

Final report describing validation work in Demonstrators

Deliverable D3.7

Authors: UFZ

*Contributors: Christian Kuhlicke,
Oliver Gebhardt, Julius Knopp*



© 2018 RECONNECT Consortium

Acknowledgement

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 776866

Disclaimer

The deliverable D3.7 reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained herein.



Document Information

Project Number	776866	Acronym	RECONNECT
Full Title	RECONNECT- Regenerating ECOSystems with Nature-based solutions for hydrometeorological risk rEduCTion		
Project URL	http://www.reconnect.eu/		
Document URL			
EU Project Officer	Nicolas Faivre		

Deliverable	Number	D3.7	Title	Final report describing validation work in Demonstrators
Work Package	Number	WP3	Title	Co-evaluation and Validation

Date of Delivery	Contractual	31 July 2024	Actual	5 September 2024
Status	Version1.0		final	<input type="checkbox"/>
Deliverable type*	R			
Dissemination level **	PU			

*R – Report, P – Prototype, D – Demonstrator, O – Other.

**PU – Public, PP – Restricted to other programme participants (including the Commission Services), RE – Restricted to a group specified by the consortium (including the Commission Services), CO – Confidential, only for members of the consortium (including the Commission Services).

Authors (Partner)	Christian Kuhlicke, Oliver Gebhardt, Julius Knopp (UFZ)		
Responsible Author	Christian Kuhlicke	Partner	UFZ
Contributors (Partner)			

Abstract (for dissemination, 100 words)	This report validates the work with stakeholders at the DEMO A and B sites and evaluates T3.5. It assesses whether the NBS implemented in the DEMO A sites actually meet stakeholders' preferences, needs and requirements. To provide methodologically robust findings we interacted two times with stakeholders: stakeholders are surveyed before the implementation of the NBS projects and thereafter to better understand whether and how their preferences and needs changed throughout the projects. This is complemented by the experiences in the DEMO B sites. The work comprises 27 interviews with stakeholders at the DEMO A sites and 8 expert interviews from the DEMO B sites.			
Keywords:	participatory approach, validation, co-creation, nature-based solutions, hydro-meteorological risk reduction, societal challenges			
Version Log				
Issue Date	Rev. No.	Author	Change	Approved by
05.08.2024	V1	Christian Kuhlicke & Julius Knopp		

Copyright notice

© 2018 RECONNECT Consortium

This document contains information that is protected by copyright. All Rights Reserved. No part of this work covered by copyright hereon may be reproduced or used in any form or by any means without the permission of the copyright holders.

Executive Summary

The aim of this report is to provide an overview on the work conducted for Task 3.5. At the core the activities in this task is the so-called validation work. More specifically, we assess whether the NBS implemented in the demonstration sites actually meet stakeholders' preferences, needs and requirements. To provide methodologically robust findings we decided to apply a three-fold study design: stakeholder in the Demo A sites are asked before the implementation of the NBS projects and thereafter to better understand whether and how their preferences and needs changed through the course of the realisation of the projects. The results are then evaluated against the expert interview from the well-established NBS in the Demo B locations.

In RECONNECT, the term "validation" addresses activities directed towards the assessment of stakeholders' highly subjective perceptions of the NBS. "Evaluation", on the other hand, is understood as the less perception-influenced measurement of comparatively "hard" indicators. Of course, there are points of contact between validation and, especially, people indicators-based evaluation activities. This report focuses on the validation work and provides relevant information on stakeholders' perceptions and expectations towards the NBS projects. We also assess to what extent stakeholders would like to be involved in the realisation process and which potential role they would like to play. This information was used to further specify the co-creation work performed in the demonstration sites.

This report provides relevant information and aims at supporting practitioners who are involved in the realisation of an NBS. They can use the information to get a better understanding of stakeholders' preferences and expectations. The document is meant to support them, when they would like to set up a co-creation process.

However, this manual is also addressed to the broad audience: academia and scientific institutions; NBS stakeholders and partners such as governments, city councils and development partners; beneficiaries, who are involved in NBS planning, monitoring and evaluation processes; staff in country offices, regional bureaus, regional centres; managers who oversee and assure the quality of planning, monitoring and evaluation of NBS processes and products, and use monitoring and evaluation for decision making; members from different consultancy organizations who oversees and supports the activities of NBS project, ensuring that the organization remains responsive to the evolving needs of different stakeholders; civil society organization and citizen groups who will be involved in the co-creation process of NBS.

The results are based on first and second round of interviews (overall n=27/16) conducted in Hamburg (n=8/8), Odense (n=11/4) and Portofino (n=8/4), all of them Demo A sites. There is a high motivation among stakeholders to also get involved during upcoming monitoring and evaluation activities. Our results suggest consistently high approval for supporting statements with respect to NBS. With the follow-up interviews, a high level of support for NBS emerged, and the majority of participants value the benefits and co-benefits in their respective sites. The results from the Demo B sites consist of 8 expert interviews from the Aarhus, Ijssel, Inn and Thur project locations. Across all sites, we can conclude the following: Firstly, local history, knowledge and conditions have to be taken

into account when planning NBS projects, and also while engaging with local stakeholder. Key insights provided by them can help mitigate unwanted dis-benefits and enhance public participation and acceptance of the project. Secondly, sufficient funding beyond the NBS implementation needs to be secured beforehand, especially for monitoring, and to counter unexpected dis-benefits. Thirdly, access is key to appreciation and valuation. With non-accessible NBS, the overall goals of a given project might still be fulfilled. However, this comes at the expense of local awareness and appreciation, lowering the cognizance of NBS.

Contents

Executive Summary	5
Contents 7	
List of figures	8
List of tables	9
Abbreviations	10
Glossary of key terms	11
1 Introduction	12
2 Methodological approach	13
2.1 Demo A sites	13
2.1.1 Methods of data collection and analysis	14
2.1.2 Stakeholder selection	17
2.2 Demo B sites	18
2.2.1 Methods of data collection and analysis	18
2.2.2 Stakeholder selection	19
2.3 Composition of the interviewees for the Demo A sites	19
2.4 Composition of the interviewees for the Demo B sites	24
3 Results	25
3.1 Demo A	25
3.2 Demo B – Expert interviews	34
4 Synthesis of our validation analysis	44
4.1 Co-creation	44
4.2 General perspective on NBS	46
4.3 Site-specific perspective on risks and NBS	47
5 Conclusion	50
References	52
Appendices	53
Questionnaire Demo A - first round of interviews	53
Questionnaire Demo A - second round of interviews	64
Questionnaire Demo B	81
Declaration of informed consent form	84
List of interviews	87

List of figures

Figure 1 Guideline for conducting stakeholder interviews in Portofino	15
Figure 2 Interviewees by stakeholder type	19
Figure 3 Interviewee detail Hamburg	20
Figure 4 Interviewee detail Odense	21
Figure 5 Interviewee detail Portofino.....	21
Figure 6 Previous experiences of interviewees with NBS projects	22
Figure 7 Best-known NBS-related terms by interviewees	23
Figure 8 Distribution and number of participants for the Demo A sites.....	25
Figure 9 The RECONNECT co-creation process for NBS	45

List of tables

Table 1 General attitudes towards NBS.....	26
Table 2 Information about the project in general	28
Table 3 Intensity of involvement.....	28
Table 4 Involvement stages	29
Table 5 Involvement mode	29
Table 6 Risks considered relevant at the site/ severity	30
Table 7 Relevance of sub-goals.....	31
Table 8 Benefits already experienced/expected from.....	31
Table 9 Current perception of the NBS area.....	32
Table 10 Current and future assessment.....	33
Table 11 Future participation.....	33
Table 12 Perspective on NBS	34
Table 13 Modes of involvement across all 4 sites	35
Table 14 Stages of involvement across all 4 sites	36
Table 15 Satisfaction levels of stakeholders with their respective involvement	37
Table 16 Attributed co-benefits by site.....	39

Abbreviations

D 2.1	RECONNECT project Deliverable 2.1 “Preparing co-creation: Stakeholder analysis”
DTU	Danish Technical University
FAI	Fondo Ambiente Italiano
LSBG	Landesbetrieb Straßen, Brücken und Gewässer Hamburg (Flood authority in Hamburg)
NBS	Nature-Based Solutions
NGO	Non-Governmental Organization
RECONNECT	Regenerating ECOSystems with Nature-based solutions for hydrometeorological risk rEduCTion
WP	Work Package

Glossary of key terms

Co-benefits	added benefits that result from actions taken to address environmental challenges like hydrometeorological hazards or climate change, and which go beyond direct benefits of a more stable climate or reduced risk (Smith, 2013)
Co-creation / co-production	an approach to collaboratively generate new knowledge, with the aim to increase the social relevance of the knowledge produced for policy and practice applications, and to generate new research questions
Meteo-hydrological hazard	a potentially damaging meteo-hydrological event that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Examples of hydro meteorological hazards include floods, storm surges, droughts, and landslides (McBean, 2016)
Nature-based solution	actions inspired by, supported by, or copied from nature that aim to help societies address a variety of environmental, social and economic challenges in sustainable ways (EC, 2017)
Stakeholder	persons, groups, and organizations who are, negatively or positively, affecting and/or being affected by current and future hydro-meteorological hazards as well as by the proposed NBS

1 Introduction

The aim of this report is to provide an overview on the work conducted for Task 3.5. At the core of the activities is the so-called validation work. That is, we assess whether the NBS implemented in the demonstration sites actually meet stakeholders' preferences, needs and requirements. To provide methodologically robust findings we conducted interviews with stakeholders before the realisation of NBS and thereafter to better understand whether and how their preferences and needs changed through the course of the realisation of the projects. The results presented here are based both on the base-line analysis as well as on the follow-up analysis. This includes interviews conducted with stakeholder before and after the NBS were implemented in the demonstrator sites. This focus is on Demonstrator A.

For the Demonstrator B sites, we opted to conduct expert interviews. Their retrospective knowledge and experiences can serve as guidelines for establishing future NBS, as they provide both access to stakeholders' perspective and further external factors and decision making. The results of this part of the work are also compared with the findings from the Demo A sites.

Furthermore, we assessed to what extent stakeholders would like to be involved in the realisation process and which potential role they would like to play. This information was used to further specify the co-creation work performed in the demonstration sites. This report provides relevant information and aims at supporting practitioners who are involved in the realisation of an NBS. They can use the information to get a better understanding of stakeholders' preferences and expectations. The document is meant to support them, when they would like to set up a co-creation process.

This report consists of six main sections: The Methodological approach reflects on the concept of validation applied in RECONNECT as well as on the data collection methods applied. In the second section we focus on the process of data collection This section gives an overview of data collection process, reflects on challenges and how they have been dealt with and a provides insights in the composition of the interviewees at the demonstrator sites. Introducing the results is covered in the next section, split between the composition of interviewees, the two rounds of data collection at the Demo A sites and a single data collection in the Demo B sites. Synthesising the results is done in chapter 5, with sub sections focusing on different aspects represented across the analysis conducted at Demo A sites as well as results obtained from the Demo B interviews.

The report is than finalised with a section each on the validation work and the conclusion.

2 Methodological approach

This section outlines the methodologies employed for two distinct study types: Type Demo A and Type Demo B.

In this study, we employed two distinct methodologies tailored to the specific aims and contexts of our research: a quantitative questionnaire and semi-structured expert interviews. These approaches were chosen to provide a comprehensive understanding of the phenomena under investigation, leveraging both numerical data over time and in-depth qualitative insights.

For the Type Demo A study, a quantitative questionnaire was utilized to track and analyse changes over an extended period. This method involved administering a structured set of questions to stakeholders at two point in time, before and after the implementation of the local NBS project. The design allowed us to observe trends, measure variables consistently, and identify causal relationships within the target groups. The approach provided robust data on the evolution of specific metrics, enabling a dynamic analysis of changes and patterns over time.

In the Type Demo B study, we conducted semi-structured expert interviews to gather qualitative insights from individuals with specialized knowledge and experience in the relevant field. This method involved in-depth, open-ended interviews guided by a flexible interview protocol. The semi-structured format allowed for the exploration of predetermined topics while also providing the freedom to delve into emergent themes and insights. By engaging with experts, we were able to gain nuanced perspectives and deeper understanding of complex issues that are not easily quantifiable.

Where possible, cross comparison was performed using tables as heatmaps, indicating both agreement levels and trends (Wilkinson & Friendly 2009).

The tables with the same colour-coding describe the level of agreement on a Likert scale ranging from strongly disagree in red to strongly agree in blue. Cells with no answers are coloured in grey. Additionally, where possible, the arrows in the trend columns mark how stable the attitude of response was before and after the NBS implementation, whether their agreement with a statement increased, lowered or remained stable after the implementation. These are based on comparing the median values of the first and second round of interview, with thresholds at <-1.5 for reduced agreement, >1.5 for increased agreement and the range in between for stable agreement.

These complementary methodologies provided a robust framework for our study, combining the rigor of quantitative analysis with the depth of qualitative inquiry.

2.1 Demo A sites

The Demo A sites consisted of Hamburg (Germany), Odense (Denmark) and Portofino (Italy). For further information on the specific sites, please refer to Deliverable 2.3 on Scope of works for Demonstrators A and B (Penchev et al. 2019).

2.1.1 Methods of data collection and analysis

Data collection to be carried out within the scope of the validation addresses not only the general and site-specific perceptions of NBS by relevant stakeholders, but also the mode and intensity of their past, current and future involvement in the planning and implementation process. Since this involvement has a significant influence on stakeholders' perceptions, the reflection of the co-creation process itself is also an essential part of the analysis.

Specifically, the following aspects are considered for the validation of the NBS by stakeholders:

- Knowledge about the specific NBS project
- Mode, phases and intensity of past and current involvement
- Willingness for future involvement
- General and site-specific relevance of NBS for reducing meteo-hydrological risks and causes for the respective perspective
- Stakeholders' risk perception
- Expected benefits of NBS (general and site-specific)
- Expected co-benefits of NBS (general and site-specific)
- Perception of the NBS site


In addition, to support the people indicator-based evaluations, information was collected on

- Access to data sets for DTU's evaluation activities to be enabled by stakeholders
- Relevance of sub-goals underlying DTU's co-evaluation activities

At demonstrator A sites a comparison of the stakeholder perception of planned NBS before (baseline assessment) and after their implementation (post-intervention assessment) is carried out. As at demonstrator B sites such a comparison is not feasible (NBS were implemented years ago), adjusted post-intervention survey will be conducted.

Due to the range of aspects to be covered intensive exchange is necessary for collecting robust empirical data. Because of the interest in individual perspectives of the representatives of the different stakeholder groups and to ensure confidentiality, bilateral exchange rather than collecting data in a workshop setting or any other form of group activity is advisable.

For data collection, a combination of methods was used, i.e. guided interviews with a combination of open- and closed-ended questions and Likert scale-based ratings. For this purpose, a total of 22 questions or answer batteries are compiled in a guide to support the interviewer. The following is a brief description of the methods.



RECONNECT – Interview guideline „Co-Validation“
Demonstration site Portofino

1. What is your professional/educational background?

.....

2. Which organisation, political or administrative body, association, company or club are you representing?"

.....

3. What are your responsibilities in your organization?

.....

4. The term Nature-based solutions (NBS) describes measures which are inspired and supported by nature for mastering socio-environmental challenges such as climate change, the biodiversity crisis, environmental pollution, food and water security and natural hazards. In the scientific as well as in the public debate there are numerous concepts being routed in this idea of relying on nature to address and manage those challenges.

Please, indicate which of the following terms you are familiar with!

a. Nature-based Solution

b. Natural Climate Solution

c. Ecosystem-based solution/management adaptation/mitigation

d. Ecological engineering

e. Catchment System Engineering

f. Ecological Restoration

Figure 1 Guideline for conducting stakeholder interviews in Portofino

Guided interviews are a method of data collection that involves a pre-determined set of questions and an experienced interviewer who leads the conversation. These interviews provide a controlled way to gather information and allows the interviewer to explore participants' thoughts, feelings, and experiences in-depth.

One of the main advantages of guided interviews is that they provide a consistent structure for data collection and allow for the collection of in-depth, detailed information. Additionally, the use of trained interviewers helps to ensure that the questions are asked in a neutral and unbiased manner.

In view of the pandemic-related travel and assembly restrictions in place in recent years but also given the improved technological advancements it has been increasingly common to conduct remote guided interviews via video call or telephone call. Remote interviews have the advantage of increasing flexibility and access to participants, regardless of their location. Additionally, remote interviews can be less time-consuming and less expensive than in-person interviews.

However, remote interviews also present some challenges. Video and telephone interviews often lack the nonverbal cues that in-person interviews provide, making it more difficult to establish rapport and trust with participants. Additionally, technical issues such

as poor internet connectivity and outdated technical equipment, but also insecurity due to inexperience of interviewees can affect the quality of the data collected.

To ensure successful remote guided interviews, it is important to ensure that participants have the necessary technical equipment and are familiar with the technical set-up being used. Additionally, it's important to establish clear instructions and provide participants with a contact person in case of technical difficulties. Finally, it is essential to provide a secure environment for data protection and privacy matters.

Overall, guided interviews, whether in-person or remote, provide a controlled and structured way to gather in-depth information, but it is crucial to address the specific challenges and considerations of remote interviews.

Likert scale-based rating is a method commonly used in survey research to measure people's attitudes and opinions. The scale consists of a series of statements to which participants respond by indicating their level of agreement or disagreement, usually on a 5- or 7-point scale ranging from strongly disagree to strongly agree. The extreme options are referred to as response anchors, and the middle point is typically a neutral item, with positive options on one side and negative options on the other. In this application, 7-point scales were used for assessing respondents' risk perception, their perception of NBS, their expectations on benefits and co-benefits of NBS. For the assessment of the relevance of the various sub-goals pursued through the realization of the NBS at your site a 10-point scale was used.

The responses are usually represented by numerical values and for the analysis can be either treated as ordinal or interval-scaled data. For descriptive analyses, the former enables, e.g. the description of the occupation of certain response categories or calculations measure of central tendency such as the median, and the latter, furthermore, e.g. allows for the determination of mean scores. In this analysis, Likert scale-based rating data is treated as interval-scaled data.

In general, Likert scales are easy to use, flexible and can be used to measure a wide range of attitudes and opinions. In addition, they allow for a more nuanced response than binary questions and can be constructed to measure different aspects of a construct and combine them into a composite score, which can increase the accuracy of the measurement.

Likert scales are also easily analysed and compared to other data, as – if treated as interval data – it is possible to calculate the mean score for each statement, which will help to understand the overall trend of responses and make comparisons between different groups or sub-groups.

However, it's also worth noting that Likert scale-based rating may suffer from some limitations. Participants may be prone to give socially desirable responses, response fatigue might occur if extensive question sets are used, and the reliability of responses may be affected by the way respondents are instructed before rating.

In preparation for data analysis, we categorize and code responses to the open-ended questions, e.g. on the organizational background of interviewees.

For data analysis, we use spreadsheet-based methods. This involves calculating measures of central tendency, such as the mean and median, and measures of dispersion, such as the standard deviation and range. This allows for identify patterns and outliers in the data.

Furthermore, we apply descriptive statistics to analyse the distribution of responses for each question for understanding the overall trend of responses and make comparisons between different groups or sub-groups. We then use visualization tools such as charts and graphs to help display the results in an easy and intuitive manner.

Spreadsheet-based data analysis provides a detailed picture of the data collected and helps us understand the attitudes and opinions of the stakeholders. It also supports identification of key aspects that need further examination.

2.1.2 Stakeholder selection

The selection of stakeholders is based on RECONNECT project Deliverable 2.1 “Preparing co-creation: Stakeholder analysis” (D 2.1). The aim is to interview stakeholders as far as possible, who are most influenced by the site-specific risk that is to be addressed by the NBS respectively influence this risk themselves or have the power to influence the implementation of NBS or might be affected by the NBS. These actors were identified as part of the stakeholder analysis conducted in preparation of the co-creation process. D 2.1 provides a comprehensive overview of the results of this stakeholder mapping at the different demonstrator sites. For the interview planning, the aim was to ideally interview insiders of the identified individual institutions and, if this was not possible, to engage representatives for all stakeholder categories relevant at the respective location.

In Hamburg the meteo-hydrological risk impacts the management operations of the Flood Authority (LSBG) and the operation of the large municipal company Hamburg Wasser (Hamburg Water) which is running the water supply infrastructure as well as local residents. The district administration (Bezirksamt) of Bergedorf has a strong influence on the implementation of NBS. levels. Additional stakeholders who influence the implementation of the NBS are the so-called Wasser- und Bodenverbände (water and soil boards) as well as policy makers and the State Administration for Environment and Energy. Stakeholders who represent economic interests in the area and might be affected by the NBS include representatives of the sectors shipping, tourism and farming.

With the exception of LSBG and, due to the early stage of planning at the time of the interviews, residents and (small) businesses all relevant stakeholders were involved in the data collection for the baseline assessment. Most importantly Hamburg Wasser as the most influential stakeholder got involved with representatives of different units being interviewed.

In Odense farmers are seen being very influential as well as most affected by the sea level rise-related risk which manifests itself in more frequent and more intensive sea flooding events. Furthermore, city politicians and regulating authorities are perceived as being most influential and the local political agenda is expected to be affected by risks. Regarding the role of citizens, a distinction was made between the direct residents in Seden Strandby and those in the neighbouring settlements in Agedrup and Bullerup. The former influence the realization and operation of the NBS and are also strongly affected by the risk. This is not the case for the citizens in Agedrup and Bullerup, but since similar measures are planned there for the next few years, their perspective is also of interest. The municipality of Odense plays an important role as relevant utility infrastructures are operated and emergency services provided by municipal companies. As, interestingly, nature itself is being perceived as a stakeholder in the process, the administration for nature conservation and several NGOs are seen as its advocates.

From this list of relevant actors, representatives of all other stakeholder groups could be interviewed, with the exception of farmers and the municipal utility company.

In Portofino, the following stakeholders are considered to be most affected by the risks and affecting the NBS: Surrounding municipalities, Portofino Park Authority, various economic activities such as restaurants and hotels, property owners including the Fondo Ambiente Italiano (FAI), a non-profit foundation for the preservation of historical monuments and nature conservation, various associations and the citizens. Also influencing the NBS but not being so much affected by the risks are regional authorities, the Ministry for Cultural Heritage, journalists and technicians. Utilities companies, operators of touristic facilities and providers of touristic services, and civil protection authorities although being affected by the risks are not seen as being influential on the realization of the NBS. Whereas tourists themselves and scientist due to their flexibility are classified as being least affected by the risks and least influential on the NBS.

From the first group of most risk-affected and NBS-affecting stakeholders, all but dedicated representatives of citizens and could be interviewed. That includes political representatives of three surrounding municipalities and of the Portofino Park Authority, the FAI as NGO and property owner, a representative of an agricultural cooperative and leading members of professional associations for agronomy, forestry and geology. In addition, representatives of the technical office of the municipality, a NGO concerned with the conservation of cultural heritage and a research institution focused inter alia on environmental research projects were involved in the data collection.

For further details on the site-specific composition of stakeholders involved in the baseline assessment for the validation of NBS with stakeholders see section 2.3.

2.2 Demo B sites

The demo B sites consisted of the Thur site in Switzerland, the IJssel river area in the Netherlands, Lake Egå in Aarhus and the Inn catchment in Austria. For further information on the specific sites, please refer to Deliverable 2.3 on Scope of works for Demonstrators A and B (Penchev et al. 2019).

2.2.1 Methods of data collection and analysis

We opted to go with a semi-structured interview, focusing on experts which were ideally experienced in the implementation of the NBS found at the Demonstrator B sites.

The interview was conceptualised in a way, that it would lead to comparable results across the demo B sites, but also leave room for comparison with the survey done in the Demo A sites. For these reasons, the interviews were structured based on the following points.

- Personal background,
- Perspective on NBS
- Co-creation of the NBS with stakeholders:
- Stakeholders' perspective on NBS:
- Perception of natural hazard-related risk by stakeholders:
- Perception of site-specific benefits and co-benefits by stakeholders:
- Strategies for institutional change and overcoming public resistance:
- Strategies for overcoming political resistance:
- Needs fulfilment of stakeholders:

All Interviews were conducted online via zoom, except for Switzerland, where the interviews were given in person with a third party and the filled-out questionnaires were handed back to the PI.

The interviews took place over the course of one month, with interview durations ranging from 45 minutes to 1 hour and 15 minutes.

The interviews were recorded, transcribed and annotated. We used the software MAXQDA 2024 (v. 24.0.0). For further analysis, the interview broken down by questions form the questionnaire. The complete guideline for the interviews is presented under Questionnaire Demo B in the appendix of this report.

2.2.2 Stakeholder selection

The stakeholder selection was driven by the availability of knowledgeable people at the different sites. As many date back to the start of this century, or even to the 1950s, it was not possible to gather first-hand information on the development and implementation process of the NBS for all sites. In addition, technical experts were excluded from the interviews, as their focus was more on the engineering and construction work needed to establish the NBS int the first place.

2.3 Composition of the interviewees for the Demo A sites

The interview partners for the Demo A sites Hamburg, Odense and Portofino consisted of a wide arrange of people. We interviewed a wide variety of stakeholders in the first round, represented in Figure 2. For a more detailed overview, please refer to Figure 3, Figure 4 and Figure 5.

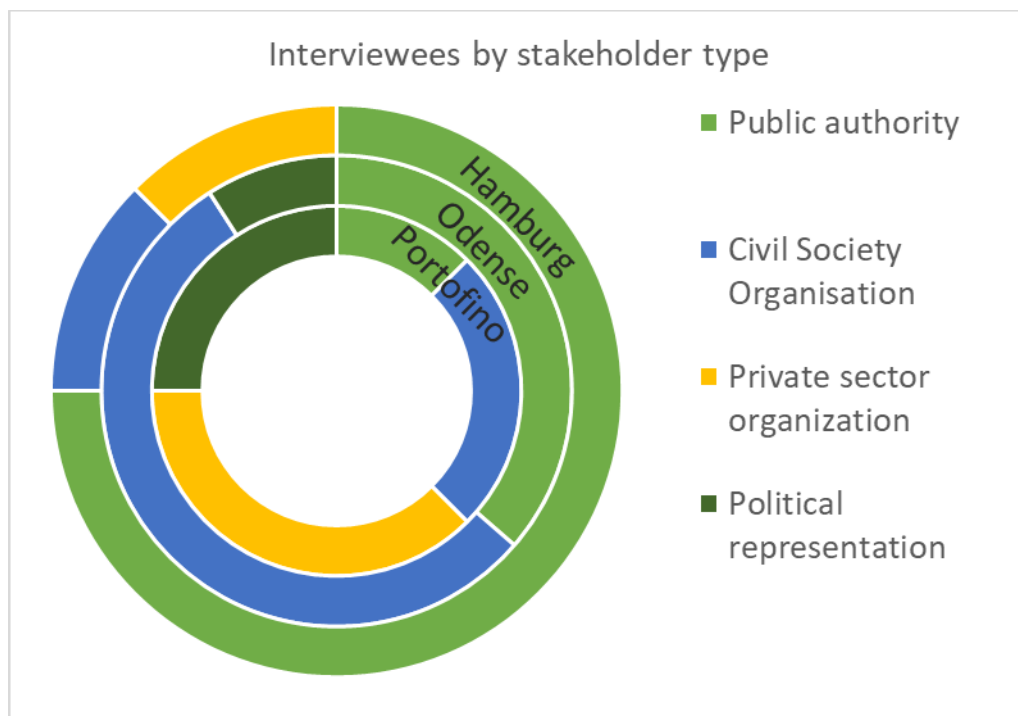


Figure 2 Interviewees by stakeholder type

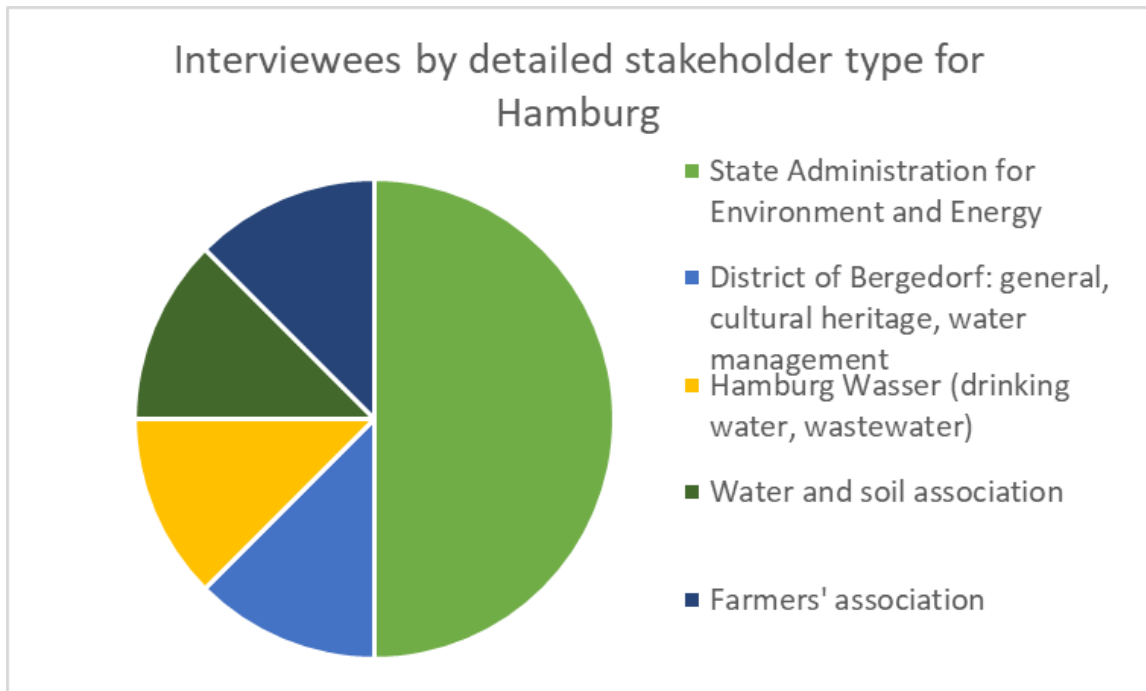


Figure 3 Interviewee detail Hamburg

Note: The absolute number of interviews used for this preliminary validation analysis for the Hamburg site is 8 (n=8).

In Hamburg the majority of interviewees represents public authorities on the district and on the state level. Figure 2 and Figure 3 illustrate the assignment of the interviewees to the different stakeholder categories. The category private sector organisations refers to the Farmers' association, Civil society organisations to the water and soil board and the category Public authorities to Hamburg Water, District of Bergedorf and the State administration for Environment and Energy.

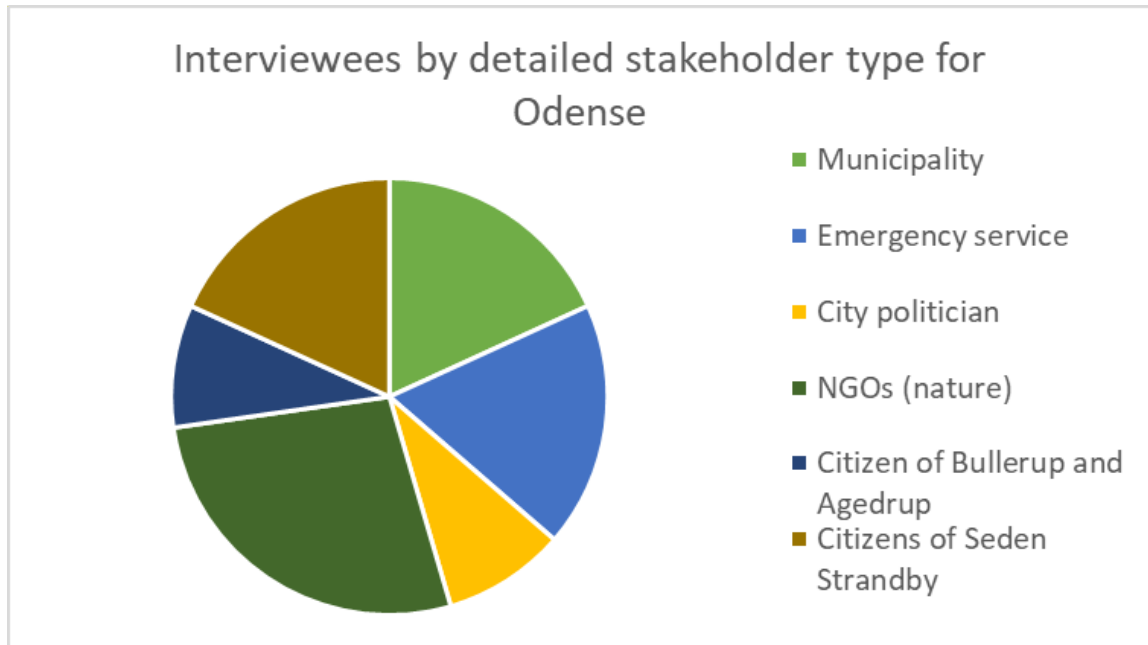


Figure 4 Interviewee detail Odense

Note: The absolute number of interviews used for this preliminary validation analysis for the Odense site is 11 (n=11).

In Odense, predominately private actors many of whom live in the vicinity of the NBS to be realised or in a neighbouring settlement were involved in the validation activities. Figure 4 depicts the assignment of the interviewees to the different stakeholder categories. The category Public authorities include representatives of the municipality and of the emergency service, Political representatives refers to local politicians and Civil society organisations covers NGOs as well as citizens residing at the NBS site Seden Strandby and the neighbouring settlements Bullerup and Agedrup.

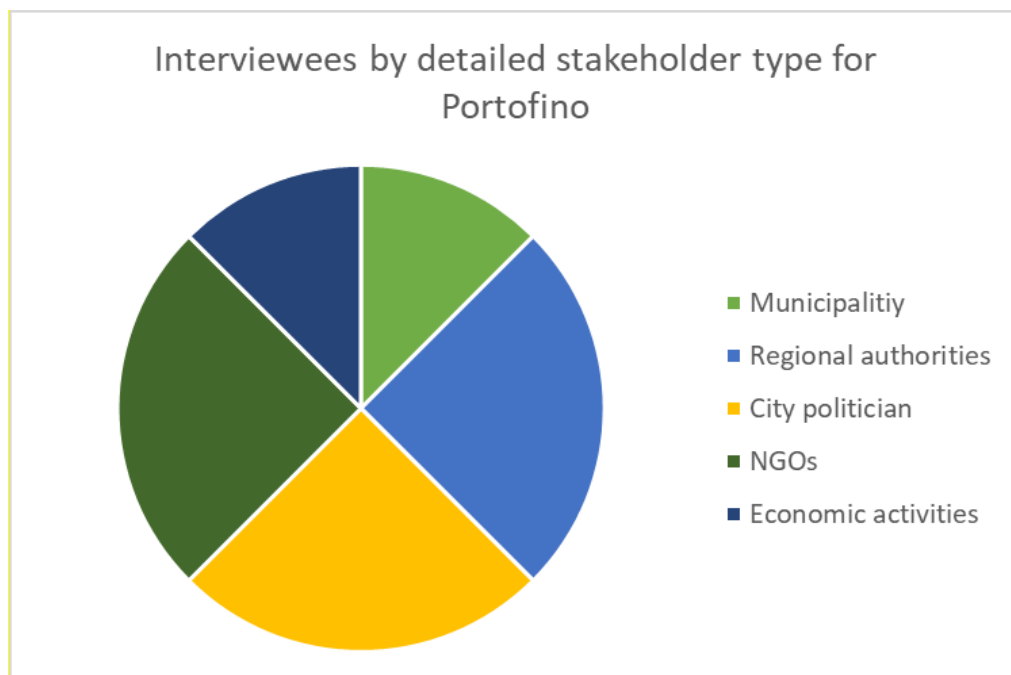


Figure 5 Interviewee detail Portofino

Note: The absolute number of interviews used for this preliminary validation analysis for the Portofino site is 8 (n=8).

In Portofino a balanced share of private, political and administrative and business actors was interviewed for the validation (see Figure 5). The category Public authorities refers to the municipality of Portofino and regional authorities, Political representatives includes mayors representing governing parties, Civil society organisations covers NGOs and Private sector organisations refers to business actors.

The different composition of the interviewees at the three locations had an influence on the respondents' level of previous experience with NBS projects. Many of the private persons interviewed in Odense had no previous experience with NBS projects, whereas the interviewees in Hamburg and Portofino were very experienced. This is also reflected in the level of knowledge with regard to NBS-related terms and concepts. A comparatively high share of interviewees in Portofino is familiar with a wide range of NBS-related terms and concepts. The lower level of awareness, especially of a considerable number of special terms in Odense than in Portofino, reflects the greater involvement of people with less technical experience at this location. In Hamburg, many terms and concepts aren't well known. For details see Figure 6 and Figure 7.

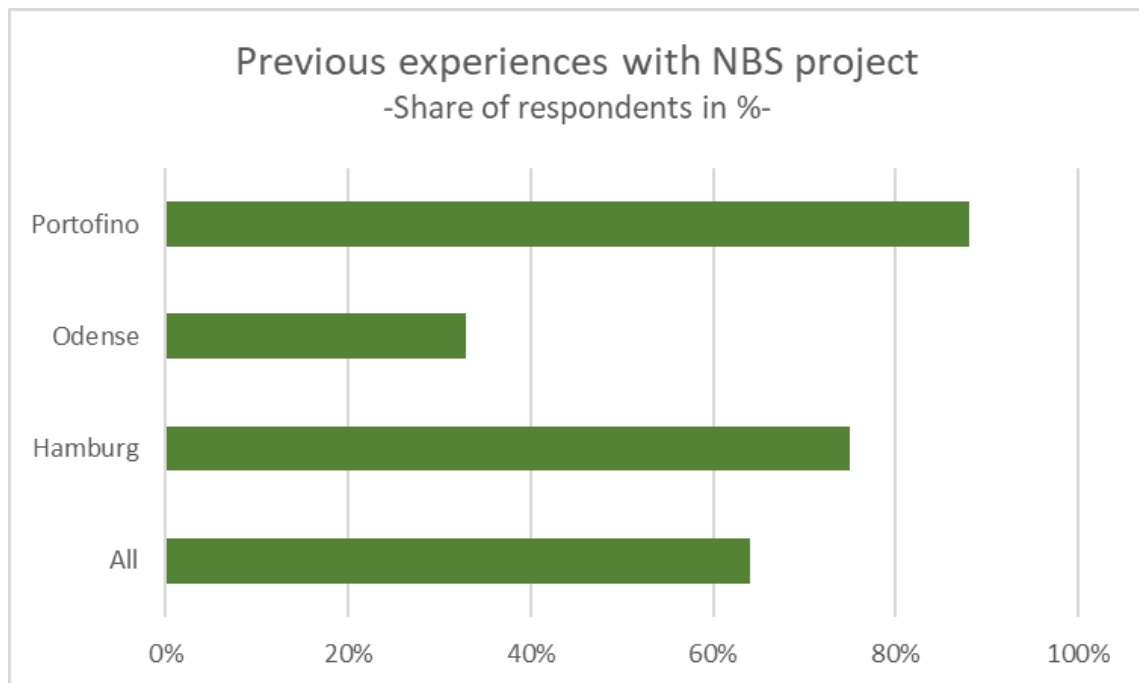


Figure 6 Previous experiences of interviewees with NBS projects

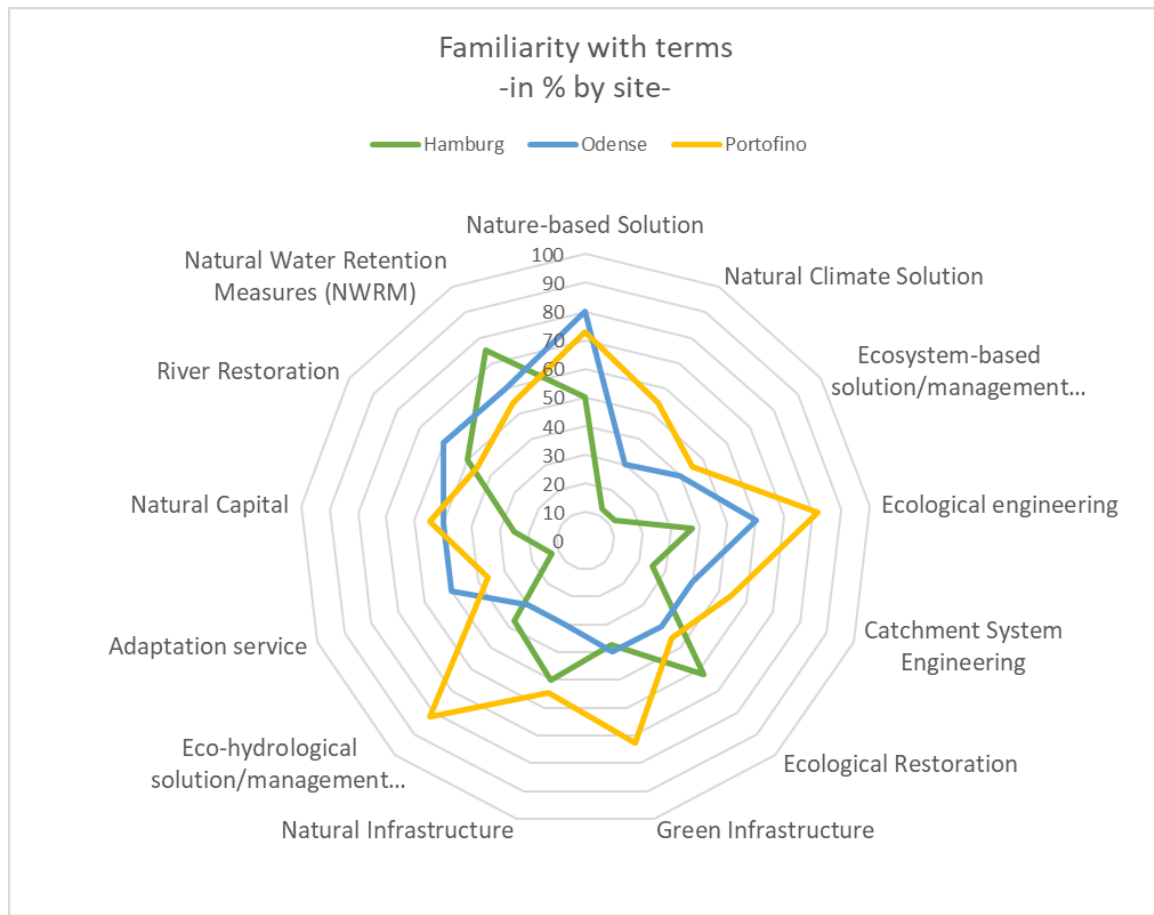


Figure 7 Best-known NBS-related terms by interviewees

Their previous knowledge is also reflected in the comments participants gave when asked about previous experiences. Several of them reported extensive involvement in river restoration, wetland projects, and initiatives aimed at nitrogen retention in water bodies. These projects were typically carried out while working for engineering companies contracted by municipal or national environmental ministries/agencies. One participant highlighted their involvement in the restoration of a path managed by the Municipality. This project incorporated green engineering practices, such as using locally sourced wood and sustainable construction techniques. This approach not only restored the path but also ensured the project was environmentally friendly.

Participants also discussed their work on Nature-Based Solutions (NBS) projects in their professional capacities as geologists. These projects included addressing the effects of landslides and managing water bodies, such as streams. Since 2015, one participant had been involved in developing guidelines for mitigating hydro-geological risks in Italy. This initiative later evolved into a bilateral project with France, a cross-border collaboration focused on resilience, innovation, and governance for hydrogeological risk prevention.

Another participant mentioned working independently, outside of their official role in the Regional Order of Geologists. They collaborated with a university on urban planning standards and ecological performance assessments. Their independent work emphasized the integration of ecological considerations into urban planning.

Participants also noted their contributions to various ecological engineering projects, particularly those aimed at preventing landslides. These projects involved the restoration

and construction of dry-stone walls and terraces. Additionally, participants were engaged in projects under the EFRE program and consultancy projects related to NBS.

One participant shared their involvement in regional-scale Rural Development Plans. A notable project within this work was the restoration of a path within Portofino Park, which used natural engineering techniques. This project included interactive signs and artistic wooden sculptures, and was completed in May 2021. This initiative demonstrated the successful integration of ecological engineering principles into regional development plans.

2.4 Composition of the interviewees for the Demo B sites

For the Demo B sites, we interviewed a total of 8 people, which translates to two per site. The interviewed persons belonged to the Thur site, the Greater Aarhus site, the Inn river and the Ijssel river sites respectively.

The associate's organizations consisted of a wide variety of players, comprising the public sector with municipalities, universities, retired national agency employees and the private sector with a consulting and engineering office. Their roles spanned research fellows, section leaders, professors, academic employees and special consultants. The professional backgrounds ranged from water management, land use planning, and nature conservation to international relations, landscape management, biologists, geologists and architectural engineering.

All of the partners had previous experience in NBS projects of various form and scale, some dating back, some quite recently.

3 Results

3.1 Demo A

As described in the previous chapter, an initial round of interviews was conducted at the demo A sites, followed by a second survey to monitor changes in interviewees perspectives. As some questions were added in the second round of interviews, and there was a low consistency between the two rounds, we opt to present the results in a cross-comparison manner where possible, supported by separate findings from the two rounds of interviews. As described in the two sub sections on the composition of the interviewees for round one and round two, the number of participants varied. In the first round, we were able to get data from 29 participants, in the second the number of respondents was 16 (see Figure 8). Between these two, we identified 10 individuals who participated in both rounds of the interview. As this leaves only a small number of responses per Demo A site (n Hamburg= 3. N Odense= 4, n Portofino= 3), we conducted a cross-sectional comparison across two points in time (before and after implantation of NBS).

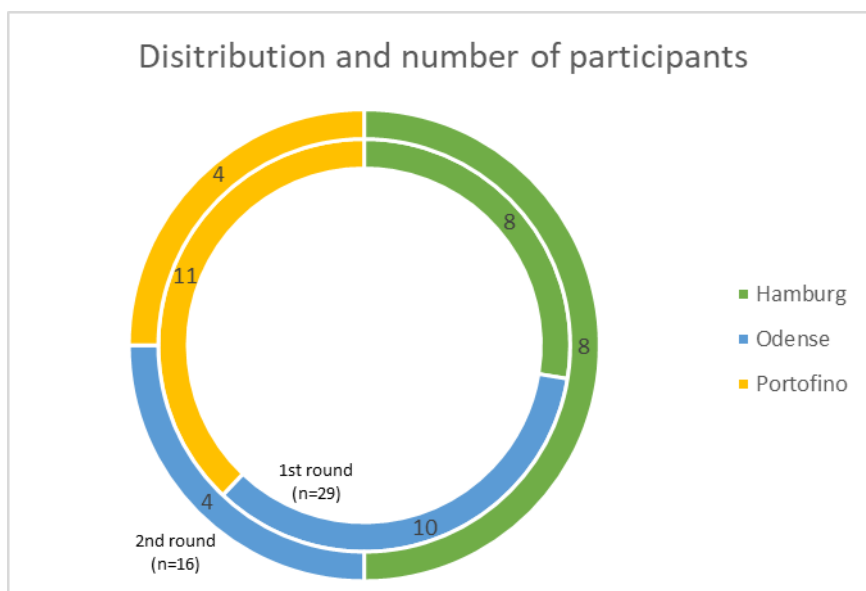








Figure 8 Distribution and number of participants for the Demo A sites

The first set of questions in both the first and second round of interviews revolved around their background as described in the previous chapter.

This was followed by a first, general assessment. Participants were asked to evaluate the importance of NBs and associated aspects. Table 1 describes both the agreement levels across sites from the first round of interviews (see columns on agreement) and the change in the second round of interviews (see columns on trend). For a detailed explanation of the visualisation, see the section on the **Methodological approach**.

Table 1 General attitudes towards NBS

		Hamburg		Odense		Portofino	
		Level	Trend	Level	Trend	Level	Trend
In general, NBS are of high relevance for reducing hydro-meteorological risks.		High	→	High	→	High	→
NBS are of high relevance for reducing hydro-meteorological risks as they ...	are effective	High	→	High	→	High	→
	are efficient	High	→	High	↘	High	↗
	help to master the biodiversity crises	High	→	High	→	High	→
	provide many different benefits	Low	→	Low	↗	Low	↗
NBS are of low relevance for reducing hydro-meteorological risks as they ...	are very difficult to realise	Low	→	Low	→	Low	→
	their benefits are very uncertain and will, if at all, only become apparent in the future	Low	→	Low	→	Low	→

Strongly agree							Strongly disagree
Increased agreement	↗	→	↘	Reduced agreement			

The results in Table 1 suggest a high level of agreement, both before and after the implementation of the NBS at the site.

These results thus indicate a high level of agreement with statements pointing towards the relevance of NBS in general and more specifically to a high level of agreement that NBS are both effective and efficient, meaning that both the means necessary and the outcome are balance in a favourable way. Additionally, NBS are seen as a key concept in conserving or re-establishing biodiversity. These statements seem to be agreed on both across the sites, and also across time.

Additional comments on the question also reflect a high valuing of NBs among participants.

The respondents in the study emphasized the importance of long-term flexibility and the need for thoughtful implementation. They highlighted that sustainable solutions are more adaptable and resilient in the long run. These approaches are seen as crucial in tackling climate change and should be integral to planning processes. They offer great potential that can significantly improve natural environments. It was also noted that implementing these solutions requires careful consideration. While they are interesting and demanding, it is essential to implement them with care to avoid potential negative outcomes. One significant challenge mentioned for Odense is the impact of rising water levels, which could affect future projects. There is a concern that some investments might be wasted if land is eventually overtaken by the sea. The study participants expressed strong support for solutions that preserve or enhance nature. Such solutions are preferred because they represent a set of adaptable and effective measures suitable for various contexts and situations. Additionally, these solutions enable critical co-benefits, such as improved ecosystem services and biodiversity.

Both surface and groundwater regulation interventions are deemed fundamentally important by participants. They also emphasized the value of natural engineering and renaturalisation efforts, particularly in countering erosion phenomena. These interventions are essential for maintaining the integrity of natural landscapes and mitigating environmental degradation.

When asked about the effectiveness of NBS in general and compared to technical measures, participants generally agreed that NBS are effective and should be prioritized in future efforts to regulate hydrological aspects. They noted that NBS are significantly more resilient than technical measures, particularly in mitigating extreme water levels. In many cases, NBS are considered at least as effective as technical solutions, if not more so. While seen as a great solution, especially for improving conditions for nature (animals and plants), participants acknowledged that NBS effectiveness must often be assessed on a case-by-case basis. One drawback mentioned is that NBS often involve higher implementation costs compared to technical measures. However, the long-term benefits and resilience of NBS can offset these initial costs. There is a concern among participants that rising sea levels will challenge natural solutions more than technical ones. Despite this, some projects have demonstrated the effectiveness of NBS in such contexts. For example, early diked salt marshes that are returned to nature and allowed to develop favourably with rising water levels have shown promise. In these projects, new storm surge protection measures have been built behind the salt marshes, showcasing a harmonious integration of NBS with traditional protective infrastructure.

It was also indicated that while NBS are effective in the short term, their long-term effectiveness remains uncertain and requires further evaluation. They emphasized that NBS, which utilize natural processes and mechanisms, often need more time to become effective compared to traditional measures. However, in certain cases, NBS prove to be effective for longer periods and provide superior landscaping and environmental integration.

NBS are not necessarily in conflict with technical (grey) solutions but rather complement them. A simple example given was the improvement of riparian vegetation and stabilization of an embankment using natural engineering techniques along a watercourse, compared

to an embankment made of reinforced concrete. This illustrates how NBS can work in tandem with technical measures to enhance overall effectiveness and sustainability.

These statements are somewhat reflected in the following Table 2. When asked about whether the participants felt well informed about NBS, both in general and within their organisation, the agreement levels were higher in Odense and Portofino. The trends however suggest a slight decline or stable conditions, with a minor increase on the second question for Portofino.

Table 2 Information about the project in general

	Hamburg		Odense		Portofino	
	Level	Trend	Level	Trend	Level	Trend
I feel well informed about different aspects relevant for realising the NBS project		→		→		→
In my organisation, we are well informed about various aspects relevant for realising the NBS project		→		→		↗

Strongly agree							Strongly disagree
Increased agreement	↗	→	↘	↗	→	↘	Reduced agreement

When answering the next question about the intensity of the involvement in the project so far, all participant were aware of the project or at higher involvement stages by the second round of interviews, particularly they had either been consulted, discussed with representatives or been involved in the decision making (see Table 3).

Table 3 Intensity of involvement

	Hamburg		Odense		Portofino	
	Level	Trend	Level	Trend	Level	Trend
I have not heard		→		→		→
I'm aware		↗		↗		↗
I've received information		↗		→		→
I've been consulted		→		↗		→
I've discussed with representatives		→		→		↗
I feel I'm part of the project		→		→		↗
I've been involved in decisions-making		→		↗		→

Yes votes from 0%									to 100%
Increased agreement	↗	→	↘	↗	→	↘	↗	→	↘
		Reduced agreement							

Stages and modes at which the respondent were involved varied, but were generally low, that is less than 50% of respondents replied that they were involved. The trends, especially for Portofino and Odense however suggest that by the second round of interviews the involvement and modes of involvement had increased (see Table 4 and Table 5).The

respondents engaged in a variety of contributions to the NBS project, including Solution selection, NBS design and regulatory processing, as well as feasibility studies as a basis for decision making and the location of interventions and their typology.

Table 5 shows that in both Odense and Portofino a small proportion of respondents, i.e. 11% and 13% respectively, actively participated in decision-making processes. However, the main mode of participation at all 3 sites was provision of knowledge. In terms of this mode of involvement, Hamburg (75% of respondents) outperformed Portofino (50%) and Odense (44%). In Odense, however, in contrast to Hamburg (0%) and Portofino (12%), a significant proportion of respondents (33%) were involved in the implementation of the NBS. Of course, this also reflects the different status of implementation at the sites.

Table 4 Involvement stages

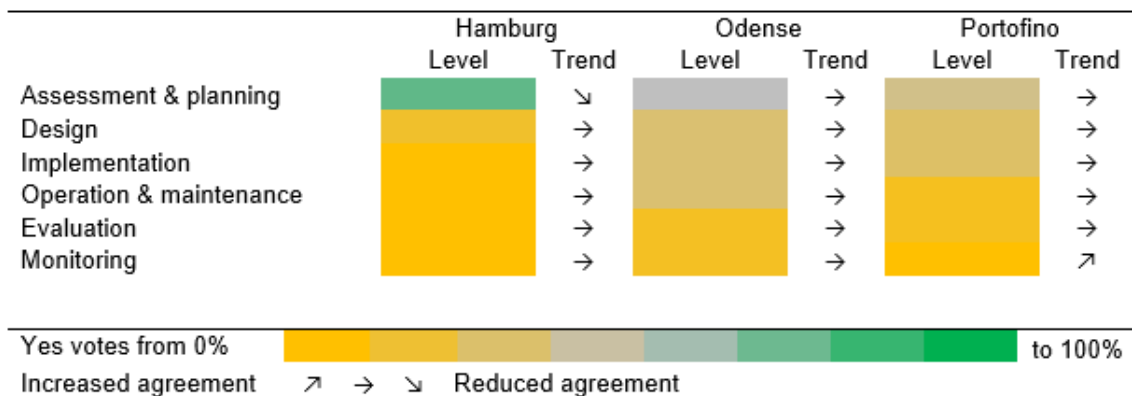
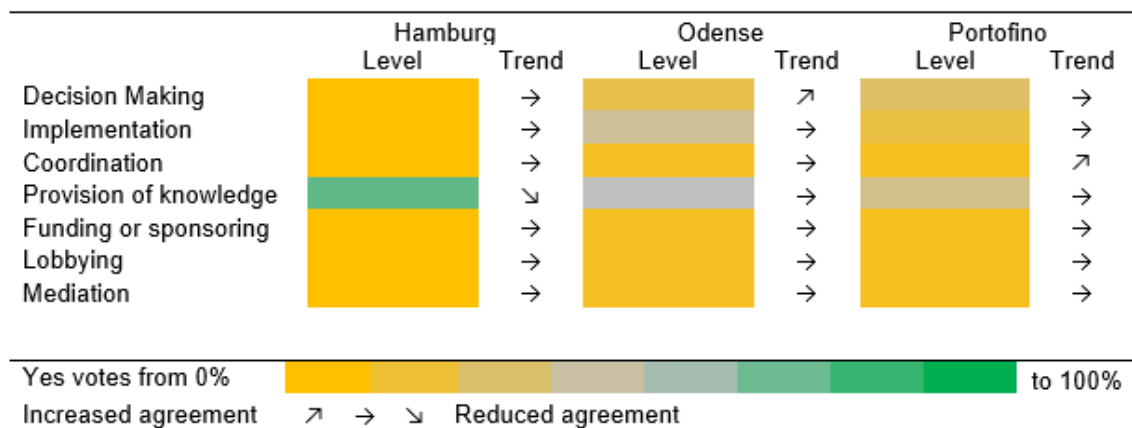
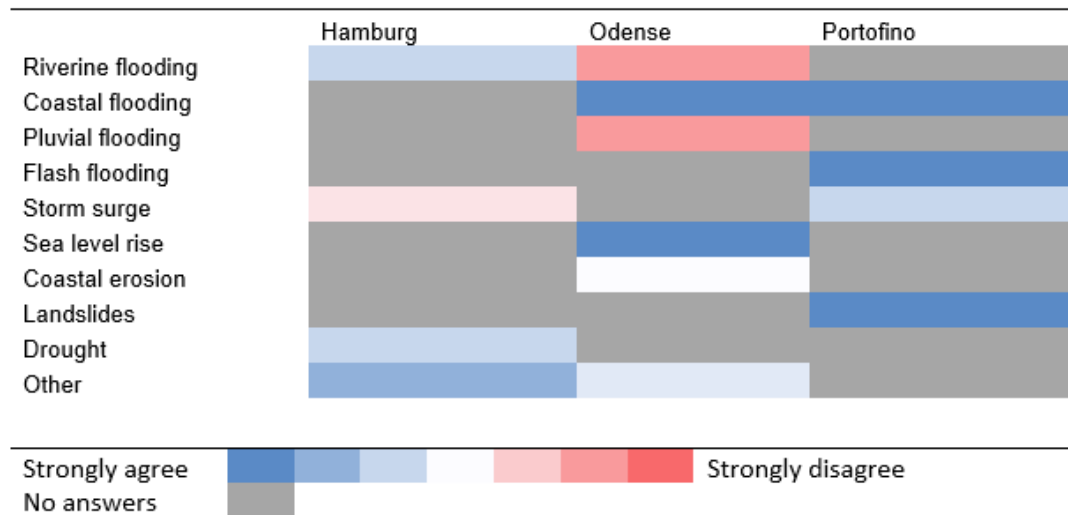


Table 5 Involvement mode



Initially perceived risks varied between the three sites (see Table 6). For Hamburg, they included riverine flooding and drought, as well as other risks. For Odense, coastal flooding and sea level rise were ranked highest, with additional mentions of coastal erosions and others. In the case of Portofino, coastal and flash flooding were classified as high risks, along with landslides. Lower importance was given to the risk of storm surges.

Table 6 Risks considered relevant at the site/ severity



These risks considered relevant in Table 6 are driven by the specific circumstances at the sites, and reflect the publics and experts opinion on what the NBS should tackle. The grey colour for no answer is rather present because most of the risk are not applicable for one single site at once.

In general participants mentioned that NBS offer significant benefits for ecosystems, serving as retreats for wildlife and promoting biodiversity. These areas benefit from occasional flooding, which supports the ecosystem, though a constant water supply is necessary for some species. Over time, NBS can be as effective as traditional methods, such as frequent mowings. LAR solutions (Local Drainage of Rainwater) exemplify climate adaptation by prioritizing on-site rainwater drainage before redirecting it elsewhere. NBS combine various objectives, enhancing their strength and effectiveness. For instance, the Seden Strand project showcases a win-win approach, proving to be cost-effective and efficient compared to purely technical methods. NBS are visionary, integrating nature and biodiversity into formerly technical solutions. While their effectiveness hasn't been formally assessed, they are seen as beneficial for biodiversity, the economy, and local communities. Trust in experts supports the belief in NBS efficacy, as illustrated by the restoration of dry-stone walls in Portofino Park, which leverages ancient techniques to mitigate landslide risks more effectively than conventional infrastructure.

As for the relevance of sub-goals within the project, Table 7 suggests a broad dispersion among the goals. This translates thus into the deigns being concerned about the multifunctionality of the NBS.

Table 7 Relevance of sub-goals

	Hamburg	Odense	Portofino
Increase recreational opportunities	Strongly disagree	Disagree	Disagree
Education and awareness about NBS	Disagree	Disagree	Disagree
Maintain and if possible enhance cultural values	Disagree	Disagree	Disagree
Improvement of accessibility	Strongly disagree	Disagree	Disagree
Improvement of community cohesion	Disagree	Disagree	Disagree
Encouragement of new business models/ other community benefits through NBS	Strongly disagree	Disagree	Disagree
Stimulation OR Increase economic benefits	Disagree	Disagree	Disagree
Direct health and wellbeing impacts	Strongly disagree	Disagree	Disagree
Indirect health and wellbeing impacts	Disagree	Disagree	Disagree


Strongly agree  Strongly disagree

Table 8 Benefits already experienced/expected from the realisation of the NBS

	Hamburg		Odense		Portofino	
	Level	Trend	Level	Trend	Level	Trend
Flash flooding risk	Disagree		Disagree		Disagree	→
Landslide risk	Strongly disagree		Strongly disagree		Disagree	→
Quantity of rainwater infiltration	Disagree		Disagree		Disagree	→
Risk of soil erosion	Disagree		Strongly disagree		Disagree	→
Biodiversity	Disagree		Disagree	→	Disagree	→
Habitat quantity	Disagree		Disagree	→	Disagree	↘
Habitat quality	Disagree		Disagree	→	Disagree	→
Ecol. Status	Disagree		Disagree	→	Disagree	→
Recreational opportunities	Disagree		Disagree	→	Disagree	→
Accessibility of natural space	Strongly disagree		Disagree	→	Disagree	→
Health and wellbeing	Strongly disagree		Disagree	→	Disagree	→
Safeguarding cultural values	Disagree		Disagree	↘	Disagree	→
Education and awareness raising	Strongly disagree		Disagree	→	Disagree	→
Community cohesion	Strongly disagree		Disagree	→	Disagree	→
Economic benefits	Disagree		Disagree	→	Disagree	↘
New business models	Disagree		Disagree	→	Disagree	→

Strongly agree  Strongly disagree

Increased agreement ↗ → ↘ Reduced agreement

This current perception of NBS as shown in Table 9 supports a high level of valuation across multiple attributes. Especially for Portofino, positive associations were either stable at a high level or increased even further over item.

Table 9 Current perception of the NBS area

	Hamburg		Odense		Portofino	
	Level	Trend	Level	Trend	Level	Trend
Ugly to beautiful			█	→	█	→
Dense/ stuffy to fresh/ airy			█	→	█	→
Stressful to relaxed			█	→	█	→
Anti-children to child-friendly			█	→	█	→
Abandoned/ dead to dynamic/ vibrant			█	→	█	↗
Shabby/ neglected to well maintained	█		█	→	█	↗
Dangerous to safe			█	→	█	↗
Empty to crowded	█		█	↗		↗
Monotone to diverse			█	↗	█	→
Dirty to clean	█		█	→	█	↗
Alien to familiar			█	↗	█	→
Loud to quiet			█	→	█	→
Hostile to welcoming			█	→	█	↗
No equipment to well equipped	█		█	↗	█	→
Lonely to communicative	█		█	→	█	↗
Unpopular to popular	█		█	→	█	→

Strongly agree	█	█	█	█	█	█	Strongly disagree
Increased agreement	↗	→	↘	Reduced agreement			

By the end of the survey, respondents were asked to rate the current and future situation in the NBS areas (see Table 10). Here, the participants agree that the NBS meets their expectation both in terms of risk reduction and co benefits, currently and in the future. All participants in Odense and Portofino mostly agree to these statements, with more undecided values for Hamburg.

In addition, the participants expressed interest to stay active within the NBS beyond the end of the RECONNECT project. In Table 11, participants from Hamburg stated that they either wanted to be involved beyond the end of the project or had interest in doing so, provided that they were given more information about the options to get involved. Staying involved beyond the end of the project also was the, most favoured option in Odense and Portofino.

Table 10 Current and future assessment

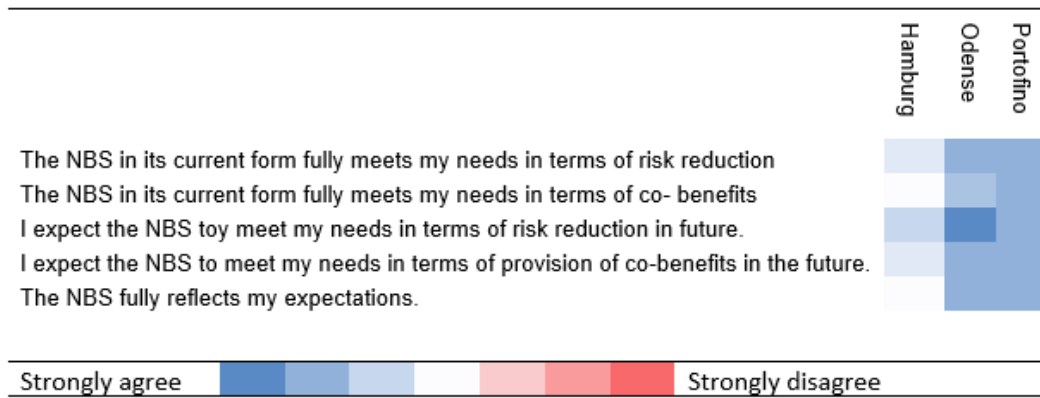
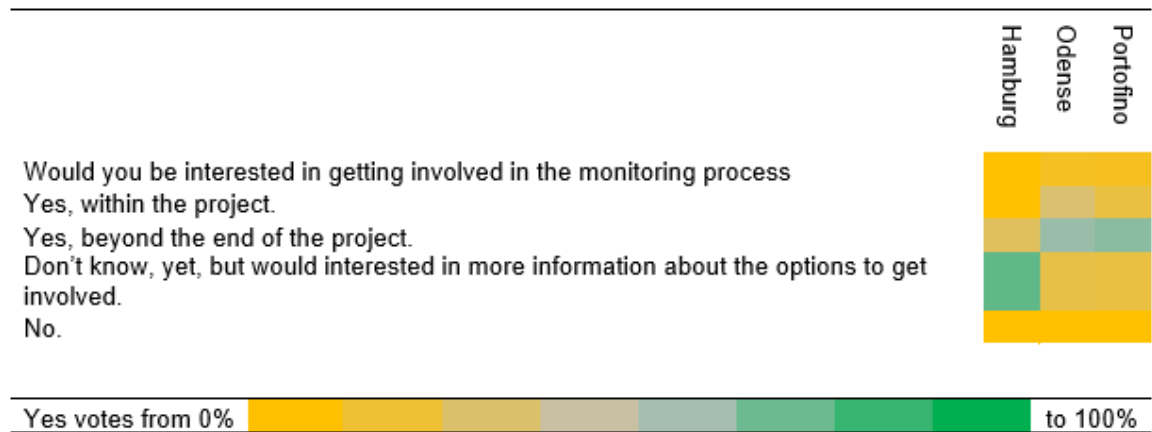


Table 11 Future participation



In general, the findings from the Demo A sites presented here can provide further insights into the successful realisation of NBS projects. Varying numbers of participants and the differences in progress within the different sites prompts the need for careful evaluation of the results shown here.

3.2 Demo B – Expert interviews

This results section presents the findings and outcomes derived from our comprehensive research and analysis. It aims to provide a clear and detailed account of the data collected. The objective is to illustrate how the results align with the project goals and objectives, highlighting significant trends, patterns, and insights.

The following subsections will delve into specific areas of the research, offering quantitative and qualitative assessments where applicable. Each finding will be supported by relevant data visualizations where applicable.

Out of the 8 participants interviewed, only 2 were actually involved in the initial phase of the project planning. The remaining interviewees however were either involved in the continued supervision of the sites or had a good understanding of the project, although not directly affiliated. As the answers given were still thorough and in depth across all interviews, we consider all interview partners as knowledgeable experts on these particular questions referring to their local sites.

Relevance of NBS

As a first set of questions, the agreement with statements relating to the relevance of NBS in a hydrological context were examined. Table 12 gives an overview over the questions and sub questions as well as their agreement levels by interviewee and site.

Table 12 Perspective on NBS

		Aarhus	Inn	Jissel	Thur
In general, NBS are of high relevance for reducing hydro-meteorological risks.		Blue	Light Blue	Light Blue	Light Blue
NBS are of high relevance for reducing hydro-meteorological risks as they ...	are effective	Blue	Blue	Light Blue	Light Blue
	are efficient	Blue	Blue	Light Blue	Light Red
	help to master the biodiversity crises	Blue	Red	Light Blue	Light Blue
	can provide many different benefits	Blue	Light Blue	Light Blue	Light Blue
NBS are of low relevance for reducing hydro-meteorological risks as they	are very difficult to realise	Blue	Red	White	Light Blue
	their benefits are very uncertain and will, if at all, only become apparent in the future	Light Red	Red	Red	Light Blue

Strongly agree	Blue	Light Blue	White	Light Red	Red	Strongly disagree
----------------	------	------------	-------	-----------	-----	-------------------

The participants mostly agreed that NBS are of high relevance for reducing hydro-meteorological risks, although the partners at the Inn site in Austria was more reserved. They expanded on the idea that it would be worse without NBS, but NBS alone might not have a sufficient impact on the situation.

The effectiveness was rated high throughout all DEMO B sites, the efficiency however was evaluated differently. In the Thur case, high costs were associated with NBS, at least in the case of Switzerland.

There was also some disagreement on whether NBS can help to master the biodiversity crisis. The Interview partners from Austria deemed their impact significantly lower, adding that this does not necessarily only apply to this site and is strongly related to the site specific characteristics, e.g. only newly planted forests.

Multiple benefits

Universal agreement was reached on the multiple benefits which NBS can provide, which all interview partners rated between somewhat agree and mostly agree.

More varied answers were once again given to the questions of realization of the NBS and the outcome in relation to the benefits. Reasoning behind the answers given ranged from NBS potentially having a higher impact on land use to public perception, where grey infrastructure could be more convincing. With regards to uncertain benefits, the remarks suggest a low level of agreement, implying that benefits are not uncertain and will not only become apparent in the future. It was mentioned multiple times that NBS might need some time to develop their full potential, and that some unexpected co- benefits could arise. However, the idea was generally disregarded, as

“Because if that's the case, then you've got a very poor design because you should set your goals” (Ijssel interview 2).

One partner also mentioned that policies should demand a report on the success ensuring a documentation that NBS are actually able to contribute to the pre-defined goals.

Modes and stages of stakeholder involvement

The next set of questions focused on the main aspects of the strategy used to engage stakeholders in the planning and implementation process of the NBS. These were separated into modes and stages of involvement as shown in Table 13 and Table 14.




Table 13 Modes of involvement across all 4 sites

	Aarhus	Inn	Ijssel	Thur
Decision-making	Green	Yellow	Green	Grey
Implementation	Grey	Yellow	Grey	Green
Coordination	Grey	Green	Yellow	Grey
Provision of knowledge	Green	Yellow	Green	Green
Funding/sponsoring	Green	Green	Yellow	Grey
Lobbying	Grey	Yellow	Grey	Grey
Mediation	Grey	Yellow	Grey	Grey

Yes votes from 0%	Yellow	Grey	Green	to 100%
-------------------	--------	------	-------	---------

Table 14 Stages of involvement across all 4 sites

	Aarhus	Inn	Ijssel	Thur
Assessment/planning	Green	Yellow	Grey	Green
Design	Green	Yellow	Green	Grey
Implementation	Yellow	Yellow	Yellow	Green
Operation/maintenance	Grey	Yellow	Yellow	Green
Evaluation	Yellow	Yellow	Grey	Grey
Monitoring	Grey	Yellow	Yellow	Grey

Yes votes from 0%				to 100%
-------------------	---	---	---	---------

Modes refer to the activities in which stakeholders engaged, while the stages refer to the overall timeline of the project.

Comparing the two tables suggests that different modes of involvement were applied during the stages of assessment and planning as well as design, with a decline in the actual implementation, operation and later stages. As the scope and the background in the different DEMO B sites varied widely, further explanation is needed.

Especially the Inn site in Austria marks an outlier, as it dates back to the 1950. As explained in the interviews, the actual project can be described as an NBS, although its implementation was also driven by post WW2 policies. This translated into a strong engagement with the local population, but this was mostly them supplying the workforce and restabilising their livelihoods after a period of deforestation in the area. Thus, they were not involved in the most of the categories respected in this question in a strict sense, though they played a crucial role in its implementation.

As for the Room for the river project in the Netherlands, the network of local projects had different outcomes in terms of local stakeholder engagement. The answers represent a balanced overview of the different sites.

The participants were afforded greater scope to respond to question number 10:

How have stakeholders' needs, preferences, expectations and concerns been identified and taken into account in the design and implementation of the NBS?

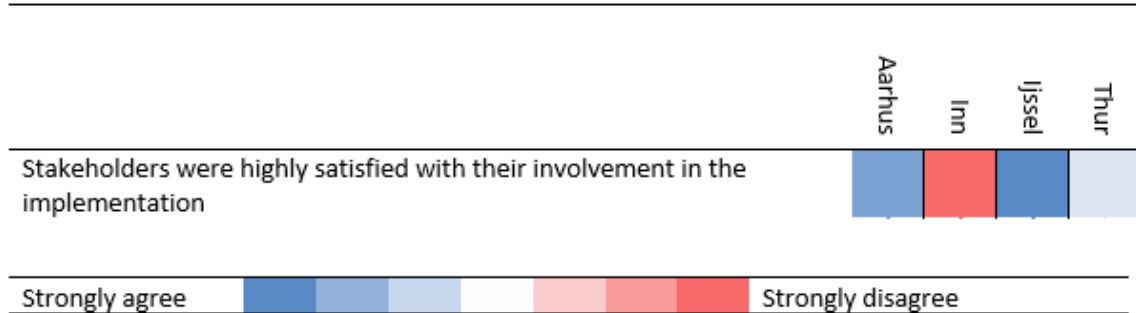
All sites, with the exception of the Inn project, had advisory groups comprising stakeholders from the local public, hosted workshops, and were involved through citizen science, with the assistance of external partners. All of these measures were implemented prior to, during, and subsequent to the implementation phase. The interviewee in Switzerland explicitly mentioned a surge in participation, which was employed in the creation of the NBS.

General satisfaction with NBS

In general, all interviewees from the sites agreed that, in the end, stakeholders were generally satisfied. It is evident that the level of satisfaction at the Inn site differs from that observed at the other locations. Similarly, the Thur site reported a general satisfaction, although different stakeholder groups, particularly nature conservationists and farmers, had competing interests. Table 15 illustrates the answers on the follow up question: Please, indicate you agree that stakeholders were highly satisfied with their involvement

in the implementation process of the NBS or not. Satisfaction levels were generally higher in the cases in Denmark and the Netherlands.

Table 15 Satisfaction levels of stakeholders with their respective involvement



Stakeholders perspectives on NBS

The next set of questions in section IV of the questionnaire focused on stakeholders perspective on the NBS.

Starting with a retrospective, participants were first asked to describe the general attitudes and perceptions of stakeholders towards the concept of NBS for managing natural hazards when the NBS was implemented. The answers varied between the Demo B sites:

Looking back, what were the general attitudes and perceptions of stakeholders towards the concept of NBS for managing natural hazards when the NBS was implemented (e.g. level of knowledge, (mis)trust)?

For the Dutch project site, there were protests in one of the areas. With the involvement of a minister over the course of many meetings with the local citizens, the initial scepticism was overcome. Additionally, there was a level of mistrust in the NBS itself, with people favouring technical solutions, in this case dykes.

As for the Danish site in Aarhus, people started appreciating the NBS when it was finished. Especially after the lake Egå site helped manage a flash flood, the value became clearer, and over time, more co-benefits emerged.

The local population at the Inn site initially mostly perceived the afforestation as something positive. Introducing this new type of concept in the 1950s was met with scepticism, but proved to be valuable over time.

Initial concerns at the Thur site also revolved around the newly introduced concept of NBS, and whether it would prove to be effective. In addition, high cost, lack of understanding and land takes were raised as major concerns at the time.

Stakeholders perception of NBS

On the question of how stakeholders initially perceived the specific NBS that was implemented, the answers were similar to the previous question across all Demo B sites. One additional aspect of resistance in the room for the river project were the initial conditions at the NBS site. Some flood areas needed to be cleared of vegetation to start with the actual work, and people perceived this as counterintuitive, that is the land-cover changed from forest areas to initially empty floodplains.

In Lystrup at Aarhus, the proposed pond in a suburban area had people worried about mosquitos, as well as the concept of grazing cows in a suburban environment.

“But very quickly, the concerns were, were turned to, yeah, more or less enthusiasm.” (Aarhus interview 1).

Again, the idea of NBS not working as controllable as a technical solution might be, was also present, but citizens were convinced during and after the implementation of the NBS. This change of mind was also present at the Thur site.

“At first there were reservations and concerns, but with the implementation there was enthusiasm (among most people)”. (Thur interview 2).

As all the NBS at the Demo B sites function as intended, the stakeholders perceptions of the local NBS evolved in a positive way. The cleared vegetation in the room for the river project was compensated for, and general approval of the concept was raised after the NBS helped mitigate the specific hydro- metrological risks at each site.

Perception of hazards at the local sites again varied widely in comparison and need to be read in local, historical context.

How did stakeholders initially perceive the hazard-related risk at the local site?

The interviews from the Ijssel site suggested that people were very familiar with floods. Near floods in the early to mid-1990s, sometimes leading to the evacuation of some people, kept the hazard very present in the public perception.

Residents in Lystrup, at the Demo B site in Aarhus, didn't feel threatened. Topographical influences, namely slope, and a location above water levels kept the perceived dangers very low to non-existent. In addition, a lack in understating of the technical concept might also influence the perception. Water retention in lakes can be counter intuitive, as a full lake still retains additional water, not causing additional flooding downstream. The risk at the Inn and Thur sites was also on people's minds, with flooding of properties and levees breaking. In addition, farmers at the Demo B site in Switzerland were concerned that a river returned back to its natural state would be more likely to flood their fields.

These perceptions changed over time however. On the question of whether stakeholder's perception has changed over time, the feedback from the Ijssel site was generally positive. Though initially either not convinced, or only expecting a reduction in flood risk, people were also interested in having the areas returned to a more natural state. Over time, these expectations were met, or even surpassed.

We can report similar findings for Aarhus, where the change in perception is mainly connected to areas that are often flooded. These are mostly low lying. Events to inform about the NBS at Lake Egå also helped, and people were able to see themselves that rising water levels in the Lake helped mitigate the flooding in downstream areas.

There was no change in Thur according to the interviewed partners. If at all, the system is now perceived as more stable, and the effectiveness was proven.

Perception of co-benefits

The next set of questions was about the perception of site-specific benefits and co-benefits by stakeholders.:

From your perspective, what were the key risk reduction-related benefits of the NBS that stakeholders expected before and which did they experience after the implementation of the NBS?

Responses reflected different positions along the different sites. Along the IJssel river, the legal standards for flood reduction had to be met, which were also expected by stakeholders. The discussion around the NBS was thus focused on risk reduction from the start.

Aarhus reported an increase in the appreciation of nature and the recreational values. This is highly linked to the NBs being accessible, which is true for most of the NBS sites around Aarhus. In contrast, the other interview partner from Aarhus stated that

“I don't know if they actually expected something. I mean, they just expect us to normally work as a municipality, people just expect us to have everything under control [...] it's our job to ensure that they don't get flooded. That's the expectation, even though sometimes it's impossible to enjoy that.

So, applying NBS, we were able to give them something more than just flood mitigation. But they didn't expect that, and that was just a gift.” (Aarhus interview 1).

At the Thur site in Switzerland, the goals of reconnecting the riparian forest and thus also creating areas for additional retention were met. From a conservation point of view, the return of the little ringed plover (*Charadrius dubius*) was an additional benefit.

Table 16 gives an overview over the co-benefits which people associate with the different sites.

The answers vary, as

- a) the interview partners had different definitions of the terms used, especially for biodiversity
- b) the site in Austria is not easily accessible to the public due to constraints in topography. This is relevant for the category accessibility of natural space, and thus influences recreational opportunities as well as health and wellbeing.

Table 16 Attributed co-benefits by site

	Aarhus	Inn	IJssel	Thur
Accessibility of the natural space				
Biodiversity				
Water-related aspects				
Recreational opportunities				
Health and wellbeing				
Education and awareness raising				

Yes votes from 0% to 100%

Accessibility was attributed to all sites except for Inn because of the aforementioned reasons.

Biodiversity is also an aspect valued by the stakeholders at the four sites. For Aarhus, this was especially true for the site in Lystrup, as Lake Egå already was a natural area. Changing the management practices at the Lystrup site, including leaving dead wood in the area, moving local plants to the site and changing a dry retention pond with a lawn to a small lake had a good impact on species richness. On the other hand, both interviewees at the Inn site were sceptical about an increase in biodiversity at the site.

Education and awareness raising was indicated by all 4 sites, though to varying degrees, from a general knowledge of the NBS to information boards and school classes going there on field trips.

Reported water-related aspects ranged from accessibility, improved water quality, the increase in local fish and plant population, also in shallower areas. However most of these are not necessarily tangible.

Recreational opportunities increased at all sites, again except for Inn. The partners from the Netherlands reported an increase in both paid and unpaid activities, from going to the park or visiting play area with their children to visiting restaurant. One interviewee from Aarhus pointed to the place being the same, while providing more features:

“Well, it's the same room but now it just, there's more to experience, right?”
(Aarhus Interview 1)

Opportunities for recreation also increased at the Thur site.

Health and wellbeing were generally also mentioned, the partners from the Room for the river project however mentioned that attributing health to a specific place can be difficult.

Education and awareness raising was again reported by all 4 sites. However, only Aarhus specified this further. Schools and kindergartens come to visit, and there is an option to book nature education material to learn about the site.

Unexpected co-benefits

After the establishment of the NBS sites, unexpected co-benefits did also arise. For instance, the network of pathways allows for people to be more active, e.g. cycling and running. A smaller side channel in Nijmegen also produces a small waterfall during high water level, which attracts tourists for water sports such as canoeing. At the Lystrup site near Aarhus, a better sense of community was also established. Citizens come together at the site to appreciate the nature in general and the grazing cow, with the goal to maintain the area together.

The dynamic changes in the waterflow at the Thur site also produced unexpected co-benefits, in the sense that they were hard to predict, i.e. when and if they would appear.

However, detrimental side effects were also reported. The Thur river would have gradually washed away a local farming route, so the impact slope of the river had to be stabilized. To prevent this, areas were characterized in which the shifting river is either monitored, or, if it exceeds the area, new measures will be taken to further stabilize the impact slope. This leads to a need for continued monitoring efforts, which leads to an increase in time and money spent on the project. This should however be calculated in when planning the project.

Additionally, neophytes settled in the new area, and a discussion about priorities ensued: protect local wildlife and leave it undisturbed or actively remove neophytes from the area.

One potentially detrimental side effect at the Inn site focused on the discussion of whether torrents should be stabilized by vegetation or left in the open, such that there is no risk of log jams. However, this has not yet occurred at the site.

Overcoming public resistance

The final set of questions focused on strategies for overcoming political and public resistance as well as institutional change.

Along the IJssel river, there was a high awareness of being flooded, so new project proposal was met with intimal interest. The government of the Netherlands decided in parliament, and funding was established. With the foundation of the Delta works, there was already an underlying framework to establish the flood protection. With the experience of past flooding, as well as the developments in climate change, the need and urgency also led to a new legal status. The laws therein de-coupled the action from political terms, making it a long-term goal.

As the proposed changes had substantial influence on the land use over large area, the ministries for spatial planning, water management and infrastructure and agriculture and nature conversation worked together, and established a regular reporting cycle.

Simultaneously, the political strategy also encompassed involving stakeholders from the start. Dedicated room and budget was given to this aspect, in such a way that the affected citizens could have a say in the matter.

On a more practical level, the creation of a dedicated team concerned with spatial quality was also establish. People from different backgrounds, some in engineering, some in landscape planning, helped to balance competing interests. This extra layer of review improved the designs over time. As officially appointed personal such as the national landscape architect were part of this board, this also helped overcoming institutional resistance.

As emphasised by one interview from the room for the river project, this multi-level approach had a big impact on the outcome of the project:

“what was important is that we had discussions at all level, individual discussions at what we call kitchen table talks with farmers” (Ijssel Interview 1)

For some landowners, especially farmers, ways to identify alternative property had to be sought. Dedicated funding and consultancy was therefore also considered. More generally, the emphasises on the community level also provide positive outcomes, as a it created a sense of community.

*“To get a kind of community feeling.
We called it the room for the river community, which was –
people really got, at some stage, got really enthusiastic about it.” (Ijssel Interview 1)*

To summarize, both communication and knowledge were stress a being to a successful implantation of NBS:

“Communication on all levels is, is really important.” (Ijssel Interview 1)

“Make sure that you have some knowledge of the area and knowledge of the history of the people in the area.” (Ijssel Interview 2)

The Greater Aarhus area experienced an evolution in policy on NBS over the last decade, both on a national and on a municipal level.

As for overcoming public resistance in the municipality, the political level is focused on citizen involvement. In the municipality of Aarhus, a dedicated department was created which focuses on citizen involvement. Approaches however differ, and foci shift, when rural and urban NBS are compared: where in areas with less people it is mostly about land owners being convinced, where the focus in more densely populated areas is on the values for citizens.

Both a local green strategy and a climate adaption strategy, which is currently being updated, give a framework for the actions. A shift in focus of the latter will bring the need for climate adaption more towards the foreground, rather than the previous approach of communicating added values through climate adaption.

In the future, the updated green strategy will also focus more on biodiversity.

The municipalities work with the water facilities has been successful in this regard, as knowledge is exchanged. Aligning both water management aspects with additional requirements for biodiversity and stakeholder involvement creates a connection, which is deemed beneficial for the outcome.

Again, multiple branches of the city apart from the water facilities are involved, specifically in the later management and maintenance of the newly built green areas. And as citizen also actively engaged in these phases, a monetary saving can actually be achieved.

Communication once again was stress as a crucial part of the NBS implementation – both for its success, but also as being very time consuming, which needs to be factored in when planning the timeframe of the project.

Overcoming political resistance and fostering institutional change

On a political level, cloudburst in the past years which lead to flooding played a major role in shifting political views on the topic of NBS. The importance of establishing nature-based solutions is clear to politicians, as before, the dangers of not supporting this idea had to be communicated more often.

To ensure that the implementation runs smoothly, a step by step approach is used in Aarhus. Adapting to each case, the amount of stages and the incentives needed can be tailored to the project, for instance with regards to the perceptions of citizens. These stakeholders however may vary over time. In the Case of Lake Egå, the project initially mostly dealt with farmers owning the land, a scheme for buying up and selling land was established, to acquire the necessary plots. As the project moved on, the farmers located elsewhere, and the interest shifted more to civil society, wanting to use the area for e.g. recreational activities, or political influence, trying to increase the biodiversity in the NBS area. This is also reflected in the step by step approach, dealing with several stages both subsequently and simultaneously.

Both interviewed stakeholders from the Inn catchment raised an additional point about the balance of NBS and civil defence. As areas with a higher likeliness of being prone to natural disasters are mapped and updated continuously, land-use conflicts arise. Shifting borders may translate to changing property values and potential uses, while NBS take up more space. Especially if land is valuable, these conflicts can interrupt engineering with NBS.

Findings from the Thur catchment followed a similar mode. Open, transparent communication as a key to acceptance and willingness to implementation, both politically and socially was underlined.

It's crucial to present and communicate the scientific basis and findings of NBS appropriately (as complex as necessary, but as simple as possible). (Thur Interview 2)

Open communication also involves acknowledging potential negative aspects, including necessary follow-up examinations and measures with associated costs. Communication and education are essential. To find solutions, dialogue with stakeholders is necessary. Acceptance of new approaches is also a generational issue, and changes take time.

Implementing the new Swiss Federal Water Construction Law at the cantonal level faced political resistance and required effort to convince and stand with the population regional politics. Utilizing legislative flexibility to avoid expropriations, and emphasizing land acquisition for strategic swaps proved viable.

4 Synthesis of our validation analysis

4.1 Co-creation

Co-creation is an essential part of the RECONNECT project and the successful implementation of NBS projects. Therefore, a dedicated section of the data collection focused on (1) level of information regarding RECONNECT (personally, institutionally), (2) the mode of involvement, i.e. the type of activities stakeholders were engaged in, (3) the phases of NBS realisation stakeholders were involved in up to the time of the interview, (4) the intensity of this involvement and (5) stakeholders' willingness to get involved in the upcoming NBS monitoring process. Identifying these levels was part of an earlier phase of this project (Barquet et al. 2021).

To put the next sections into context, Figure 9 provides an overview over the levels of participation, as well as giving an overview of the different stages and pre-existing influences. It serves to put the different questions posed into perspective.

The research findings highlight the crucial role of co-creation in implementing Nature-Based Solutions (NBS) for addressing hydro-meteorological risks and biodiversity issues. Stakeholder involvement varied significantly across different project phases, with higher engagement during the planning and assessment stages and less during implementation. Projects like Room for the River in the Netherlands demonstrated extensive stakeholder engagement through advisory groups, workshops, and citizen science, which were essential for addressing local needs and expectations.

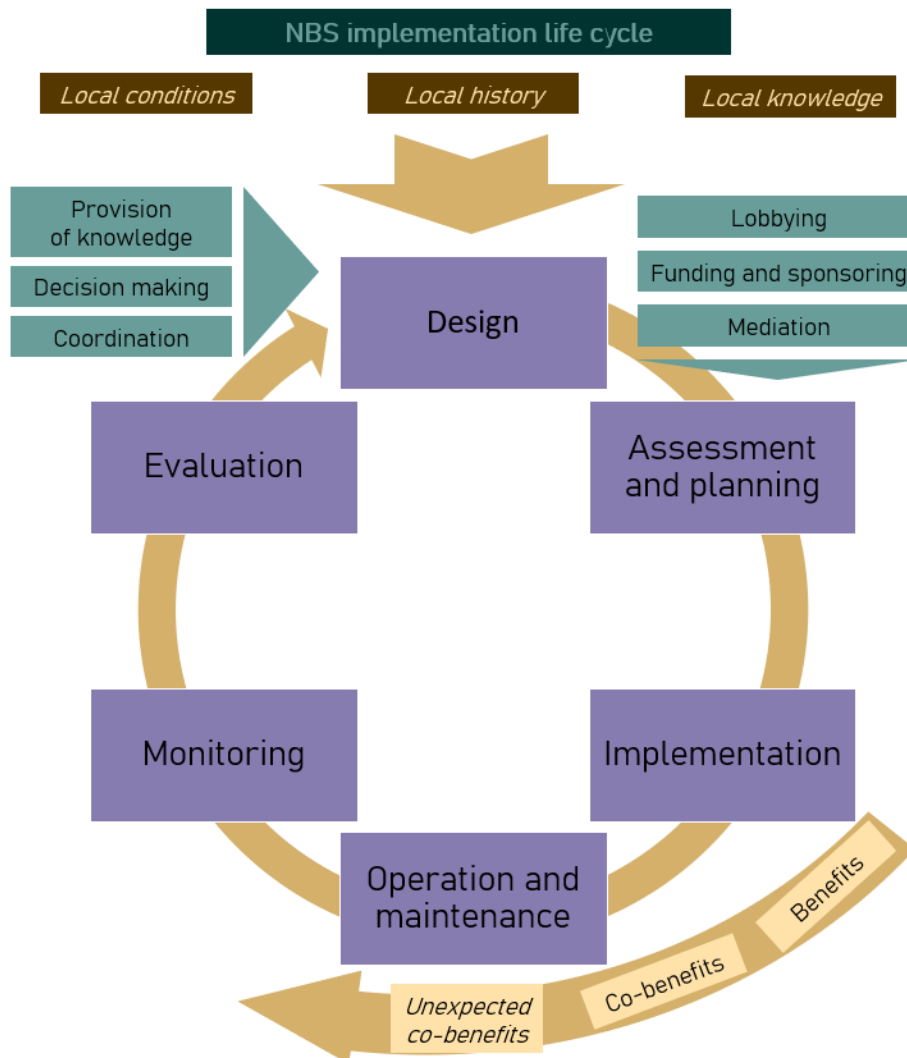


Figure 9 The RECONNECT co-creation process for NBS

In Hamburg Assessment & Planning was by far the most common phase for involving the stakeholders interviewed, whereas in Portofino and Odense involvement was relatively evenly distributed across all phases up to operation of the NBS (see Table 4).

In addition to looking back and at the current situation, stakeholders were also interested in their willingness to get involved in the future, for example in the context of monitoring the NBS. The willingness to participate in the monitoring process of the NBS beyond the end of the RECONNECT project was very high in Portofino (75% of interviewees) and high in Odense (56%). In view of the fact that at the time of the survey the specific NBS location could not yet be named and, thus, a possible (personal) connection of the interviewees with this location did not play a role, the 25% of respondents in Hamburg who could imagine to get involved in this way are also quite a substantial figure. In Portofino and Odense, about 1/3 of the respondents were willing to participate in the monitoring of the NBS still within the RECONNECT project. Uncertainty regarding a possible participation was highest in Hamburg. This was certainly also due to the fact that many of the respondents there were part of the public administration and without knowing further details, were not in a position to commit themselves in this respect.

Table 11 gives an overview of the share of respondents who were willing to participate in this way.

4.2 General perspective on NBS

In addition to the co-creation-related aspects, stakeholders' general perspective on NBS was of interest in order to be able to put the site-specific assessments into perspective. The general relevance of NBS to reduce meteo-hydrological risks was emphasised at all sites. The data shows the consistently high approval ratings for the statement that this importance is high at all locations.

Stakeholders generally agreed on the high relevance of NBS in reducing hydro-meteorological risks, though there were reservations about their efficiency and biodiversity impact. The effectiveness of NBS was acknowledged widely, but efficiency concerns were raised, particularly regarding the high costs in certain areas like Switzerland. There was universal agreement on the multiple benefits of NBS, such as increased recreational opportunities, biodiversity, and educational aspects. Unexpected co-benefits, including improved community sense and increased physical activities, were reported. However, there were site-specific challenges, like neophyte invasions and ongoing maintenance needs. Public and political resistance were addressed through comprehensive communication strategies, stakeholder engagement, and adaptable approaches based on local contexts. Examples from the Netherlands and Aarhus highlighted the importance of community involvement and transparent communication in overcoming initial resistance and fostering a sense of community and ownership among stakeholders. Stakeholder satisfaction was generally high across most sites, with positive changes in perception over time as the benefits of NBS became evident. Initial concerns and scepticism were often mitigated through effective communication, demonstration of NBS benefits, and active involvement in the implementation process. Overall, the research underscores that co-creation is pivotal for the successful implementation and acceptance of NBS projects. It emphasizes the need for continued stakeholder engagement, transparent communication, and adaptability to local contexts.

All suggested possible reasons for the high perceived relevance of NBS to reduce meteo-hydrological risks, i.e. effectiveness and efficiency of NBS to do so, to create co-benefits and to make a positive contribution to addressing the biodiversity crisis, were highly rated at all sites. In Hamburg stakeholders did consider the ability of NBS to mitigate the biodiversity crisis somewhat lower, but still positive with a value of 5.3 on a 7-point scale. Regarding possible reasons for NBS being less relevant for the reduction of meteo-hydrological risks, i.e., specifically the uncertainty of the occurrence of the expected benefits and the difficulty of realizing NBS, opinions differed at the three sites. Stakeholders in Portofino and Odense considered these two aspects to be rather less relevant. In Hamburg, on the other hand, stakeholders were quite of the opinion that this uncertainty and greater complications in implementation negatively affect the importance of NBS to reduce meteo-hydrological risks. This may again be due to the fact that representatives of public authorities, which were more strongly represented in the Hamburg sample, are somewhat more sceptical in this respect.

In support of the people indicator-based evaluation activities, stakeholders were asked to rate the relevance of the sub-goals of NBS realization specified by the RECONNECT team in WP3. These sub-goals can be understood as a range of motivations for implementing NBS.

Education and awareness raising as well as economic benefits were considered to be highly relevant motivations at all sites. In addition, in Odense there was a special focus on the increase of recreational opportunities and in Portofino the improvement of accessibility, community cohesion and safeguarding cultural values were considered to be more relevant than at the other both sites. In Hamburg safeguarding cultural values was assessed to be equally important as the stimulation of economic benefits. On average, however, the mean scores in Hamburg were substantially lower than those at the other two locations with the one for the encouragement of new business models scoring lowest. As a perspective from the Demo B sites, the findings underscore the significance of Nature-Based Solutions (NBS) in managing hydro-meteorological risks and enhancing biodiversity. Despite varying degrees of stakeholder involvement across different project phases and sites, the consensus is that NBS are highly relevant for mitigating natural hazards and offering multiple benefits. These benefits include increased recreational opportunities, enhanced biodiversity, and educational potential.

The effectiveness of NBS in reducing risks was widely acknowledged, although concerns about their efficiency and cost were noted, particularly in Switzerland. Stakeholders generally agreed on the multiple benefits of NBS, such as improved community engagement and unexpected positive outcomes like increased physical activities and a stronger sense of community. However, some challenges were reported, including the invasion of non-native species and the need for ongoing maintenance.

4.3 Site-specific perspective on risks and NBS

Although the general perspective of the stakeholders on NBS provided interesting insights, the assessment of the site-specific situation was the main focus of the data collection and analysis. This included (1) an assessment of the relevance of the site-specific risks that NBS were intended to address, (2) site-specific relevance of NBS to reduce meteo-hydrological risks and (3) potential causes for the perceived relevance, (4) expected impact of NBS on the reduction of these meteo-hydrological risks, as well as (5) expected additional co-benefits of the NBS to be realized.

In Hamburg, the special situation existed that the area in which the NBS to be realized was only roughly defined. Against this background, the majority of stakeholders were only able to assess the site-specific meteo-hydrological risks.

The relevance of the site-specific meteo-hydrological risks previously identified by the RECONNECT partners and to be addressed by the NBS were assessed quite different at the three sites.

In Odense the risks of sea-level rise and coastal flooding were perceived as being very high, but riverine and pluvial less relevant. In Portofino the risk of landslides was considered to be of highest importance and the risk of flash flooding was also seen as being relevant. In Hamburg, both drought risk and river flood risk were considered to be highly and equally important.

The expected impact of NBS on the reduction of the site-specific meteo-hydrological risks could only be surveyed in Portofino and Odense, as the location for the realization of the NBS in Hamburg had not yet been determined at the time of the interviews.

Stakeholders in Odense had high expectations regarding the impact of NBS on coastal flooding risk and risks connected with sea-level rise. This holds in absolute terms but also compared to other flooding-related risks. In Portofino substantial positive impacts on risk of landslides and soil erosion were expected and to a lesser extent also a reduction of the risk of flash floods.

The expected impact of NBS on the reduction of the site-specific meteo-hydrological risks could only be surveyed in Portofino and Odense, as the location for the realization of the NBS in Hamburg had not yet been determined at the time of the interviews.

Stakeholders in Odense had high expectations regarding the impact of NBS on coastal flooding risk and risks connected with sea-level rise. This holds in absolute terms but also compared to other flooding-related risks. In Portofino substantial positive impacts on risk of landslides and soil erosion were expected and to a lesser extent also a reduction of the risk of flash floods.

The Room for the River project in the Netherlands showcased extensive stakeholder engagement, with advisory groups, workshops, and citizen science initiatives playing a critical role. Initial resistance and scepticism about NBS were mitigated through comprehensive communication and involvement strategies. Protests were managed by engaging local citizens and involving government officials, which helped overcome mistrust and preference for technical solutions like dykes. Over time, stakeholders' perceptions became positive as the benefits of NBS, such as flood risk reduction and enhanced recreational opportunities, became evident.

In Aarhus, Denmark, the implementation of NBS saw increasing stakeholder appreciation post-completion. The Lake Egå site, which helped manage a flash flood, showcased the value of NBS, leading to greater public acceptance. Initial concerns about issues like mosquitoes and grazing cows in suburban areas were quickly alleviated, turning scepticism into enthusiasm. The focus on citizen involvement and communication was pivotal, with strategies tailored to address the specific concerns and values of urban and rural stakeholders. The project benefited from a shift in policy that emphasized NBS as crucial for climate adaptation and biodiversity enhancement.

The Inn site in Austria, dating back to the 1950s, had a unique historical context, with strong initial local engagement mainly for labour provision rather than broader stakeholder involvement. Although initially perceived positively for afforestation, concerns remained about the overall effectiveness and biodiversity impact of NBS. The project highlighted challenges such as balancing civil defence needs with NBS implementation, dealing with shifting land-use conflicts, and maintaining ongoing stakeholder communication.

At the Thur site in Switzerland, stakeholders had mixed perceptions about the cost and effectiveness of NBS. Concerns about high costs and land use were prominent, alongside a lack of initial understanding of NBS benefits. Over time, stakeholder perceptions improved as the effectiveness of NBS in reducing hydro-meteorological risks became evident. The project also highlighted unexpected co-benefits, such as the return of specific bird species, though challenges like maintaining balance between natural river dynamics and local farming interests persisted. Transparent communication and continuous

stakeholder engagement were crucial in addressing these issues and improving public perception.

Across all sites, the research emphasized the critical role of comprehensive communication strategies and stakeholder engagement in overcoming resistance and ensuring the successful implementation of NBS. The findings suggest that adaptable, site-specific approaches that prioritize stakeholder involvement and transparent communication are essential for the long-term success and acceptance of NBS projects.

5 Conclusion

This report has given a valuable insight into NBS projects, both on a local and regional scale. With the combination of reviewing established NBS projects and surveying current ones, both through different lenses, multiple angles are covered within this report.

Across all sites and regardless of stakeholder type and expert level, there seems to be consent on the effectiveness, efficiency and overall high relevance of NBS for reducing hydro- meteorological risks. Additionally, the enhancement of biodiversity is also regarded as a key point, and mostly differs along the definitions of biodiversity.

The RECONNECT project underscores the pivotal role of co-creation in the successful implementation of Nature-Based Solutions (NBS) for managing hydro-meteorological risks and enhancing biodiversity. A detailed data collection effort focused on various aspects of stakeholder involvement, including their level of information, mode of involvement, stages of participation, intensity of engagement, and willingness to continue involvement in NBS monitoring. This comprehensive approach was integral to understanding and optimizing stakeholder contributions across different project phases and locations.

The findings highlight that stakeholder engagement varied significantly across different project phases. High engagement levels were noted during the planning and assessment stages, while participation decreased during implementation. Exemplary projects, such as Room for the River in the Netherlands, demonstrated extensive stakeholder engagement through advisory groups and workshops, effectively addressing local needs and expectations. Despite broad recognition of the relevance of NBS in reducing hydro-meteorological risks, concerns about efficiency and high costs, especially in Switzerland, were prevalent. Nonetheless, stakeholders universally acknowledged the multiple benefits of NBS, including recreational opportunities, biodiversity enhancement, and educational potential. Unexpected co-benefits, such as improved community sense and increased physical activities, were also reported.

Challenges such as ongoing monitoring and maintenance needs were identified, along with public and political resistance. These issues were mitigated through comprehensive communication strategies, stakeholder engagement, and adaptable approaches tailored to local contexts. Examples from the Netherlands and Aarhus demonstrated the importance of community involvement and transparent communication in overcoming initial resistance and fostering a sense of ownership among stakeholders. Stakeholder satisfaction generally increased over time as the benefits of NBS became evident, with initial concerns often alleviated through effective communication and active involvement. Stakeholder involvement at specific sites varied, reflecting different project statuses and local contexts.

The general perspective on NBS was overwhelmingly positive across all sites, with high approval ratings for their relevance in reducing hydro-meteorological risks and addressing biodiversity crises.

Site-specific assessments revealed varying perceptions of risks and NBS impacts. In Odense, coastal flooding and sea-level rise were seen as significant risks, with high

expectations for NBS impact. In Portofino, landslides and flash floods were major concerns, with stakeholders anticipating substantial positive impacts from NBS.

Case studies from various sites, such as the Room for the River project in the Netherlands and the Lake Egå project in Aarhus, underscored the importance of stakeholder engagement and communication in mitigating initial resistance and enhancing acceptance. These projects highlighted the need for adaptable, site-specific approaches that prioritize stakeholder involvement and transparent communication to ensure long-term success and acceptance of NBS.

We conclude that 3 key points emerge which seem to be essential for establishing well accepted NBS projects:

- Firstly, local history, knowledge and conditions have to be taken into account when planning NBS projects, and also while engaging with local stakeholder. Key insights provided by them can help mitigate unwanted dis-benefits and enhance public participation and acceptance of the project.
- Secondly, sufficient funding beyond the NBS implementation needs to be secured beforehand, especially for monitoring, and to counter unexpected dis-benefits
- Thirdly, access is key to appreciation and valuation. With non-accessible NBS, the overall goals of a given project might still be fulfilled. However, this comes at the expense of local awareness and appreciation, lowering the cognizance of NBS.

As per definition, NBS are “Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience” (EC 2017). This project has added to the existing body of literature on NBS, and has determined key factors for successful NBS implementation.

References

Barquet, K., Segnestam, L., Dickin, S., Bredimas, A., Kuhlicke, C., Esquivel, N. (2021): Social innovation approach. Deliverable 1.2. RECONNECT Consortium. Online: <https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5ddbfa99&appId=PPGMS> [accessed 2024-07-22].

European Commission (2017) Nature-based solutions. Online: https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en [accessed 2024-07-31]

McBean G. (2016) Hydrometeorological Hazards. In: Bobrowsky P.T. (ed.) Encyclopedia of Natural Hazards. Springer, Dordrecht. DOI: https://doi.org/10.1007/978-1-4020-4399-4_179.

Penchev, V., de Jager, J., Pérez-Lapeña, N. B., Kirova, A., Knecht, J., Boogaard F. (2019): Scope of Works for Demonstrators A and B. Deliverable 2.3. RECONNECT Consortium. Online: <https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c2ac0c09&appId=PPGMS> [accessed 2024-07-22].

Smith, R. C., Bossen, C., & Kanstrup, A. M. (2017). Participatory design in an era of participation. *Codesign*, 13(2).

Wilkinson, L., & Friendly, M. (2009). The History of the Cluster Heat Map. *The American Statistician*, 63(2), 179–184. <https://doi.org/10.1198/tas.2009.0033>.

Appendices

Questionnaire Demo A - first round of interviews

1. What is your professional/educational background?
2. Which organisation, political or administrative body, association or company are you representing?
3. What are your responsibilities in your organization?
4. The term Nature-based solutions (NBS) describes measures which are inspired and supported by nature for mastering socio-environmental challenges such as climate change, the biodiversity crisis, environmental pollution, food and water security and natural hazards. In the scientific as well as in the public debate there are numerous concepts being routed in this idea of relying on nature to address and manage those challenges.

Please, indicate which of the following terms you are familiar with!

- a. Nature-based Solution
 - b. Natural Climate Solution
 - c. Ecosystem-based solution/management adaptation/mitigation
 - d. Ecological engineering
 - e. Catchment System Engineering
 - f. Ecological Restoration
 - g. Green Infrastructure
 - h. Natural Infrastructure
 - i. Eco-hydrological solution/management /adaptation/mitigation/engineering
 - j. Adaptation service
 - k. Natural Capital
 - l. River Restoration
 - m. Natural Water Retention Measures (NWRM)
 - n. Other ...
5. Have you been involved in NBS-related-projects before? If so, please, specify!

12. If you are/were involved in the RECONNECT project, at what stage did you make a contribution? If so, please, specify!
- a. Assessment and planning, i.e. assessment of hazards, vulnerabilities, risks to hydro-meteorological events, stakeholders' experiences, expectations, needs and capacities to implement NBS and other risk mitigation options
 - b. Design, i.e. specification of NBS design
 - c. Implementation, i.e. realisation of NBS measures
 - d. Operation/maintenance, i.e. activities required to run and maintain the NBS (except for the construction of new measures)
 - e. Evaluation, i.e. evaluation of the performance of the NBS
 - f. Monitoring, i.e. monitoring of the performance of the NBS
13. If you are/were involved in the RECONNECT project, in what way were you involved? If so, please, specify!
- a. Decision-making, i.e. being responsible for making and executing NBS-related decisions
 - b. Implementation, i.e. involvement in execution or implementation of NBS-related plans
 - c. Coordination, i.e. involvement in coordination of a variety of actors for the implementation of NBS-related plans
 - d. Provision of knowledge, i.e. provision of information, expert knowledge or site-specific data
 - e. Funding/sponsoring, i.e. financing of NBS-related activities at the site
 - f. Lobbying, i.e. attempting to influence NBS-related activities decision-making at the site
 - g. Mediation, i.e. being responsible for mediating and facilitating communication between different sections of society
14. In what way would you like to get involved in the NBS project in future? Please, specify!
15. The following list of hydro-meteorological risk to be addressed by the NBS project was compiled on the basis of consultations with RECONNECT partners at your demonstration site. Which of the following risks do you consider relevant at your site and how severe is this risk from your perspective?
- Please, indicate on a scale of 1 to 7 whether you agree that the risk is high! Whereby 1 means „I strongly disagree that there is high risk“ and 7 means „I strongly agree that there is a high risk“.
- a) Riverine flooding

Strongly disagree ₁ Strongly agree

b) Coastal flooding

Strongly disagree ₁ Strongly agree

c) Pluvial flooding

Strongly disagree ₁ Strongly agree

d) Sea-level rise

Strongly disagree ₁ Strongly agree

e) Coastal erosion

Strongly disagree ₁ Strongly agree

f) Other,

Strongly disagree ₁ Strongly agree

16. Which of the following benefits do you expect from the realisation of the NBS project and what will be their magnitude?

Please, indicate on a scale of 1 to 7 whether you expect a beneficial effect on the particular aspect! Whereby 1 means „I strongly disagree that the realisation of the NBS has a high beneficial effect“ and 7 means „I strongly agree that the realisation of the NBS has a high beneficial effect“.

a) Riverine flooding risk

Strongly disagree ₁ Strongly agree

No effect expected.

I don't know.

b) Coastal flooding risk

Strongly disagree ₁ Strongly agree

No effect expected.

I don't know.

c) Pluvial flooding risk

Strongly disagree ₁ Strongly agree

No effect expected.

I don't know.

d) Risk of sea-level rise

Strongly disagree ₁ Strongly agree

No effect expected.

I don't know.

e) Risk of coastal erosion

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

f) Other risk

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

g) Biodiversity

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

h) Habitat quantity

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

i) Habitat quality

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

j) Ecological status

Strongly disagree ₁ ₇ Strongly agree

No effect.

I don't know.

k) Recreational opportunities

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

l) Accessibility

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

m) Health and wellbeing

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

n) Safeguarding cultural values

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

o) Education and awareness raising

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

p) Community cohesion

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

q) Economic benefits

Strongly disagree ₁ ₇ Strongly agree

No effect expected.

I don't know.

r) New business models

Strongly disagree ₁ Strongly agree

No effect expected.

I don't know.

17. We would like to know how do you perceive the measures in this NBS project?

Please, indicate to what extent do you agree or disagree with the following statements! Whereby 1 means „I strongly disagree” and 7 means „I strongly agree”.

a) In general, NBS are of high relevance for reducing hydro-meteorological risks.

Strongly disagree ₁ Strongly agree

b) NBS are of high relevance for reducing hydro-meteorological risks as they ...

i. are effective.

Strongly disagree ₁ Strongly agree

ii. are efficient, i.e. the effect to be expected is very favourable relation to the resources employed.

Strongly disagree ₁ Strongly agree

iii. help to master the biodiversity crises.

Strongly disagree ₁ Strongly agree

iv. provide many different benefits.

Strongly disagree ₁ Strongly agree

c) NBS are of low relevance for reducing hydro-meteorological risks as they ...

i. are very difficult to realise.

Strongly disagree ₁ Strongly agree

ii. their benefits are very uncertain and will, if at all, only become apparent in the future.

Strongly disagree ₁ Strongly agree

18. There are various sub-goals pursued through the realization of the NBS at your site.

Please, rate the relevance of the following sub-goals from your perspective on a scale of 1 to 10! Whereby 1 means the sub-goal is of low relevance and 10 means the sub-goal is high relevance.

a. Increase recreational opportunities

low relevance ₁ ₁₀ high
relevance

b. Education and awareness about NBS

low relevance ₁ ₁₀ high
relevance

c. Maintain and if possible enhance cultural values

low relevance ₁ ₁₀ high
relevance

d. Improvement of accessibility

low relevance ₁ ₁₀ high
relevance

e. Improvement of community cohesion

low relevance ₁ ₁₀ high
relevance

f. Encouragement of new business models and other community benefits provided by NBS

low relevance ₁ ₁₀ high
relevance

g. Stimulation/Increase economic benefits

low relevance ₁ ₁₀ high
relevance

h. Direct health and wellbeing impacts (e.g. improvement of mental well-being, physical health)

low relevance ₁ ₁₀ high
relevance

i. Indirect health and wellbeing impacts (e.g. reduction of noise or air pollution)

low relevance ₁ ₁₀ high
relevance

19. Please, indicate how you currently perceive the NBS area on a scale of 1 to 7!

- a. beautiful ₁ ugly
- b. dense, stuffy ₁ fresh, airy
- c. relaxed ₁ stressful
- d. child-friendly ₁ anti-children
- e. dynamic, vibrant ₁ dead, abandoned
- f. shabby, neglected ₁ well-maintained
- g. safe ₁ dangerous
- h. empty ₁ crowded
- i. diverse ₁ uniform/monoton
- j. clean ₁ dirty
- k. alien ₁ familiar
- l. loud ₁ quiet
- m. welcoming ₁ hostile
- n. well equipped ₁ no equipment
- o. communicative ₁ lonely

p. unpopular ₁ popular

20. Please, indicate on which of the following aspects regarding the NBS site you would be able and willing to provide information for!

a. Hazard maps

b. Value maps

c. Transaction prices of land and properties in NBS area

d. Socio-demographic data of NBS area

e. Housing-related data

f. Tourism-related data of NBS area

g. Data on environmental stressors (noise, heat, air pollution etc.)

h. Risk awareness

i. Risk worryness

j. Risk preparedness

k. Event history

l. Data on environmental attitudes/concerns of population

m. Data on subjective well-being of population

21. Would you be interested in getting involved in the monitoring process within and/or beyond the end of the RECONNECT project?

a. Yes, within the project.

b. Yes, beyond the end of the project.

c. Don't know, yet, but would interested in more information about the options to get involved.

d. No.

22. Are there any other stakeholders who could be interested in making a contribution to the RECONNECT project you could name?

a. No.

b. Yes, in fact

Questionnaire Demo A - second round of interviews

RECONNECT

Thank you very much for starting this survey.

It will take you roughly 20 minutes. The survey involves multiple choice questions as well as open questions.

Read them carefully, there are no right or wrong answers. Just indicate what comes to your mind first. You would do us a favour if you answer as many questions as possible.

There are 32 questions in this survey.

Role and organisation

1.1 What is your professional/educational background? *

Please write your answer here:

1.2 Which organisation, political or administrative body, association, company or club are you representing? *

Choose one of the following answers

Please choose **only one** of the following:

- Authority
- Research
- Private sector
- Political representative
- NGO/IGO
- Society
- Other

Make a comment on your choice here:

2.1 Which of the following RECONNECT sites do your answers refer to? *

Choose one of the following answers
Please choose **only one** of the following:

- Hamburg
- Odense
- Portofino

Follow-up

3.1 What is your overall perspective on nature-based solutions for addressing hydrometeorological risks? *

Please write your answer here:

3.2 How do you perceive the effectiveness of Nature-based Solutions in general and compared to more traditional, i.e. technical measures?

If possible, specify using an example!

*

Please write your answer here:

Now we have some questions about the NBS project at your location

Do you feel well-informed about the NBS project?

4.1 I feel well informed about different aspects relevant for realising the NBS project. *

Please choose the appropriate response for each item:

Strongly disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4.2 In my organisation, we are well informed about various aspects relevant for realising the NBS project. (if applicable) *

Please choose the appropriate response for each item:

Strongly disagree	Mostly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Mostly agree	Strongly agree	Not applicable
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4.3 How intensely have you been involved in the NBS project? *

Select all that apply

Please choose **all** that apply:

- I have not heard of the project before and have not been involved, so far.
- I'm aware that the project is carried out but have not been involved, so far.
- I have received information about the NBS project.
- I have been consulted by representatives of the NBS project for sharing information.
- I have discussed with representatives of the NBS project about the project.
- I feel I'm part of the project.
- I have been involved in decisions-making process of the project.

4.4 If you are/were involved at the NBS site, at what stage did you make a contribution?

If so, please, specify!

*

Comment only when you choose an answer.

Please choose all that apply and provide a comment:

Assessment and planning, i.e. assessment of hazards, vulnerabilities, risks to hydro-meteorological events, stakeholders' experiences, expectations, needs and capacities to implement NBS and other risk mitigation options

Design, i.e. specification of NBS design

Implementation, i.e. realisation of NBS measures

Operation/maintenance, i.e. activities required to run and maintain the NBS (except for the construction of new measures)

Evaluation, i.e. evaluation of the performance of the NBS

Monitoring, i.e. monitoring of the performance of the NBS

Not involved

4.5 If you are/were involved in the NBS project at your site, in what way were you involved?

If so, please, specify!

*

Comment only when you choose an answer.

Please choose all that apply and provide a comment:

Decision-making, i.e. being responsible for making and executing NBS-related decisions

Implementation, i.e. involvement in execution or implementation of NBS-related plans

Coordination, i.e. involvement in coordination of a variety of actors for the implementation of NBS-related plans

Provision of knowledge, i.e. provision of information, expert knowledge or site-specific data

Funding/sponsoring, i.e. financing of NBS-related activities at the site

Lobbying, i.e. attempting to influence NBS-related activities decision-making at the site

Mediation, i.e. being responsible for mediating and facilitating communication between different sections of society

Not involved

4.6 In what way would you like to stay involved in the NBS project in future? Please, specify!

*

Please write your answer here:

Local NBS projects

The following list of hydro-meteorological risk to be addressed by the NBS project was compiled on the basis of consultations with RECONNECT partners at your demonstration site. Which of the following risks do you consider relevant at your site and how severe is this risk from your perspective?

5.1 Please, indicate on a scale of 1 to 7 whether you agree that the risk is high!

*

Please choose the appropriate response for each item:

	Strongly disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly agree (7)
Flash flooding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Landslides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Whereby 1 means "I strongly disagree that there is high risk" and 7 means "I strongly agree that there is a high risk".

5.1.1 Any other risks?

Please specify in the comment field and on the scale

*

Choose one of the following answers
Please choose **only one** of the following:

- Strongly disagree
- Mostly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Mostly agree
- Strongly agree

Make a comment on your choice here:

5.2.1 Which of the following benefits do you already experienced/expect from the realisation of the NBS project and what is/will be their magnitude?

Please, indicate on a scale of 1 to 7 whether you expect a beneficial effect on the particular aspect!

*

Please choose the appropriate response for each item:

	Strongly disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly agree (7)	No effect expected	I don't know
Flash flood risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Landslide risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quantity of rainwater infiltration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soil erosion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Whereby 1 means "I strongly disagree that the realisation of the NBS has a high beneficial effect" and 7 means "I strongly agree that the realisation of the NBS has a high beneficial effect".

5.2.2 Which of the following benefits do you already experienced/expect from the realisation of the NBS project and what is/will be their magnitude?

*

Please choose the appropriate response for each item:

	Strongly disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly agree (7)	No effect expected	I don't know
Biodiversity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Habitat quantity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Habitat quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecological status	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please, indicate on a scale of 1 to 7 whether you expect a beneficial effect on the particular aspect!

Whereby 1 means "I strongly disagree that the realisation of the NBS has a high beneficial effect" and 7 means "I strongly agree that the realisation of the NBS has a high beneficial effect".

5.2.3 Which of the following benefits do you already experienced/expect from the realisation of the NBS project and what is/will be their magnitude?

*

Please choose the appropriate response for each item:

	Strongly disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly agree (7)	No effect expected	I don't know
Safeguarding cultural values	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recreational opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accessibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health and wellbeing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please, indicate on a scale of 1 to 7 whether you expect a beneficial effect on the particular aspect!

Whereby 1 means "I strongly disagree that the realisation of the NBS has a high beneficial effect" and 7 means "I strongly agree that the realisation of the NBS has a high beneficial effect".

5.2.4 Which of the following benefits do you already experienced/expect from the realisation of the NBS project and what is/will be their magnitude?

*

Please choose the appropriate response for each item:

	Strongly disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly agree (7)	No effect expected	I don't know
Community cohesion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Education and awareness raising	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic benefits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
New business models	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please, indicate on a scale of 1 to 7 whether you expect a beneficial effect on the particular aspect!

Whereby 1 means "I strongly disagree that the realisation of the NBS has a high beneficial effect" and 7 means "I strongly agree that the realisation of the NBS has a high beneficial effect".

5.2.5 Other benefits?

Please specify in the comment field an on the scale

*

Choose one of the following answers

Please choose **only one** of the following:

- Strongly disagree
- Mostly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Mostly agree
- Strongly agree
- No effect expected
- I don't know

Make a comment on your choice here:

5.3 We would like to know how do you perceive the NBS in the RECONNECT project?
In general, NBS are of high relevance for reducing hydro-meteorological risks.

*

Please choose the appropriate response for each item:

Strongly disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly agree (7)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please, indicate to what extent do you agree or disagree with the following statements!

Whereby 1 means "I strongly disagree" and 7 means "I strongly agree".

5.4 NBS are of high relevance for reducing hydro-meteorological risks as they ...

*

Please choose the appropriate response for each item:

	Strongly disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly agree (7)
are effective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
are efficient, i.e. the effect to be expected is very favourable relation to the resources employed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
help to master the biodiversity crises	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
provide many different benefits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5.5 NBS are of low relevance for reducing hydro-meteorological risks as they ...

*

Please choose the appropriate response for each item:

	Strongly disagree (1)	(2)	(3)	(4)	(5)	(6)	Strongly agree (7)
are very difficult to realise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
their benefits are very uncertain and will, if at all, only become apparent in the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Perception of NBS

6.1 Please, indicate how you currently perceive the NBS area on a scale of 1 to 7 *

Please choose the appropriate response for each item:

	1	2	3	4	5	6	7	Not applicable
ugly (1) to beautiful (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
uniform/monotone (1) to diverse (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
dense, stuffy (1) to fresh, airy (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
shabby, neglected (1) to well-maintained (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.2 Please, indicate how you currently perceive the NBS area on a scale of 1 to 7 *

Please choose the appropriate response for each item:

	1	2	3	4	5	6	7	Not applicable
hostile (1) to welcoming (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
dead, abandoned (1) to dynamic, vibrant (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
empty (1) to crowded (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.3 Please, indicate how you currently perceive the NBS area on a scale of 1 to 7 *

Please choose the appropriate response for each item:

	1	2	3	4	5	6	7	Not applicable
lonely (1) to communicative (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
stressful (1) to relaxed (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
alien (1) to familiar (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
unpopular (1) to popular (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
dangerous (1) to safe (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.4 Please, indicate how you currently perceive the NBS area on a scale of 1 to 7 *

Please choose the appropriate response for each item:

	1	2	3	4	5	6	7	Not applicable
dirty (1) to clean (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
loud (1) to quiet (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
anti-children (1) to child-friendly (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
no equipment (1) to well equipped (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Outlook

Please, indicate to what extent do you agree or disagree with the following statements!

7.1 The NBS in its current form fully meets my needs in terms of risk reduction

*

Choose one of the following answers

Please choose **only one** of the following:

- Strongly disagree
- Mostly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Mostly agree
- Strongly agree (7)

Make a comment on your choice here:

Please, indicate to what extent do you agree or disagree with the following statements!

Whereby 1 means "I strongly disagree" and 7 means "I strongly agree".

Please explain your assessment

7.2 The NBS in its current form fully meets my needs in terms of co- benefits

*

Choose one of the following answers

Please choose **only one** of the following:

- Strongly disagree
- Mostly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Mostly agree
- Strongly agree

Make a comment on your choice here:

Please, indicate to what extent do you agree or disagree with the following statements!

Whereby 1 means "I strongly disagree" and 7 means "I strongly agree".

Please explain your assessment

7.3 I expect that the NBS will fully meet my needs in terms of risk reduction in future.

*

Choose one of the following answers
Please choose **only one** of the following:

- Strongly disagree
- Mostly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Mostly agree
- Strongly agree

Make a comment on your choice here:

Please rate the following sentence and explain your assessment.

Whereby 1 means "I strongly disagree" and 7 means "I strongly agree".

7.4 I expect that the NBS will fully meet my needs in terms of provision of co-benefits in the future.

*

Choose one of the following answers
Please choose **only one** of the following:

- Strongly disagree
- Mostly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Mostly agree
- Strongly agree

Make a comment on your choice here:

Please, indicate to what extent do you agree or disagree with the following statements!

Whereby 1 means "I strongly disagree" and 7 means "I strongly agree".

Please explain your assessment

7.5 The NBS fully reflects my expectations.

*

Choose one of the following answers
Please choose **only one** of the following:

- Strongly disagree
- Mostly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Mostly agree
- Strongly agree

Make a comment on your choice here:

Please, indicate to what extent do you agree or disagree with the following statements!

Whereby 1 means "I strongly disagree" and 7 means "I strongly agree".

Please explain your assessment

Outro

Thank you very much for participating in this online survey

8.1 For identification purposes and relinking your survey to the previous one, please state

*

Please write your answer(s) here:

The last letter of your last name	<input type="text"/>
The first letter of your first name	<input type="text"/>
The second to last letter of your last name	<input type="text"/>
The second letter of your first name	<input type="text"/>

8.2 Would you be interested in getting involved in the monitoring process beyond the end of the RECONNECT project?

*

Choose one of the following answers
Please choose **only one** of the following:

No

We thank you for your time spent taking this survey.

Your responses have been recorded.

Submit your survey.

Thank you for completing this survey.

Questionnaire Demo B

Interview guideline: Exploring stakeholder perspectives on well-established Nature-based solutions (NBS) at RECONNECT demonstration sites

I. Background

1. What is your name?
2. What is your professional/educational background?
3. Which organisation, political or administrative body, association, company or club are you representing?
4. What are your responsibilities in your organization?
5. Which of the following RECONNECT sites do your answers refer to?
 - Ijssel River Basin
 - Inn River Basin
 - Greater Aarhus
 - Thur River
 - Les Boucholeurs
 - Var River Basin
6. Have you been engaged in NBS-related-projects before? If so, please specify how you were involved!
7. Were you involved in the planning or implementation of the NBS to be discussed below? If so, in what way?

II. Perspective on NBS

8. Given your experience with NBS-related projects we would like to know how do you perceive these NBS measures?

Please, indicate to what extent do you agree or disagree with the following statements! Whereby 1 means „I strongly disagree” and 7 means „I strongly agree”.

- a) In general, NBS are of high relevance for reducing hydro-meteorological risks.

Strongly disagree 1 7 Strongly agree

- b) NBS are of high relevance for reducing hydro-meteorological risks as they ...

- i. are effective.

Strongly disagree 1 7 Strongly agree

- ii. are efficient, i.e. the effect experienced/expected is very favourable relation to the resources employed.

Strongly disagree 1 7 Strongly agree

- iii. help to master the biodiversity crises.

Strongly disagree 1 7 Strongly agree

- iv. can provide many different benefits.

Strongly disagree 1 7 Strongly agree

- c) NBS are of low relevance for reducing hydro-meteorological risks as they ...

- i. are very difficult to realise.

Strongly disagree 1 7 Strongly agree

- ii. their benefits are very uncertain and will, if at all, only become apparent in the future.

Strongly disagree 1 7 Strongly agree

III. Co-creation of the NBS with stakeholders:

9. Can you describe the main aspects of the strategy used to engage stakeholders in the planning and implementation process of the NBS (e.g. ways of identifying, involving and communicating with relevant stakeholders)?

Modes of involvement:

- (1) decision-making,
- (2) implementation,
- (3) coordination,
- (4) provision of knowledge,
- (5) funding/sponsoring,
- (6) lobbying,
- (7) mediation
- (8) other

Stages of involvement:

- (1) assessment/planning
- (2) design
- (3) implementation
- (4) operation/maintenance
- (5) evaluation
- (6) monitoring

10. How have stakeholders' needs, preferences, expectations and concerns been identified and taken into account in the design and implementation of the NBS?
11. Overall, how satisfied were stakeholders with the participatory process of co-creating the NBS?

Not satisfied Satisfied

Please, indicate on a scale of 1 to 7 whether you agree that stakeholders were highly satisfied with their involvement in the implementation process of the NBS! Whereby 1 means „I strongly disagree“ and 7 means „I strongly agree“.

Strongly disagree 1 7 Strongly agree

IV. Stakeholders' perspective on NBS:

12. Looking back, what were the general attitudes and perceptions of stakeholders towards the concept of NBS for managing natural hazards when the NBS was implemented (e.g. level of knowledge, (mis)trust)?
13. How did stakeholders initially perceive the specific NBS that was implemented in your local area? Were there any concerns, reservations or enthusiasm?
14. Over the years, how have stakeholders' perceptions of the local NBS evolved?

V. Perception of natural hazard-related risk by stakeholders:

15. How did stakeholders initially perceive the hazard-related risk at the local site?
16. Has their perception changed over time? If so, how and due to what reasons did their perception change over time?

VI. Perception of site-specific benefits and co-benefits by stakeholders:

17. From your perspective, what were the key risk reduction-related benefits of the NBS that stakeholders expected before and which did they experience after the implementation of the NBS?
18. Could you discuss the most important co-benefits attributed to the NBS, i.e. additional benefits beyond its primary purpose of risk management, that were particularly valued by stakeholders (e.g. accessibility of the natural space, biodiversity, water-related aspects, recreational opportunities, health and wellbeing, education and awareness raising)? This could include some of the following possible co-benefits:

- Accessibility of the natural space,
 - Biodiversity,
 - Water-related aspects,
 - Recreational opportunities,
 - Health and wellbeing,
 - Education and awareness raising
19. Have there been any initially unexpected co-benefits that have emerged over time?
20. Were there any detrimental side-effects for stakeholders that negatively affected their perception of the NBS?
- VII. Strategies for institutional change and overcoming public resistance:**
21. Could you elaborate on the strategies that were employed to foster changes in favour of the adoption of NBS for natural hazard management on the regulatory level and/or administrative level, i.e. within or between organisations involved in the implementation of the NBS!
22. In retrospect, how were challenges related to resistance from the general public handled during the NBS planning and realization process?
- VIII. Strategies for overcoming political resistance:**
23. Can you describe the strategies used to navigate political resistance or challenges that arose during the planning and implementation of the NBS and their impacts!
- IX. Needs fulfilment of stakeholders:**
24. What strategies have been pursued to ensure that the implementation of the NBS is effectively responsive to the needs of stakeholders (e.g. introduction of incentive schemes, use of step-by-step approaches etc.)?
25. To what extent has the NBS met stakeholder expectations in terms of both risk reduction and co-benefit provision?

Declaration of informed consent form

Project:	<u>RECONNECT</u>
Grant Agreement no.:	<u>776866</u>
Start date of the Project:	<u>1st September 2018</u>
End date of the Project:	<u>31st August 2023</u>
Financed by:	<u>European Union</u>
Programme:	<u>H2020-SC5-2017-TwoStage</u>
Website:	<u>www.reconnect.eu</u>

ABOUT THE RECONNECT PROJECT

RECONNECT aims to rapidly enhance the European reference framework on Nature-Based Solutions (NBS) for hydro-meteorological risk reduction by demonstrating, referencing, upscaling and exploiting large-scale NBS in rural and natural areas. RECONNECT stimulates a new culture of co-creation of 'land use planning' that links the reduction of hydro-meteorological risk with local and regional development objectives in a sustainable and financially viable way. To do that, RECONNECT draws upon a network of carefully selected Demonstrators and Collaborators that cover a wide and diverse range of local conditions, geographic characteristics, institutional/governance structures and social/cultural settings to successfully upscale NBS throughout Europe and Internationally.

Duration, funding and partners

The RECONNECT project is funded by the European Union under Horizon 2020, running from 1st September 2018 to 31st August 2023, for a period of five years and with an overall total cost of approximately € 15 million.

The RECONNECT consortium consists of 36 partners from 18 countries including the Member States (Netherlands, Germany, UK, Italy, France, Denmark, Croatia, Austria, Spain, Belgium, Poland, Bulgaria, and Sweden), associated countries (Switzerland, Serbia), and international partners (Malaysia, Taiwan and Thailand).

PURPOSE OF THE DATA COLLECTION IN WHICH YOU ARE INVOLVED

The aim of collecting information is to validate NBS with stakeholders.

The data collection procedures in which you are involved will be carried out under the responsibility of Work Package (WP) 3 with lead partners UFZ.

PRIVACY AND DATA PROTECTION

Responses you give in questionnaires and workshops will be documented in a form of a project report/deliverable. However, all information which could lead to your personal identification will not be included in the report/deliverable.

After completion of the RECONNECT project, your contact data will be deleted automatically, unless you expressly agree to further store your contact information for future activities or related projects.

The results of this study may be published in scientific journals or conferences and may be used in related projects. Nothing of the provided personal data will be handled out to third parties.

CONSENT

Participation in this study is voluntary. You have the possibility to decline your participation in this study and to withdraw your consent at any point of the process, without consequences. If you should decide to deny your consent or you have any issue involving your role of participant in this study, please inform the RECONNECT Project Director Zoran Vojinovic (z.vojinovic@un-ihe.org) from IHE Delft.

I agree to participate in this activity within the RECONNECT project.

yes

no

I agree storing, processing and publishing photos/videos taken of me on the occasion in question, in both printed and digital form, for the purpose of disseminating information on RECONNECT activities

yes

no

I agree that my data is stored beyond the end of the RECONNECT project. This can be later changed at any point in time.

yes

no

I agree to be contacted for future related projects. For this, my contact details are stored beyond the end of the RECONNECT project. This can be later changed at any point in time.

yes

no

It is clear to me that this consent is voluntary and I keep the right to withdraw my participation in this study at any moment.

yes

no

I have read (or someone has read/translated to me) the information in the consent form. I have had an opportunity to ask questions and all my questions have been answered to my satisfaction.

By signing this consent form, I willingly agree to participate in this study.

Name of the Participant (Name of the Organization)

Signature

Place, Date

I have explained the purpose of this work to the participant and answered all of his/her questions. I believe that he/she understands the information described in this consent form and freely consents to participate.

Name of RECONNECT Investigator/researcher (Name of the Organization)

Signature

Place, Date

List of interviews

Demonstration site	Date	Organization (activity)	Interviewer (Co-Interviewer)
Hamburg	04.02.21	Hamburg Water (water pumping)	Oliver Gebhardt
Hamburg	04.02.21	Hamburg Water (groundwater management)	Oliver Gebhardt
Hamburg	26.02.21	State Administration for Environment and Energy (management of nature conservation project)	Oliver Gebhardt
Hamburg	02.03.21	State Administration for Environment and Energy (nature conservation and landscape management)	Oliver Gebhardt
Hamburg	03.03.21	District of Bergedorf (water resources management)	Oliver Gebhardt
Hamburg	16.03.21	Farmers' Association (management)	Oliver Gebhardt
Hamburg	19.03.21	State Administration for Environment and Energy (water information systems)	Oliver Gebhardt
Hamburg	19.03.21	State Administration for Environment and Energy (flood protection)	Oliver Gebhardt
Hamburg	05.05.21	Water and Soil Board (operative management)	Oliver Gebhardt
Odense	08.10.20	Political representative	Karsten Arnbjerg-Nielsen (Oliver Gebhardt, Martina Viti)
Odense	11.02.21	Foundation / NGO (management of built environment-related projects)	Oliver Gebhardt
Odense	15.02.21	National Coastal Authority	Oliver Gebhardt
Odense	01.03.21	Municipality (management of nature- and climate-related projects)	Oliver Gebhardt

Odense	12.03.21	NGO (management of nature conservation-related projects)	Martina Viti (Oliver Gebhardt)
Odense	23.03.21	Citizens	Martina Viti (Oliver Gebhardt)
Odense	24.03.21	Local emergency service	Oliver Gebhardt
Odense	24.03.21	Citizens	Martina Viti (Oliver Gebhardt)
Odense	04./06.05.21	Municipality (management of climate- and biodiversity-related projects)	Oliver Gebhardt
Odense	05.05.21	Citizens	Martina Viti (Oliver Gebhardt)
Odense	06.05.21	NGO (management of bird-related projects)	Martina Viti (Oliver Gebhardt)
Portofino	08.01.21	Professional association (agronomy, forestry)	Martina Viti (Oliver Gebhardt)
Portofino	13.01.21	NGO / property owner (preservation of historical monuments and nature conservation)	Martina Viti (Oliver Gebhardt)
Portofino	11.03.21	Agricultural cooperative	Martina Viti (Oliver Gebhardt)
Portofino	11.03.21	Professional association (geology)	Martina Viti (Oliver Gebhardt)
Portofino	18.03.21	Municipality (technical office)	Martina Viti (Oliver Gebhardt)
Portofino	22.03.21	NGO (conservation of cultural heritage)	Martina Viti (Oliver Gebhardt)
Portofino	31.05.21	Political representative	Oliver Gebhardt (Clarissa Bruzzone)
Portofino	04.06.21	Political representative	Oliver Gebhardt (Clarissa Bruzzone)

Portofino	06.06.21	Portofino Park Authority	Oliver Gebhardt (Clarissa Bruzzone)
Portofino	06.07.21	Research institution (environmental research projects)	Oliver Gebhardt
Portofino	21.07.21	Political representative	Martina Viti (Oliver Gebhardt)

Demo A second round

The second round of Interviews at the Demo B sites was conducted online via Limesurvey from 2024/04/26 to 2024/06/17.

Demo B

Aarhus	07.05.2024	Municipality	Julius Knopp
Aarhus	14.5.2024	Municipality	Julius Knopp
Ijssel	08.05.2024	National agency employee (retired)	Julius Knopp
Ijssel	23.05.2024	Consulting and engineering office	Julius Knopp
Inn	16.05.2024	University	Julius Knopp
Inn	16.05.2024	University	Julius Knopp
Thur	05.2024	Cantonal Office Hydraulic Engineering Department	Mario Schirmer
Thur	05.2024	Federal Institute of Hydrology	Mario Schirmer
