvo), Leira-Nitelva, and Øyeren. One pilot will be in Hurdal municipality and two in Lillestrøm municipality.

Duration: 1 March 2022–31 December 2024

Project leader: Norwegian Institute of Bioeconomy Research (NIBIO)

Involved actors: County Authority of Viken (Viken FK/River Basin District): project owner and initiator. NIBIO is responsible for project management and professional assessments in the pilot. The three River Basin Sub-Districts (Hurdalsvassdraget/Vorma (Huvo), Leira-Nitelva and Øyeren) are responsible for mapping local environmental challenges and for contact with local stakeholders. The Norwegian Water Resources and Energy Directorate (NVE), the County Governor and the Norwegian Environment Agency are supporting organisations.

Budget: 900,000 DKK (NCM contribution) + self-funding from municipalities and others

Primary type of NBS action: Restoration

Key societal challenge(s) addressed: Climate change adaptation, Environmental degradation and biodiversity loss.

4.6.1 Background, concept and status

Aim: The aim of the pilot project is to address stream bank erosion and soil stability in agricultural catchments (see Figure 23), especially in response to changing hydrological pressures and adaptation to climate change. Moreover, the pilot is also expected to support biodiversity and reduce water pollution.

Challenge: Undercutting of bank toe and resulting steepening of the slope is the main cause of the streambank failures observed in agriculture catchments in Eastern Norway (Skarbøvik & Blankenberg, 2014; Skarbøvik, 2016). The triggers are either hydrological factors (snow melt, intensive/prolonged rainfall) or human activity (using heavy machinery close to the edge of streambanks, new infrastructure etc.). Stream bank erosion is a major challenge in several areas of Viken County, with damage to infrastructure on land and changing hydromorphology, fluvial processes and ecology in the watercourses.

Concept: Traditional slope reinforcement measures, including reinforcement with stones, concrete walls, gabions etc., greatly influence local environmental conditions, water quality and biodiversity. As an alternative, the Norwegian pilot aims to test a selection of vegetative structure(s) in a Norwegian context, inspired by cases in Spain and Scotland, by reinforcing the stream bank using logs with roots, local soil and gravel from the riverbed as well as planting locally sourced trees and brushes and keep existing vegetation in the riparian zone (see Figure 24).

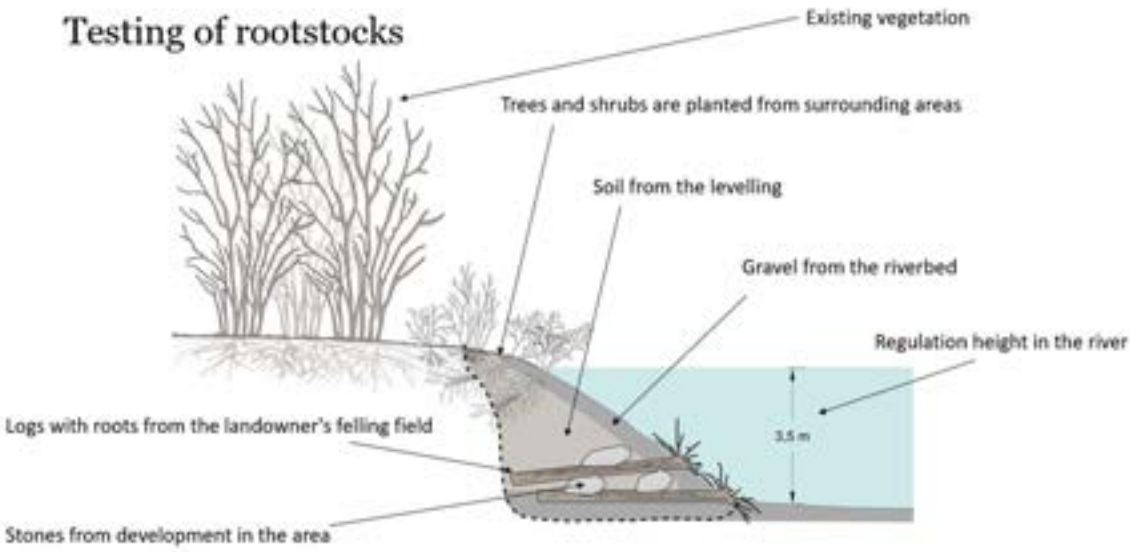

Figure 24. Testing of large wood structures is part of the pilot project (source: NIBIO).

Activities within the pilot:

- **Implementation plan with guidelines and infographics**: summarizing the current state of knowledge and practical experience with crib-wall structures or large wood (incl. lessons learned and best-practice, description of administrative procedures in Norway, implementation plan with guidelines, and monitoring and maintenance plan).

- **Implemented and functioning measures**: The implementation plan from the first activity will be followed to select three suitable locations for implementing crib-wall structures, identify a company that will build the crib-wall or large wood structures, install monitoring setup, and document the economic issues.
- **Demonstration day**: Organize a visit in the field and open panel discussions with key actors, addressing questions and concerns of potential stakeholders, as well as preparing dissemination and communication materials like leaflets, posters and movies demonstrating the whole operationalization process (from planning, to implementation, monitoring and maintenance).

Status: As of November 2023, the project is in the second phase. The plan is to implement a NBS structure in three different locations. A large wood structure has been implemented in Gjødingelva (Hurdal municipality) in the Hurdalsvassdraget/Vorma (Huvo) River Basin Sub-District during the spring of 2023 (see Figure 25, first location selected previously as a test site). Simultaneously, the project partners are proceeding with planning for implementation of vegetative structures, either the crib-wall or large wood, in two more locations in Lillestrøm municipality within the Øyeren and Leira-Nitelva River Basin Sub-Districts. The main cause for the delay for these two locations is unstable ground conditions. The project team is working on securing necessary applications, assessments and funding.

Figure 25. Implementation of the large wood structure in Gjødingelva (Hurdal) during the spring of 2023. To the left: excavation work, 31.3.23. To the right: planting of tree seedlings, 2.6.23. Photos: Helge B. Pedersen (Huvo).

4.6.2 Organisation and involvement

The pilot project is managed by NIBIO, a state-owned research institute, which has engaged with landowners in the catchments to identify suitable locations in which the landowners are willing to test the crib-wall or large wood structure. Engaging with the landowners, in this case the farmers, is also an important prerequisite for successful implementation and for upscaling this kind of NBS, according to the project leader, who explained that the farmers are concerned about erosion and have thoughts about how to solve these issues – and the power to implement their solution.

While funding from the NCM NBS programme covers the costs of the NIBIO team and communication and dissemination activities and materials, it does not cover physical implementation of measures. In some cases, the landowners already had secured funding for physical measures. While in others, NIBIO and the landowners collaborated on applying for funding for physical implementation, for which the landowners handed in the applications. Moreover, the project secured funding for implementing measures from, and in collaboration with, the Viken county council and the local River Basin Sub-District (Hurdalsvassdraget/Vorma).

The team involved the entrepreneur (which implemented the NBS in Gjødingelva) in the planning phase through several meetings where the team described the method, discussed several options and agreed upon the solution. Then, a machine operator and project manager from Scotland joined the first day of constructing the large wood structure along with the entrepreneur and several people from the team and partner organizations. From the second day onwards, the entrepreneur carried on by themselves.

Figure 26. The project team has also invited politicians out in the field (Photo: Helge B. Pedersen, Huvo).

4.6.3 Effects of the NBS intervention – monitoring

The project aims to conduct monitoring of biodiversity and stream bank stability before and after the restoration. Before restoration, the stream bank was about three meters high and mostly vertical along the whole stretch. After restoration, the stream bank slopes gently upwards. Thus, the stability of the stream bank will be monitored not just to document the effectiveness of implemented solution, but also to make sure to avoid more erosion.

In the remaining two locations, monitoring changes in flow patterns will be funded by another project and may provide knowledge about how the vegetative structures influence the flows in the stream. According to the project leader, while the rootstocks will give hiding places for fish, this will be hard to document.

Monitoring the pilot over time will require new funding, as the funding from the NCM ends in 2024.

4.6.4 Next steps and potential for upscaling

The pilot aims to build knowledge about crib-walls and large wood structures to stabilize stream banks in a Norwegian context. The ambition is that the implementation plan with guidelines can be used by the municipalities, project executors and as input to NVE's technical guide, thus creating a potential for upscaling the use of crib-wall/large wood structures for stream bank stabilization.

The next steps are to implement crib-wall/large wood structures at the two remaining locations. In order to do that, the necessary applications need to be approved and funding secured. Sorting out administrative aspects like the kinds of approvals needed is an important prerequisite for implementing the NBS in this project and for others that want to do the same. The hope is that the guidance documents which will be developed in the pilot – including descriptions of the administrative procedures – will make this process easier for future projects.

4.6.5 Key lessons learnt and reflections relevant for nature-based solution projects

- **Administration related to securing funding and necessary approvals was time consuming**. The project experienced that it took time to identify which applications they needed to submit and whether geophysical assessments were required.
- **Hydrotechnical assessments should be conducted, especially in natural streams**, to learn where the current is strong or weak and thus where and how to restore the stream bank. The project team advise to secure funding for such assessments when doing stream bank restoration.
- **Stakeholder involvement is a success factor, and a prerequisite**, for these kinds of projects. Conventional restoration methods don't always work in areas with sand and clay, and any measures need to be adapted to the site conditions. Thus, working with landowners and entrepreneurs among others is crucial.
- **In the planning and implementation phases it proved very helpful to involve experts on the chosen technique** of building large wood structures, which is a new technique in Norway. Involving people skilled in this approach helped the process of choosing the right solutions, and they shared knowledge with the entrepreneur and others (on site) on how to do it in practice.
- **The main enabling factor** for this pilot was the funding from NCM and the municipalities' interest in working on this topic.

4.7 Pilot 7: Floating wetland raft system for treating sea waters (Sweden)

Figure 27. Prototype of a floating wetland raft (Photo: Initiativ Utö and alchemia-nova).

Project name: Prototype testing of a novel engineered floating wetland system in the Utö, Stockholm archipelago

Location: Utö island, Haninge municipality, Sweden

Duration: 15 May 2022–15 September 2023 (extended to November/December 2023)

Project leader: KTH Royal Institute of Technology

Involved actors:

- *KTH Royal Institute of Technology* leads the project, responsible for coordinating the project and monitoring the performance of the NBS pilot.
- *alchemia-nova (ALCN)* is an Austrian tech company on nature-based solutions responsible for design and construction of the NBS pilot system.
- *Insamlingsstiftelsen Initiativ Utö* is responsible for providing necessary information from the pilot site and implementation of the NBS pilot on site.

Budget: Total 928,256 DKK (897,516 DKK NCM contribution)

Primary type of NBS action: Sustainably use and manage marine ecosystems

Key societal challenge(s) addressed: Environmental degradation, Water security.

4.7.1 Background, concept and status

Aim: The aim of the pilot project is to implement the floating wetland raft system (see Figure 27) in Utö, an island southwest in the Stockholm archipelago. The artificial floating wetland raft is used to remove excess nutrients from the sea water by mimicking the functions of natural "terrestrial" wetlands. The applied technology is patented by the tech company alchemia-nova and has previously been tested and applied in full-scale to treat wastewater/greywater in Austria, Switzerland and Spain.

Challenge: The Baltic Sea has severe eutrophication problems due to nutrient accumulation through extensive nutrient inputs from catchments and internal releases of phosphorous from sediments under oxygen free conditions. The foundation Initiativ Utö was founded in 2017 to reverse negative environmental impacts on the Baltic Sea by restoring marine environments and establishing new measures, benefitting the environment and the local community.

While there already are three constructed wetlands in the Utö island, which provide water purification and nurseries for pike and perch, this pilot project aims for complimentary strategies to capture nutrients (especially phosphorus) from the marine environment. The project partners (Initiativ Utö and KTH from Sweden and alchemia-nova from Austria) started investigating nature-based solutions to treat eutrophic Baltic Sea water together in 2021. A preliminary study showed that lab-scale versions of a floating wetland raft systems could work to treat excess nutrients from the sea water. This motivated the application to the NCM pilot program.

The concept:

- The floating wetland raft is comprised of two planted basins (plants with substrates including gravel, expanded clay, and zeolite) that are aligned stepwise above each other, with a biochar tank in the back (see Figure 28).
- A solar panel installation provides energy for a water pump (feed pump) and an aeration pump/compressor which provides circulation of air to the plants.
- Water is pumped from the surrounding sea and into the inlet zone of the upper planted basin. The water then flows through the basins to provide nutrient capture through microbial communities and plant uptake. In the next step, the biochar tank captures excess nutrients.
- The nitrogen (N) and phosphorous (P) which is removed from the water and taken up by the plants and biochar can then be recovered and used for soil improvement in agriculture.
- The planted basins used on the floating wetland raft are 2 m long and 40 to 28 cm wide (the front is inclined). The water inflow is 500 L/day, but the project team thinks the maximum treatment capacity might be higher and should be tested in the future.
- The raft that the system is placed on is 6 meters long and 2 meters wide. It is not expected to cause negative disturbance to the natural environment, and fish are using them for shelter.
- Future potential development includes modifying the floating wetland raft to make it automatically mobile, allowing it to move around the Island of Utö depending on where the need for nutrient removal is the highest.
- Examples of the species and types of plants that were tested in the system are *Bolboschoenus maritimus, Schoenoplectus tabernaemontani, Lythrum salicaria L., Juncus inflexus, Spartina pectinate.*

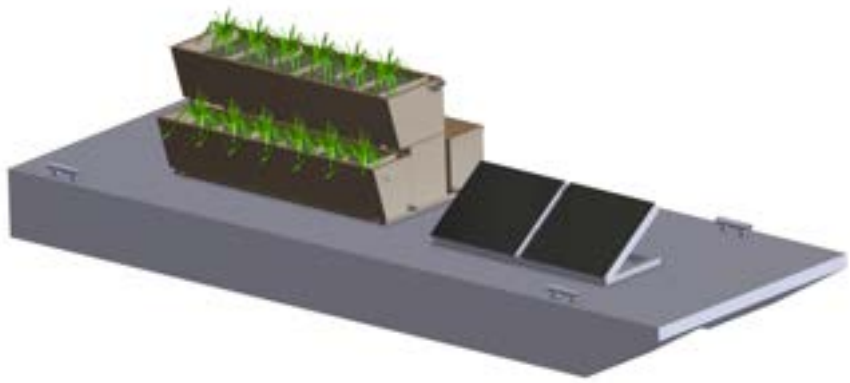

Figure 28. Illustration of the floating wetland raft concept (source: Marco Hartl, alchemia-nova).

Status: In June 2022, the project team visited the Utö island to collect water samples and identify locations for the floating wetland raft system. The first floating wetland raft was placed on site in early May 2023 and has been running there since then (Figure 29). As of October 2023, the project period has been extended from the planned end in mid-September 2023 to November/December the same year. The project will also continue monitoring the system over the coming winter at their own cost.

Figure 29. Assembling the system (Photos: Initiativ Utö and alchemia-nova).

4.7.2 Organisation and involvement

The project team consists of three different partners with complementing roles and competences. The pilot project is led by Swedish KTH Royal Institute of Technology, which is responsible for coordinating the project and monitoring the performance of the pilot. They describe themselves as the "end users" of the NBS, which was constructed by the Austrian tech company alchemia-nova (ALCN) and provide specialised NBS competence. The first small scale prototypes were therefore designed, constructed and tested in a lab in Austria.

The local foundation Initiativ Utö has been the main actor in the field and responsible for providing necessary information from the physical pilot site as well as the practical implementation and maintenance of the floating wetland raft on site. Initiativ Utö is also described by the project as "the public figure" of the partners, as they already had contacts with the local community and NGOs in the area. Their website[16] communicates activities related to wetlands and water quality in the coastal zone. They are also responsible for communication on social media and local news. The local project partners found that the floating rafts attracted media attention, as they are physical structures bringing the idea «to life».[17] Ideally, they think this can then start a broader conversation about the environmental challenges in the Baltic Sea. Appearing in the media also created opportunities for new collaborations and the project has been in contact with a wastewater treatment company located in Stockholm, who are interested in the floating wetland raft concept. The pilot project and its results have also been presented by KTH and alchemia-nova at conferences (i.e. WETPOL 2023 in Belgium).

The project has included children and youth at project events to increase knowledge and awareness, in collaboration with the stakeholder Haninge Municipality. In September 2022 and 2023 the project arranged a two-day camp with an upper secondary school. While the pilot does not need to involve landowners for e.g. use of their land, the project is looking to inform and engage the local community, for example by placing information boards by the pilot location and by having more regular citizen engagement activities.

4.7.3 Effects of the NBS intervention – monitoring

Monitoring of the floating wetland raft system has been ongoing from the start through measuring water quality and assessing the potential for nutrient capture, in addition to visual assessment and monitoring of the system (e.g. anchoring) and plants.

Every two weeks during the summer of 2022, water samples from 1) the inlet, 2) a sampling point after two plated stages before the biochar chamber, and 3) the outlet of the system, were collected and analyzed for pH, salinity, TDS (total dissolved solids), anions and cations. In 2023, the project expanded the monitoring to the whole year at their own cost. The plant growth has been documented through videos and photos. The biochar materials saturated with nutrients will be tested in terms of nutrient capture capacity, and lab scale investigations (planned in 2024) will be carried out for their use for fertilization.

So far, the project has found that the monitoring shows that the wetlands worked well in reducing nitrogen and phosphorous during algal blooms in May–June (2023). However, the project team experienced some technical issues with the pumps on the raft during the summer of 2023. The pumps did not work properly when they were covered in algae, this is something that the project will work on to solve for future seasons.

Overall, the pilot project found that the floating wetland raft system was able to reduce N and P concentrations sufficiently during algal blooms with effluent values below the (HELCOM) eutrophication thresholds.[18] The system also handled fluctuating nutrient loads well, since the system could reduce the phosphate and nitrate level below eutrophication thresholds, even after a long period of very low inflow concentrations. This is generally established knowledge for treatment wetland systems such as the vertECO raft, according to the project team. The inflow phosphate and nitrate concentrations were relatively low most of the sampling times. However, during the sampling event 12th of June 2023 a clear increase in inflow concentration were

16. https://initiativuto.se/
17. E.g. https://www.mitti.se/nyheter/de-hoppas-radda-ostersjon-med-unik-flotte-6.3.82462.a8f3649478
18. https://helcom.fi/baltic-sea-trends/eutrophication/

observed which is likely due to the algae bloom reported from the end of May until around beginning of June that year. At that time, the team found that the vertECO® prototype reduced the phosphorus by 87 per cent and the nitrogen by 88 per cent in the inflow water and the final nutrient concentrations were below eutrophication threshold level stated by HELCOM.

The plants used in the wetland were from the Baltic region, both local Swedish and other non-invasive species. The project first started with plants purchased in Austria, but they experienced that this did not work out well. Furthermore, when nutrient concentrations were lower (not during the algal bloom) the project experienced that some of the plants showed very slow growth due to nutrient starvation. On the other hand, some of the plant specialists in the wider team thought that some plants might have been exposed to a nutrient load that was too high. The project team also said that a there is a need for more sensitive measurement techniques that can detect very low phosphorus concentrations in the water, as this would help to understand the system performance better. As part of future upgrades of the system, they would like in-situ nutrient detection sensors adapted for very low nutrient concentrations and applicable for brackish/ sea water. The project is also looking into local plant types that better survive during winter conditions.

4.7.4 Next steps, potential for upscaling

The primary aim of the pilot has been to test the floating wetland raft system and to further develop the concept and functioning based on the results. Potential upscaling entails increasing the size of the floating wetland raft with capacity for cleaning more water. There are still some technical issues and potential modifications that the pilot will work more on, and larger rafts may also require other materials and design to let the sunlight go through. For future developments, the project is also thinking about making the current system more mobile, e.g. with GPS and sensor system (for on-site nutrient measurements).

The team has ambitions to continue to monitor effects after the pilot has ended and is currently looking into collaborations and funding opportunities for this. One concrete potential for upscaling to other areas that is being discussed is to collaborate with a wastewater treatment company located in Stockholm and to use the system in road runoff ponds. Another possibility is to place a raft in the Utö harbour to absorb toxic substances from the sea water there. The project is also considering testing out planting vegetables or other edible plants using the nutrient-rich biochar collected from the biochar tank of the floating wetland raft in the future.

A key success factor of this system is its ability to reduce nutrient concentrations in the sea water. The ambition is that the pilot can provide a model for a sustainable solution to reduce eutrophication in the Baltic Sea that can be adapted and used in the Nordic region and in other water bodies. As such, the project also aims to influence policies and convince governmental institutions to scale up. Considering policies, according to the project team, the requirements and permissions needed for the floating wetland rafts are still somewhat unclear. Within the team, there is local knowledge on such processes, but for others to be able to follow this information should be made more accessible.

4.7.5 Key lessons learnt and reflections relevant for nature-based solution projects

- **Diligent planning is important, including securing a contract and solving aspects related to intellectual property** (IP) of the technologies and methods to be used. This took considerable time in the start-up phase of the pilot project. With a relatively short project period, the team experienced that substantial resources and costs went into project planning and setting up the system, rather than actual implementation in the field. The project leader therefore recommends looking into such aspects and questions as early as possible, as the start of the project depends on contracts being in place.
- **A project team with the "right combination of people" has been a key enabling factor for** the project. This is meant both in terms of appropriate and complementary competencies and good communication within the project group, as well as having dedicated roles among the project partners.
- **Local plants are probably more robust and better suited to be used in the** floating wetland raft system, as the project found that non-native plants used in the system were struggling.

4.8 Pilot 8: Establishing multifunctional wetlands in agricultural areas (Åland)

Figure 30. Restoration for better wetland function in agricultural land in Åland (Photo: Ålands Vatten).

Project name (local language): ultifunctional wetlands for water quality, sustainable food production, climate adaptation and biodiversity - nature-based solutions and ecosystem services in Åland in the Baltic Sea (Multifunktionella våtmarker för vattenkvalitet, hållbar livsmedelsproduktion, klimatanpassning och biologisk mångfald – naturbaserade lösningar och ekosystemtjänster mitt i Östersjön).

Location: Åland

Duration: 1 April 2022–31 January 2024 / extended until 31 December 2024

Project leader: Ålands Vatten Ab

Involved actors: *Ålands Vatten Ab,* a publicly owned drinking water company in Åland is leading and managing the pilot project.

The *Project steering group* have members representing Åbo Akademi University, Åland University of applied sciences, Turku University of Applied Sciences' (Åbo Yrkeshögskola) department for engineering and business, and RI.SE Research Institutes of Sweden's department for Urban Water Management.

The *Project Reference group* members represent the Government of Åland's Environmental Agency and the water protection project Raseborgs Å.

Budget: Total 1,267,200 DKK (852,200 DKK, NCM contribution)

Primary type of NBS action: Conservation, Restoration, Sustainable use of resources

Key societal challenge(s) aimed to address: Water security, Environmental degradation and biodiversity loss, Climate change adaptation.

4.8.1 Background, concept and status

Aims: The pilot project aims to restore one and create two new multifunctional wetlands for better water quality, sustainable food production, climate adaptation and increased biodiversity (see Figure 30). The wetlands are expected to have benefits for the aquatic environment, drinking water supply, sustainable food production, climate mitigation and adaptation and biodiversity.

Challenge: Agriculture and human activities have large impacts on water quality and ecosystems. Due to low water quality in the Åland Water raw water reservoirs in the 1980s, three water protection areas were established. While the quality increased over the subsequent decade, the water bodies started deteriorating again in the 2000s. The publicly owned water company, Ålands Vatten Ab, supplies drinking water to about 75 per cent of Åland's population. Since 2015, the company has intensified its work for sustainable drinking water supply and water protection - a strategy that is linked to Åland's development and sustainability agenda. An investigation in 2017 showed that the nutrient loads in several lakes were very high, with agriculture being the largest source.[19] The company's goals are to stabilize the water quality in Åland's drinking water sources to good levels by 2030 and to ensure that activities are not negatively impacting the raw water reservoirs.

Concept: The concept is to establish different types of multi-functional wetlands through restoration in agricultural areas in main Åland, which is the largest island of Åland. Multifunctional wetlands may contribute to reduced flooding and more stable access to irrigation water for farmers. Higher raw water quality for drinking water supply would also require less energy and reduced chemicals for purification. It is expected that the wetlands and ponds can provide habitats for protected species such as small and large water salamanders, as well as frogs, insects and birds.

Status: Three locations in Åttböle/Markusböle, Prästgårdsnäset and lake Finnbacka have been selected for wetland creation and restoration in the pilot project (see Figure 31 and Figure 32). They are all part of the lake Markusbölefjärden catchment area which is a drinking water reservoir. The project started in 2022 with meetings and visits to the sites where restoration of wetlands was considered. At the same time, a procurement process began as external expertise was enlisted to assist in the work. A consultant helped with developing the plans and a contractor was engaged for the on-site excavation and restoration work. The plans for the three areas have been finalized at different times. Once the plans were ready, they were presented to the project steering group and local landowners for inputs and feedback before the field interventions could start. Recently it has been decided to develop the plan for Finnbacka träsk further.

As of October 2023, one of the planned wetlands has been created. The plan and status for the three locations are:

- **Åttböle:** Establish a multifunctional wetland/combi pond[20] for irrigation water and additional retention of water to prevent flooding and runoff during high rainfall events (see Figure 31). The planned wetland area is 0,55 hectare with a maximum depth of 1,1 meter, with a volume of approx. 5000 m^3 of water. The land is privately owned by a local fruit and berry farmer who needs more water for irrigation. The multifunctional wetland was constructed in the summer of 2023 and will continue to be developed in 2024, by improved availability and measures to improve biodiversity.

19. https://vattenskydd.ax/utredning-tillrinningsomrade/
20. https://vattenskydd.ax/bsi-kombidammar/

- **Finnbacka träsk:** Improve the wetland function in and around the lake and the adjacent wetland to improve water retention capacity. The aim is to improve the availability of water for irrigation and at the same time reduce risk of floods and nutrient runoff. The plan is developed in the autumn of 2023 in collaboration with an Estonian company. As of November 2023, the work is in progress, and the plan is to finalize the restoration during 2024.
- **Prästgårdsnäset:** Establish a multifunctional wetland to prevent runoff and improve the conditions for agricultural production of the nearby areas. There are cows grazing in the area, and to prevent them from going into the raw water, an additional pond where cows can drink is planned. The plan was finalized in 2023. In November 2023, the landowner (Northern Åland church) is processing the request from Ålands Vatten. Ålands Vatten has also approached the Åland Government about the potential for increased cooperation and funding in this location.

Figure 31. Location for a multifunctional wetland/combi pond in Åttböle (left). Excavation contractor, project leader and landowner in from of the newly established wetland in Åttböle (right) (Photos: aerial photo, Ålands Vatten).

Figure 32. Activities in one of the pilot projects sites (Photos: Ålands Vatten).

4.8.2 Organisation and involvement

The project is run by Ålands Vatten Ab. A steering group has been established to monitor whether goals and deliverables have been achieved. The group consists of contacts from other projects and relevant stakeholders, such as Turku University of applied sciences, and from a Finnish project on environmental measures in agriculture named Raseborgs å, as well as RISE in Sweden. It is highlighted by the project leader that it is valuable to include both representatives from Sweden and Finland in such projects in Åland.

Ålands Vatten Ab is a drinking water company owned by the Åland government and eight municipalities, including Mariehamns stad. They have worked on environmental measures related to water quality and runoff from agricultural areas for several years and have experience with one wetland restoration and construction before this pilot project.

Communication: The project leader has been responsible for most of the communication activities in the project but has also engaged a communication agency. They helped to build an information website called the "wetland web" (Våtmarkswebben) which has been established under Ålands Vatten Ab's website , vattenskydd.ax, as part of this project (see Figure 33).[21] This came about because they realised that there was lack of easily accessible information on what has been done in Åland on wetland construction and restoration and that it is not easy to find examples for inspiration or to learn from. The pilot project has been presented in several forums, including a fair about water in a local library and in conferences on NBS. In the autumn of 2023 Ålands Vatten was part of co-organising a seminar and field day on practical solutions for agricultural water management aimed at farmers, students, entrepreneurs, planners and people working in consultancy, organisations, management and projects. The pilot plans to further increase the communication efforts to engage civil society when the wetlands have been finally established, and beyond the project period.

21. https://vattenskydd.ax/vatmarkswebben/

How messages are communicated and framed is important, for example, the project leader makes the message more positive by talking about "*retaining nutrients in the ground*" rather than talking about "*nutrient leakage*". The project also experienced that highlighting the connection between local measures and positive effects on the Baltic Sea has created engagement and interest in the pilot work.

Figure 33. Poster about the wetland web, "Våtmarkswebben" (Photo: Ålands Vatten).

Collaboration and operations: The project has experienced challenges related to finding the right external expertise and competence, and it has taken time to establish contact. According to the pilot project leader, the demand for restoration and NBS consultancy services is very high, which is driving prices up and it has been a challenge to find someone who can do the job at a price that is within the project budget. The planning of the wetland restoration has been carried out by a now retired consultant. The entrepreneur was selected by a procurement process.

The cooperation between Ålands Vatten and local farmers has been a key part of the project. Land ownership is a strong right in Åland, and cooperation with landowners is important for the restoration activities. The landowners keep the right to the land and they enter into an agreement with the project before any work is done in the field. The project leader highlighted that having experience working with these issues has been important for establishing the relationships and agreements with landowners in the selected areas. Cooperation and communication were mentioned as essential factors for addressing potential conflicts of interest.

The maintenance work related to the restored wetlands is expected to vary for the different areas and may be the responsibility of Ålands Vatten for some, while in other cases the landowners will according to the agreement take over responsibility for the maintenance. In terms of making agricultural land available for wetland restoration, the two landowners that are private farmers are also in need of (more) water for irrigation in the future. The wetlands are expected to contribute to more stable access to irrigation water, so it is assumed to be beneficial for the farmers. In the third area, the landowner is a church which is renting out the land to a farmer. The flooded parts of the area are no longer used for agricultural production, and therefore not included in the farmers' lease. For this wetland, the project leader says a collaboration between the water company, the landowner and the Åland government is needed, since the area is close to a nature reserve. This also has implications for the maintenance that will probably be handled by the property board (Fastighetsverket) that also takes care of the nature reserve.

4.8.3 Effects of the NBS intervention – monitoring

During field visits to the different restoration locations in 2022 the state of the areas was documented by photography, video and drone images. Additional documentation was obtained from GPS data, GIS and satellite images and old drainage maps (maps showing old ditches and field drainage.)

The pilot has defined milestones and desired results for the project, but not specific indicators to assess. The monitoring is mainly done by Ålands Vatten and they are testing out different solutions to see what works. For example, when choosing the type of seeds for the wetland area, there were different recommendations from other projects, advisors and consultants about which seeds to use.

For the water company, having higher quality raw water for the drinking water supply would require less energy consumption and less chemicals for the purification process. The aim is that all three planned wetlands will contribute to better water quality in the drinking water reservoir, as they are part of its catchment. The pilot project does not have a budget for "scientific monitoring", such as analysing water samples, and there is also a challenge to define where such samples should have been taken to effectively show results before and after restoration.

It is expected that the restored wetlands and ponds can provide habitats for protected species such as water salamanders, as well as frogs, insects, and birds. There is a plan to follow up the monitoring of biodiversity in the future. At the project end, environmental benefits, working methods and cooperation process will be evaluated by the project team with the aim of providing good examples and learning points for other similar initiatives.

4.8.4 Next steps, potential for upscaling

Two of the three planned pilot wetland restorations are still waiting to be implemented and are planned for 2024. Before the next phase of restoration or construction, a new procurement process will be conducted. According to the pilot manager, the current budget will not cover all planned activities.

The project plans to share more information about the practical implementation of wetland restoration and construction and will continue to develop the wetland web. In addition, the pilot may cooperate with a vocational college in Finland to develop a handbook for wetland restoration and construction.

Åland Vatten also aims to keep seeking different funding opportunities and taking on new projects related to wetlands, restoration of ditches and improving water retention capacity etc. The project leader highlighted that it should be an ambition for Åland to increasingly apply for Nordic project funds. The project leader is also advocating for a program of measures for each of Åland's water bodies and is encouraging the Åland government to address this.

4.8.5 Key lessons learnt and reflections from relevant for nature-based solution projects

- **Stability and conditions for long-term thinking** are highlighted as important enabling factors in the project. This covers several aspects, such as planning, who will be involved in running the project, and funding opportunities. It was highlighted that up-front payments of funding have been important to ensure predictability for the pilot project.
- **Exchanging knowledge and experiences with other similar projects** is also important, as well as a project team that communicates well and is working toward the same goals. Creating networks and enabling exchange of experience is emphasized by the pilot as valuable for future success with NBS implementation.
- **Well-established relationships and communication with authorities** is key to understanding the legal frameworks and applying for the necessary permits to implement the NBS.
- **Each process often takes more time than expected**, and it is difficult to plan for and leave enough contingency time for unforeseen events, such as weather and ground conditions that can lead to delays. Also, the dialogue and time for mutual understanding and agreement with landowners and other important parties has demanded even more time than foreseen when planning the project. A certain level of flexibility in the project plan related to the actual implementation is therefore useful.
- **More education and courses for contractors and constructors** who are building and restoring wetlands are needed. Considering the high demand for the right competence and knowledge of NBS and restoration, the project leader also calls for more focus on this in higher education.
- **Every place is unique, and it is key to visit the locations** and establish dialogue with local stakeholders and landowners when planning and implementing NBS.

5. Insights and lessons learned from the NBS pilot projects

In this chapter we synthesize key insights and learning outcomes from following the eight nature-based solutions (NBS) pilot projects. Section 5.1 provides a broad overview, capturing the themes and insights across all projects. Section 5.2 then presents nuanced experiences and perspectives, echoing the themes of section 5.1 but providing additional depth and detail. Our findings are categorised into distinct yet interconnected themes, reflecting common topics.

5.1 Overall insights from across the NBS pilot projects

Six common, overarching aspects emerged from studying the eight nature-based solutions (NBS) projects:

A supporting and enabling environment and leadership is central if NBS projects, or related actions, are new to the responsible organization. The project leaders played an instrumental role in the pilot initiatives. As pioneers, they needed to spend time communicating the benefits of the NBS project, not only to stakeholders but also people in their own organizations.

Careful planning is an important component to be able to execute the NBS projects effectively. The pilot projects underscored the importance of appropriate planning specifically to ensure the multifunctionality of the NBS.

Involvement and collaboration with various stakeholders, citizens and landowners is a key part of the NBS project work. A significant observation from the pilot projects is that collaborating with various actors proved essential, considering the socio-cultural and legal contexts intertwined with the NBS landscapes.

Interdisciplinarity and multifunctional solutions: Combining different disciplines, types of knowledge, and roles is necessary to achieve multifunctionality of the specific NBS. The pilot projects have demonstrated that radical interdisciplinarity is beneficial, such as integrating social and natural sciences with communication, management skills and technical skills.

Monitoring of effects of the NBS will be necessary after the end of the pilot projects to assess their long-term performance. This will require additional funding.

Financing: The eight Nordic NBS pilot projects would not have taken place without funding from external sources. As such, the four-year NBS program of NCM has been essential to the projects and in getting these started.

5.2 Detailed insights from the NBS pilot projects: Nuanced experiences and perspectives

In this section we present nuanced experiences and perspectives that emerged from interviews and interactions with the pilot projects, expanding upon the overarching themes outlined in Section 5.1. For empirical context, we connect the insights to the pilot project(s) in brackets.[22] However it is important to note that these experiences may not be exclusive to the mentioned projects.

5.2.1 Practical implementation of NBS (or relevant project activities)

All the eight pilot projects clearly articulated their interest in learning how to best go from plans and interest in using NBS to solve a certain challenge **to on the ground implementation**. As the pilot projects are not yet finished, they are still gaining valuable experience in this.

Getting to the practical implementation has in several pilots involved **obtaining the necessary permits** (*NO, SE, FO*), and this has taken some time, especially if one has not done it before. Also, several projects reported that **finding the right competence and expertise (at the right time) was challenging**, e.g., finding contractors to do the practical implementation work (*AX*). Furthermore, it was necessary or useful for project leaders to ensure timely follow-up on the agreed responsibilities of the people involved (*FI*). Being a **team with diverse skills**, including members with hands-on and field experience (*SE*), has been advantageous. Also, knowing the partners and **having already built relationships** and having worked together before (with a contractor, teacher, consultant etc.) in projects or other work **made the practical implementation easier** (*FI, AX, FO*).

A common experience of all the NBS pilot projects was that **each site and area was unique and required both site visits and close dialogue with project partners and the stakeholders concerned.** Natural conditions (soil properties, landscape, terrain etc.) and weather (e.g., storms, heavy rainfall, drought) sometimes presented challenges during practical implementation that were not initially anticipated, which underlined the importance of site visits. One might be lucky and find favourable conditions, but it is always good to **do contingency planning** and try to identify factors that might influence the timeline and timing of activities beforehand (*AX, FO, IS*). During practical implementation details are important, such as how exactly gravel is placed or where the excavator can drive in the landscape etc., as they influence the functioning of NBS (*FI*). It is necessary to **follow up closely with contractors and entrepreneurs** while the physical work is being carried out (*NO, FI*).

Implementation of NBS in areas with many interests, concerns and/or competing wishes for the use of land **needs dedicated processes and coordination of actors in a meaningful way**. This requires time and dedication, skills, and a mindset to be willing to listen and engage without having all the answers upfront (*DK-H, DK-R*), as experienced, in particular, in the Danish pilot project on multifunctional land consolidation (*DK-H*).

22. The pilot projects are in this chapter referenced using the following codes: *DK-R*: Pilot 1- More Nature - Less Waste with brush fences (Denmark); *DK-H*: Pilot 2 - Planning for multifunctional land consolidation (Denmark); *FO*: Pilot 3 – Land restoration in the Faroe Islands; *FI*: Pilot 4 - Stream and watershed restoration in peatland and unproductive forest areas (Finland); *IS*: Pilot 5 - Crop wild relative biodiversity in urban green and coastal areas in Reykjavik (Iceland); *NO*: Pilot 6 - Protecting stream banks against erosion (Norway); *SE*: Pilot 7 - Floating wetland raft system for treating sea waters (Sweden); *AX*: Pilot 8 - Establishing multifunctional wetlands in agricultural areas (Åland).

> *If you haven't done it before, you first need to find out which permits are required and who are the contact points for these?*

5.2.2 Engagement, collaboration and communication

Overall, all pilots involve different actors and engage with stakeholders in one form or another, and their experiences and reflections are summarized below:

Outreach and communication early on can be valuable for NBS projects, as experienced by several of the pilot projects. The project leaders therefore advise doing substantial outreach and communication *before* and *while* the work is being done – not primarily when it is finished.

A related point is the fact that some stakeholders, like **landowners, are key in order for measures to take place.** NBS require available land/areas on which the solutions can be implemented.Several of the pilots have established contracts with the landowners to be able to conduct the pilots and/or planned interventions on the dedicated land areas (*FO, FI, AX, DK-H*). During the project works, the pilot project leaders also reflected on that some stakeholders may be sceptical towards the solutions. Actors may, if they are not involved and informed, choose conventional rather than NBS or the solution may not work as intended due to the site conditions which were uncounted for.

It is not always easy to identify *who* to engage or *how* to engage them, which was a common experience made by several pilots. While collaboration and involvement across different actors is described as very valuable, the aspect of coordinating and engaging the many different stakeholders and balancing interests, is also mentioned as challenging and involves investing time for it to be fruitful (*AX, DK-R, DK-H*).

> *It is not just about the environment; it is about the people.*

Involvement also means meeting and engaging with people with different opinions and concerns. Several of the pilots have experienced meeting landowners and other actors, where some were positive, and others were more sceptical towards NBS. It was mentioned that this place some pressure on the pilot (team) to show that the intervention is/will be working. Negative feedback can come from landowners or others who see the pilot as a threat to current practices or from actors concerned about facing increased demands towards them. In such cases, all pilots mention dialogue and interactions with the landowners and other stakeholders as key. Also, within a sector, such as agriculture, interests and perspectives can be different at different levels e.g., agencies and institutions vs individuals. Some have experienced positive interest and support from individuals when there has been scepticism at the agency level.

Influencing people's relationship with nature was identified as the ***aim*** of stakeholder engagement in several pilots (*IS, FO, DK-R*), but it was also expressed as a ***prerequisite*** *for behavioural changes* to support NBS (*DK-R, IS, FO, NO*), particularly in the case of owners and

managers of land. A pleasant discovery for some of the pilots was to find that people understood why there was a need to address the problem the project was focused on *(IS, DK-R).* Some of the pilots have **positive experience with involving students and school children** as part of their key pilot work and activities (*FO, DK-R*).

Most of the pilots **have received media attention** and several shared that there was **great interest both from the media as well from local politicians.** Positive attention in the media may also make it easier to get new funding and has made it possible to engage at the political level and attract politicians (*IS, DK-R, DK-H*). Also, some projects have produced dedicated information materials and targeted marketing to engage specific citizen groups (*DK-R*).

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> *One of the key challenges and joys is engaging citizens and stakeholders.*

5.2.3 Financing and funding

Getting funding has been and still is a challenge for implementing NBS and/or doing multifunctional land use projects, this was mentioned by all the pilot projects. Before funding is provided for NBS projects, financial actors often want to see statistics about the **expected results or performance of the NBS** (*DK-H, DK-R, FO*). This information is often difficult to provide, especially in experimental NBS projects and upfront. It is also important to consider that different funding sources and programs come with different commitments and requirements, so it is wise to check these as part of the acquisition processes (*SE*).

In the case of the eight Nordic NBS pilot projects, **funding from the NCM has been instrumental in getting the pilot projects going**. The pilots consider that such NCM funding can be used as leverage to show first results and attract future funding, and that (positive) outcomes from these pilot projects can help to attract more funding. Unfortunately, most funding programs and mechanisms are only short-term and with no, or uncertain, follow-up opportunities, which makes it challenging for long-term planning (*DK-H, FI, SE*).

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> *We need money annually, and we should know that we are getting that money annually. Now we are doing activities over some period, but we don't know how to do the activities after these years.*

5.2.4 Monitoring and evaluation

The pilots used different strategies related to **monitoring the effects of the NBS**. Some of the pilot projects had included baseline pre-action monitoring (*NO, FI, IS, DK-H*), some chose locations where an existing monitoring scheme was already in place (*NO*). Several had not budgeted for monitoring and, therefore, **relied on external funding sources or their own funding** for this purpose (*SE, FI, FO*). The monitoring is either conducted by the pilot team themselves, commissioning university partners *(DK-R*) or involving students in monitoring work (*FO*). The involvement of students in monitoring turned out to be an inspiring idea for other pilots as well who are now interested in exploring this approach in their future work (IS).

Monitoring is costly, so project leaders were thinking about **how it could be done effectively** (*AX*). Monitoring of effects on the natural environment should be continued for most pilots after the end of the pilot project period, because both the implementation and its developing effect on the natural environment takes time. Unfortunately, **monitoring and evaluation *beyond* the pilot project period** was (at the time of study) not arranged for most pilots. Some reflected on that monitoring and evaluation of NBS implementations should ideally be funded by the organizations funding the NBS itself and be a natural part of project planning and implementation.

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> *Just one sample in the inlet and outlet does not say a lot.*

5.2.5 Upscaling and mainstreaming

An aim with the NCM program and pilots on nature-based solutions (NBS) has been to promote the **increased use and spread of new/best practices in NBS.** The eight NBS pilots in the program address aspects of effective and efficient ways of implementing, organising and planning NBS in various ways.

Some are experimenting with and testing novel technical-natural approaches at small scale, so the next steps towards upscaling would be testing the methodology at a larger scale (*SE*). For others it is about getting similar or *different* actors (than those leading these pilots) to adopt the ways of working and taking the initiative to do similar interventions in their areas, e.g., for a municipality to initiate and conduct a similar NBS-related project (*AX, NO, IS, DK-H, DK-R, FO*). Some are engaging in method development and approaches for working on changing the ways in which we (humans) look at and interact with nature and natural resources (*DK-R, IS, FO*).

The pilot projects demonstrate how multifunctional and multi-actor land use planning could be done in practice and how such practices could be incorporated into politically adopted processes for future land use development and management (*DK-H*). Quite a few of the pilot projects will develop outputs such as different kinds of **plans, guides, and knowledge synthesis**, that can enable others to embark on similar projects. Furthermore, the pilot projects as results and experiences were starting to develop, appreciate the possibility to learn from one another.

> *Cooperation projects, seminars and fairs for further exchange of Nordic experiences would be much appreciated.*

5.2.6 Challenges and barriers

The NBS pilot projects all agreed that **doing new things for the first time takes more time than expected**. It takes time before the NBS project materializes in reality, because one needs to involve different actors and manage their expectations, acquire the necessary funding, and there is often more paperwork involved (i.e. getting permits) than initially anticipated. This has not only been time-consuming but also **challenging to balance the interests of different stakeholders** and levels of governance, especially concerning the management of land ownership and land use rights *(DK-H, FO).*

Obtaining the **appropriate competence and knowledge** – both in planning and implementation, such as finding contractors with the required experience, was stated to be a challenge in several of the pilots (*AX, NO*). Similarly, enabling truly multi-functional land use can be challenging and requires dedicated focus (*DK-H*). As well, the process of managing several different actors is rewarding, yet time consuming (*DK-R, DK-H*).

In our study, we noticed that most of the pilot projects strongly **depended on very committed individuals**. The project leaders had a lot of responsibility and tasks that were demanding to manage alone. Processes and tasks requiring a lot of dedication and efforts from them, even when the project included dedicated collaborators.

> *It really takes a lot of time, the collaboration between public, civil and private actors....you can't be too result-oriented because it takes a long time.*

5.2.7 Success factors and enabling conditions and mechanisms for NBS

Enabling conditions are the factors that support the adoption of nature-based solutions (NBS) and successful NBS projects. They can be of different type and character, both formal and informal, and include policies and management approaches etc. As such, the factors are wide-ranging and can include social or cultural beliefs, availability of information, and economic conditions.

When asked about success factors and what would enable successful NBS projects, the project leaders gave the following advice with respect to both the specific pilot experiences as well as related work:

- **Tailor the solution to local conditions:** Knowledge from other cases/regions needs to be adapted to the local context.
- Choose **interdisciplinary teams** and enable **dialogue and collaboration** across actors.
- **A network of people is important** for discussions and support when needed, including within the project group, as well as having connections to others outside the project, such as likeminded people (e.g., consultants, researchers). The establishment of a reference group early in the project can be wise.
- Acknowledge that many of the **NBS projects are about the people** and keep a focus on how to get the relevant actors, be it citizens and land users, owners, or others onboard, and how to do this effectively.
- Create a **space with sufficient time** and keep up the momentum, even if it's slow, as that's important for the collaboration.
- Allow and plan for some **flexibility and unforeseen things** that might occur.
- For NBS projects to happen there needs to be funding available. **Having funding in place for actual NBS implementation** is helpful in involvement processes, to demonstrate that this is real, and not just a potential plan that might not be carried through.
- **Holistic thinking is crucial** to be able to address the societal challenges at hand using NBS but also to ensure that the implemented solution does not cause damage elsewhere in an area and in the catchment.
- Include **children and young people** as NBS ambassadors.
- It is important to **plan for participation**, coordination, and engagement of various stakeholder groups and interests, including "**bridge-building**" between the involved organizations.

5.2.8 Key areas for future NBS knowledge development and support

As part of the study, we asked the pilot project leaders about which knowledge areas they considered to be lacking in information, where there is a need to develop more knowledge, e.g. what should future research projects focus on (knowledge gaps). The perspectives and answers were strongly related to the country where the pilot is situated, who is involved, and the kind of NBS they focus on, therefore also policy-related aspects were brought up.

Knowledge-related aspects:

Several of the pilot projects mentioned that a key focus going forward should be on gathering **evidence on the effectiveness of different NBS**. Creating systems to monitor the effects to be able to compare the effectiveness of NBS compared to conventional methods is incredibly important (*NO*).

There is also a need for the further development of systematic **methods for implementing NBS at a larger scale, at landscape** (*D-H*) and catchment level (*NO*). In the Faroe Islands, the project leader told us, there is a lack of research and knowledge on terrestrial ecosystems. There is a need for more **public knowledge and learning about nature in general**, to be able to see and understand degradation and how to protect ecosystems and local plants (*FO*).

Several pilots highlighted the need to further develop knowledge related to **strengthening or changing citizens' relationship with nature** (*IS, FO, DK-R*), including emphasis on that NBS is about adapting and solving human-induced challenges on natures' terms (*AX*). It is also relevant to improve **the knowledge about NBS in education** starting already at primary school *(DK-R, AX)*.

The term 'nature-based solutions (NBS)' is still not defined or used in the same way everywhere. It was mentioned that it is **important to use the correct terminology**, including NBS, when applying for projects and funding, but that the term NBS is still not so commonly in use (*AX*).

Policy-related perspectives:

A catchment-based approach when addressing a specific problem, by mapping and considering measures for the entire watercourses, is important to avoid creating or moving problems elsewhere (*NO*). The project leader of the Norwegian pilot advised that the public authorities should **support (through funding) the process-based part of NBS implementation** so that the process can be holistic, considering the catchment as a whole and facilitating collaboration with several landowners and entrepreneurs in the catchment/area. In that sense, the operationalization of the Water Framework Directive (WFD) might be the correct avenue for such work with NBS.

Several of the pilot projects pointed toward gaps or lack of regulation and policies in different areas of environmental management *(FO, IS, DK-H)*. The Icelandic pilot highlighted the need for a **uniform international legal framework for genetic resources** in the Nordic countries to ease collaboration (IS). The Danish Holmehave pilot pointed to the need to strengthen truly multi-functional land use programs and policies (*DK-H*). In some cases, the pilots have met barriers in the form of bureaucracy and complicated application processes (*NO, FO*). In other cases, the project leaders have pointed out that there is too little enforcement or restrictions on carrying out measures and interventions. For example, the project leader in the Åland pilot (*AX*) suggested that authorities could **improve the requirements on how different solutions are carried out** to avoid ponds with straight edges and to make the water flow more natural. There could also be potential for **using compensation measures to a larger degree**, for example, to require some areas to be restored to compensate for interventions in other places.

Getting stakeholders such as farmers involved **should not just be about financial compensation** for measures, to avoid everything just becoming a question of money. It should be communicated in a way **conveying that this is important work to protect nature and biodiversity for future generations** and that stakeholders can be proud of participating and doing their part *(FO)*. In the Faroe Islands up until now there has been little focus on policies for nature protection, but a new law is now being implemented in 2024.[23] Sometimes there is no data available for land areas where there are initial plans to implement NBS, meaning there is no foundation for decision-making or means of protecting the area. There is a need to **prioritize scientific research into laws and policies**, but also there is not always time to wait for research data to protect areas, and one have to act on the best knowledge available (*FO*).

Several of the pilot projects highlighted **the importance of enhancing cross-sectoral communication and collaboration**. It was suggested to organize workshops or meetings for diverse stakeholders and sectors, aiming to foster dialogue about the implementation of nature-based solutions (NBS), while also taking different policies into account.

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> *If people who work with land use, nature and politics are not involved, handbooks, guides and similar material on NBS is of little use.*

23. https://logir.fo/Logtingslog/70-fra-22-05-2023-um-natturuvernd

6. Concluding remarks and recommendations

As we conclude the exploration of the eight nature-based solutions (NBS) pilot projects, we present key recommendations and their broader implications for NBS in the Nordic context. Section 6.1 discusses specific aspects and suggestions pertinent to the ongoing and future Nordic NBS initiatives. Section 6.2 is divided in two parts, one providing recommendations for those directly involved in NBS projects and one section with recommendations for stakeholders and policymakers who facilitate, enable and support the implementation of NBS.

6.1 Recommendations concerning the NBS pilot projects

The eight NBS pilot projects serve as tangible demonstrations of the potential that NBS applications have in the Nordic region. Having followed the projects for about half or a little longer of their duration, it is evident that the experiences and the insights that have emerged from their planning, establishment and in some cases operational phases align with and reaffirm established international findings on NBS projects.

Identifying and understanding the unique features of the Nordics is relevant for effectively adapting measures and strategies to national and local conditions. These projects highlight Nordic characteristics, such as short growing seasons and harsh weather conditions, which influence the running and implementation of the NBS projects. Also, the Nordics have a strong public sector and high taxation welfare model, along with strict environmental laws, permits and strong landownership, shaping the context in which these projects operate, impacting both their execution and standards. This can influence how quickly and easily projects can be implemented, but also ensures higher standards for environmental protection as well as landowner rights.

As the NBS pilot projects are still ongoing, a follow-up study is warranted to complete the insights covering the full project-cycle of the NBS pilots and beyond. This is especially interesting as all eight projects emphasized the importance of the external funding from the Nordic Council of Ministers (NCM) to get the pilots started. A crucial question is if the NBS initiatives manage to continue long-term after the project and program period is over. The outcomes of the national pilot projects carry unique implications and knowledge relevant for advancing and implementing similar projects. Therefore, to continue to study the NBS after the projects are officially finished, is something we highly recommend. This will ensure a comprehensive understanding of their long-term impacts and efficacy. The IUCN Global Standard for NBS, although not actively used in the pilot projects thus far, could hold relevance and merit for both assessing and guiding future initiatives, as it was observed that many of the dimensions in the criteria of the IUCN standard were highly relevant in the eight projects.

We also recommend continuing to encourage the exchange of experiences among the pilot projects and other relevant stakeholders during the remainder of the NCM's NBS program. This can foster a collaborative environment that promotes shared learning and risk-taking for the collective advancement of NBS in the Nordics and beyond.

6.2 Recommendations for enhancing the implementation of nature-based solutions in the Nordics

Drawing on the insights gathered, we conclude by offering a set of recommendations aimed at achieving a broader, more effective, and efficient implementation of nature-based solutions (NBS) in the Nordic region. The recommendations target NBS practitioners i.e., professionals planning, designing, establishing and running NBS projects as well as enablers of NBS i.e., policymakers, bureaucrats, funding organisations and other stakeholders supporting and setting the framework for NBS implementation.

6.2.1 Recommendations for implementors and practitioners of NBS

Given the diversity of NBS, the different types of NBS projects and the varied contexts in which they are applied, it is crucial to acknowledge that there is no one-size-fits-all approach.

Implementation strategies should be tailored to each location's individual characteristics, requiring place- and context-specific assessments. Yet, based on our study of the processes in the eight NBS pilot projects, some common key aspects emerged. As these findings are in line with leading frameworks on NBS, we indicate how they relate to relevant parts of the IUCN global standard for NBS:[24]

- **Prioritizing stakeholder engagement:** Aim to actively involve local communities, landowners, citizens, governmental bodies, and other relevant stakeholders in all phases of the NBS project. Awareness of their needs, interests and capacity for involvement makes engagement activities meaningful for the different actors and benefits the project. Fostering collaborative decision-making processes can ensure that diverse perspectives and local knowledge are considered. *(IUCN criterion 1, 5, 8)*
- **Comprehensive site analysis and planning:** Understanding site conditions, as well as meticulous planning, is essential for selecting suitable areas for NBS. Consider land use, landownership and prioritize spaces where interventions are feasible and impactful. Prior to physical implementation, conduct thorough site assessments including e.g. assessment of soil and other relevant environmental conditions, mapping of elements affecting where and how the NBS can be established such as e.g., water pipes, areas of high cultural values. Make sure to understand and respect landowner rights and priorities. *(IUCN criterion 2)*
- **Holistic approach for multifunctionality:** Considering the broader landscape, including the catchment and its usage, is essential to achieve the multi-functional outcomes desired from the NBS. Considering the area's dynamics is crucial not only to prevent shifting or generating new problems, but also to identify the most effective solutions. Often, these solutions are multifunctional, reflecting the competition for various land uses. Thus, a holistic approach requires inclusion of diverse perspectives and expertise, including, but not limited to, diverse users of the land/area. *(IUCN criteria 2, 6)*

24. In brackets we indicate where the recommendations in this report are in line with the IUCN Global Standard for Nature-based Solutions' criteria. It is important to note that our empirically derived recommendations are not intended to replace any other guidelines or recommendations, and that they do not necessarily capture all elements of the IUCN criteria that we refer to. See also chapter 2.2.

- **Ecological diversity and ecological principles:** The improvement of ecosystem services, resilience and biodiversity benefits are fundamental to NBS. Implementation therefore needs to emphasize the enhancement of biodiversity through the selection of locally appropriate NBS, both in terms of what species are planted or used, and the enhancement of biodiversity through habitat creation, e.g., the enhancement of bird or butterfly biodiversity by increased quality and quantity of river and stream riparian habitat. Working at the landscape and/or the catchment scale, considering ecological principles (e.g., bottlenecks and founder events, population dynamics, trophic cascades, large-scale ecological processes) can help to maximize the positive ecological and biodiversity impact on local ecosystems and enhance long-term sustainability. Consider not only the site where your NBS is located, but also other connected ecosystems (Palmer, 2016; Lindenmayer, 2020) *(IUCN criterion 3)*
- **Adaptability and resilience planning:** Design NBS projects with a focus on adaptability and resilience, so that they are effective despite changing environmental conditions, climate change and other short-term and long-term uncertainties. NBS are not static, they influence their surroundings as well as being shaped by socio-environmental conditions. Incorporate flexible NBS design and management strategies that allow for adaptation over time based on ongoing monitoring and feedback. *(IUCN criterion 7)*
- **Effective use of resources and expertise:** Leverage local expertise and resources to ensure the that the NBS project is grounded in the community's context and capabilities. Identify, work together with and train local contractors and entrepreneurs who can effectively implement NBS on the ground. When needed, collaborate with experts from other locations, including abroad, while being mindful of local conditions and needs. *(IUCN criterion 4, 5)*
- **Monitoring and documentation**: Implement monitoring and documentation throughout the NBS project-cycle, and if possible, beyond. This includes tracking progress, evaluating the effectiveness of interventions, and gathering data on ecological and social impacts. This helps to adapt strategies as needed, as well as providing valuable insights for stakeholders and the broader NBS community. Regular documentation ensures that lessons learned are captured and that these can be used to share knowledge and to guide future NBS initiatives. *(IUCN criterion 1–8)*
- **Capacity building and education:** Aim to empower the local community with the knowledge and skills needed for the long-term NBS stewardship. Promote a sense of community ownership and sustained success beyond the project by e.g. engaging the community in maintenance activities. Inform and educate citizens by creating informative materials and implementing targeted strategies to inspire future NBS actions. Establishing demonstration sites and working with NBS ambassadors e.g., school children and students, could be part of this. *(IUCN criterion 5, 8)*

Given that we have not followed the pilot projects for their full duration, these recommendations above are based on the project phases studied.

The ICUN Global Standard for Nature-based Solutions

1. NBS effectively address societal challenges
2. The design of NBS are informed by scale
3. NBS result in a net gain to biodiversity and ecosystem integrity
4. NBS are economically viable
5. NBS are based on inclusive, transparent and empowering governance processes
6. NBS equitably balance trade-offs between the achievement of their primary goal(s) and the continued provision of multiple benefits
7. NBS are managed adaptively, based on evidence
8. NBS are mainstreamed within an appropriate jurisdictional context

For more details see Chapter 2.

6.2.2 Recommendations for NBS enablers

The insights derived from the study of the eight pilot projects have confirmed the important role of policy and enabling mechanisms for nature-based solutions (NBS). The success of and mainstreaming of NBS hinges not just on appropriate design and implementation, but also on the supporting policies and enabling factors, such as access to funding and adequate processes for obtaining the necessary permits.

Our recommendation to NBS enablers, reflecting the eight ICUN Global Standard for Nature-based Solutions' criteria, are:

- **Promote understanding and applications of NBS**: Convey the impacts of NBS by emphasising their local benefits, particularly when communicating with actors unfamiliar with the concept. It's essential to communicate what NBS can contribute in contrast to other approaches. NBS address social, economic, and environmental challenges effectively and adaptively, while simultaneously providing human wellbeing, ecosystem services, resilience, and biodiversity benefits.
- **Facilitate and promote monitoring and documentation of NBS projects and interventions:** Recognize the significance of monitoring and evaluation of NBS by strongly encouraging or requiring it in tenders and project calls, while at the same time facilitating it in terms of funding. Allocate additional dedicated funds to support long-term monitoring and evaluation after completion of NBS projects. There is a lot to learn by one's own doing, but also from others' experiences – to be inspired by their successes and avoid making the same mistakes twice. Emphasize learning from both successes and failures to enhance future NBS initiatives and enable NBS project outcomes to be thoroughly documented and reported, by setting aside funds for it.

- **Facilitate cross-Nordic sharing and learning**: Encourage the exchange of experiences and lessons learned among NBS projects across the Nordics and beyond. Foster a platform for ongoing communication, for example through seminars or joint projects, to enhance mutual learning and support networking. Teams working on NBS can benefit from mutual support.
- **Provide institutional support mechanisms and policies:** Support the effectiveness of NBS projects by ensuring supportive institutional mechanisms at all phases of the projects. Recognize that pioneering projects often encounter unexpected challenges and therefore explore ways to mitigate risks, such as providing flexible, but structured support. Acknowledge context-specific needs and challenges faced by project teams and consider embedding some flexibility in for example framework conditions, project calls and guidelines to accommodate diverse scenarios.
- **Promote transdisciplinary, cross-sectoral, and inclusive approaches:** Holistic perspectives ensures the support in NBS projects that foster collaboration across various disciplines, sectors, actors and knowledges through targeted funding and calls. Recognize that NBS requires land/area. Promote innovative models for engaging landowners and other stakeholders, which emphasise the importance of multifunctional land use and ownership considerations.
- **Establish a comprehensive financing framework:** Broad-based, long-term funding structures are needed to support and cover all phases of NBS projects, recognizing the importance of planning, maintenance, and post-monitoring phases. Continue the Nordic funding to accelerate NBS adoption, successful implementation and consolidation. Ensure that funding schemes in all Nordic countries accommodate the varying timelines of NBS projects, from quick implementations to those where nature takes longer to fully function and show the results of the intervention. Stability in financing is vital; unpredictable funding can hinder project initiation due to uncertainties about the longevity of financial support.

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Appendix 1: Questionnaire

The project leaders of the pilot projects answered the questionnaire in June-August 2022. The questionnaire consisted of the following questions:

Basic information

- Name of the pilot project
- Location (municipality, country)
- Actual starting date (dd.mm.year):
- Planned end date of the pilot project (dd.mm.year):
- Contact person(s) and email:
- At what stage is the NBS pilot now? Please describe with a few words where you are in the process.
- What overall problem(s) does the project aim to solve? Summarize in 3-5 sentences.
- Which type of solution(s) does the pilot include? Check all options that apply.
    - Conservation
    - Restoration
    - Sustainable use
    - Other (please fill in)

Planning the pilot

- Type of NBS included in the pilot: Please describe your NBS concept briefly.
- Have there been any substantial changes to the pilot project after the application was submitted?
- If several partners are involved in the NBS pilot, what are the roles of the different partners? Explain briefly.
- What was the background and reason for choosing this specific case (including topic, location) as a pilot? Explain briefly.
- What are the anticipated overall key success factors of your pilot project? Describe briefly.
- Are you using any NBS frameworks or guidelines for NBS planning, implementation and assessments?
    - Yes (describe briefly and include reference/link)
    - No
- If several partners are involved in the NBS pilot, what are the roles of the different partners? Explain briefly.
- What was the background and reason for choosing this specific case (including topic, location) as a pilot? Explain briefly.
- What are the anticipated overall key success factors of your pilot project? Describe briefly.

Experiences so far

- Are you using any NBS frameworks or guidelines for NBS planning, implementation and assessments?
    - Yes (describe briefly and include reference/link)
    - No
- How and at which stages do you plan to engage civil society and NGOs in the pilot? Describe briefly and provide examples if relevant.
- Are there any mechanisms in place to address possible conflicts of interest? Please describe briefly.
- To what extent will the NBS pilot require maintenance?
    - Who is responsible for this?
    - How will this be taken care of (including funding) after the NCM project period?"
- Considering the effects of the NBS in your pilot – what impacts do you expect it to have on:

	Negative change	**No change**	**Some improvement**	**Large improvement**	**Not sure**
Climate change mitigation					
Climate change adaptation					
Disaster risk reduction					
Economic and social development					
Human health					
Food security					
Water security					
Biodiversity					
Reducing environmental degradation					

- Please elaborate briefly on the most important expected benefits of the pilot NBS:
- How are you planning to evaluate the NBS pilot? Please describe briefly (e.g. approach, data, timing, which aspects).
- Have you defined key performance indicators (KPIs)? Describe which indicators and how you plan to track them.
- What has worked well so far, and why? Please explain briefly.
- What has been challenging so far, and why? Please explain briefly.
- Is the implementation of the pilot enabled or supported by specific policies in your country (e.g., regulation, strategy, programme)? If so, please briefly provide details."

Appendix 2: Interview guides

The pilot project leaders were interviewed twice, through semi-structured interviews, once in March 2023 and again in October 2023, via Microsoft Teams meetings with two S-UMMATION project team members leading and noting the interviews. We also audio-recorded the interviews, with consent, using a separate device. Additionally, three workshops organized by the project covered experiences, lessons, findings, and plans for upscaling and further development.

First round of interviews – March 2023

Intro/warm-up

- Briefly, what are you currently working on in the pilot?

Background/context

- Has there been any changes to the scope of the project? If so, why?
- Before entering this pilot, did you/the team been involved in similar or other related NBS projects? (if yes, has that previous work been useful, how?)
- How was the team put together? What are *key professions* involved in the pilot?
- Are there other projects you look to/learn from, in your country, or abroad?

Involvement and engagement

1. What has been key engagement, dissemination and communication activities. Any plans/activities for the spring?
2. What concrete activities have stakeholders been involved in so far – why and how? Did this go as expected/hoped? E.g. how many, what type, etc
3. What is your plan to further engage or continue involvement in the project, and have you had any adjustments or changes to this along the way?
4. What are the main strengths and weaknesses / benefits and disadvantages to involvement in general and your approach to this specifically?

Frameworks and (plans for) evaluation/monitoring/follow up

5. You during summer last year shared that you will be using some standard to evaluate the pilot. Could you elaborate a bit on this? How is this going? Has this been done?
6. Are you doing anything specific on monitoring biodiversity?

Success factors and Important prerequisites for (success) of such projects

7. What have been key enabling factors for your project to be established and develop as it has so far? (What are currently working well?)
8. Are you facing any challenges in the project at the moment? How will these be solved?
9. From planning to actual implementation of NBS and follow-up, do you see any potential hurdles (barriers)? Is this based on your own experience? (link it back to case if so, to the interviewee see these as NBS and/or context specific?)
10. What are in your experience key important prerequisites for successful implementation of NBS?

Key take-ways/reflections/learnings so far (and mainstreaming/scaling up):

11. If someone embarking on the same as your project, what advice would you give them? What is your main recommendation for other similar projects that aim to replicate/establish similar NBS/ initiatives?
12. What are 2-3 key learnings so far, that you think would be useful for others implementing NBS?

Anything related to the topic of implementing NBS that you would like to share/raise?

Second round of interviews – October 2023

Status and next steps

1. Briefly, what is the current status and what are you currently working on in the pilot project?
2. Since spring 2023 (the previous interview) what has been key developments/achievements and, if any, challenges?
3. How is any monitoring going?
4. Next steps for the rest of the project period? And any plans for beyond the end of pilot project ("upscaling")?

Lessons learned

5. Any other projects or handbooks that has been useful for you as a guide or example/that you would recommend looking at regarding nature-based solutions?
6. Is there something that has surprised you when working with this project? What and why?
7. Main lessons learned that you would like to convey that could be relevant for other similar and/or other types of NBS related projects?

Supporting and enabling factors and ways forward

8. Do you have any thoughts on what would be the most effective types of policy support for NBS? Both specifically for your NBS pilot type / in your context and general.
9. With what you know now, what is something that you would recommend to a new NBS initiative for it to be successful?
10. Do you have any opinion on what should be key question to focus on in the next years regarding Nature-based solutions? (i.e., where is more knowledge needed)?

Anything related to the topic of implementing NBS that you would like to share/raise?

Appendix 3: IUCN framework

To guide the user throughout the assessment, the tool includes guiding questions and text for each indicator which also includes descriptions of each level in the scale. The tool is designed so that the user for each indicator assesses to what degree the indicator has been achieved, which results in a score (0–100%) for each criterion which is then illustrated as a spider web. The visual output can be used to get a clearer understanding of the strengths and weaknesses of the NBS actions, which can be used to improve the work with similar solutions. The tool is made available for those registered as users (see link under 'notes' at IUCNs website about the tool: https://portals.iucn.org/library/node/49070)

The figure below is an example of the results from the IUCN self-assessment tool for *a fictive example.* Each of the criteria get a score between 0–100%, based on the self-assessment of the indicators for each criteria.

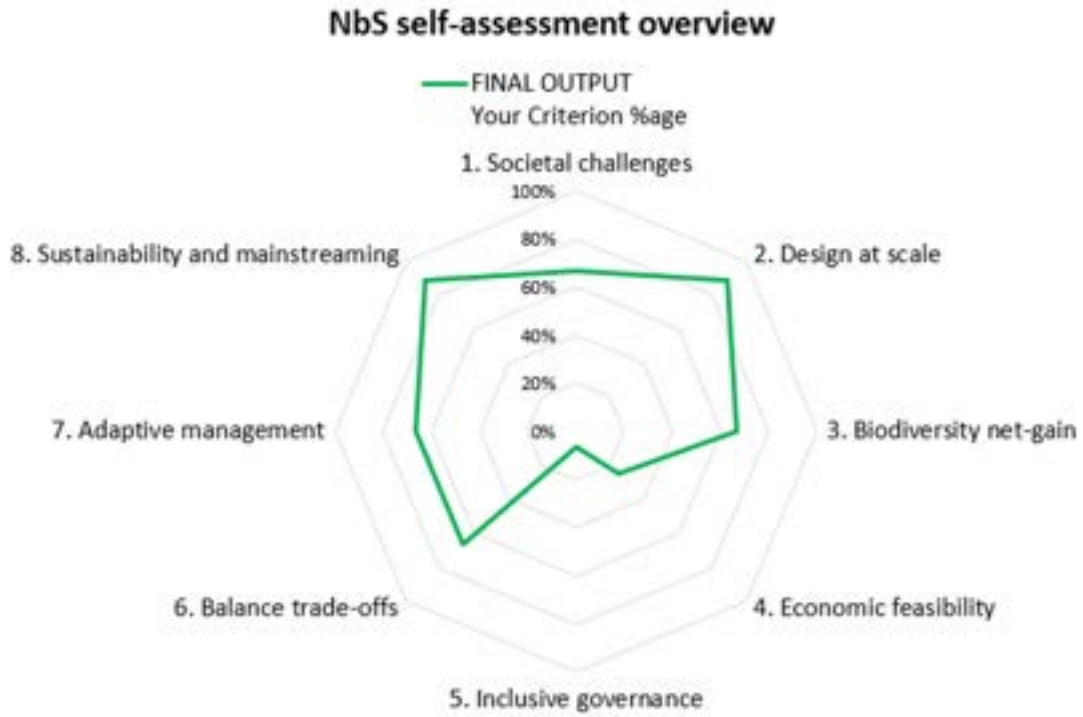

Table 1 IUCN self-assessment tool has, for each of the eight criteria, a set of indicators which is assessed using a scale with the help of guiding questions. The tool is demonstrated here for criterion 3.

IUCN criteria for NBS	**Indicator with guiding questions**		**Self-assessment** *(choosing one of the options)*	**Guiding text for each level per indicator**
3. NBS result in net benefits to biodiversity and ecosystem integrity	3.1	Is the current state of relevant ecosystems assessed? ...	Strong	Yes. An updated assessment of ecosystems at the appropriate spatial and temporal scales is in place ...
			Adequate	There is available information about the current state of the ecosystems using secondary data and reference maps ...
			Partial	General information about existing land cover and land use is used for assessing the status of the ecosystems ...
			Insufficient	No. There is no information available about general conditions ...
	3.2	Are clear and measurable biodiversity conservation outcomes identified? ...	Strong	Yes, they include specific and measurable indicator variables for biodiversity and ecosystem integrity, the direction ...
			Adequate	Yes, they include measurable indicators ... related to biodiversity and ecosystem integrity, but may lack specific details related to the magnitude and timeframe ...
			Partial	The NBS outcomes related to biodiversity and ecosystem integrity lack specificity. There is a general indication that ...
			Insufficient	No. The NBS lacks identified outcomes related to biodiversity or ecosystem integrity ...

About this publication

Practical experiences with nature-based solutions in the Nordics

Summarising insights from eight pilot projects (2022–23)

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