



**UNALAB PROJECT SUMMARIES OF  
KEY RESOURCES FOR THE ADOPTION  
OF NATURE-BASED SOLUTIONS**

# CHECKING A NATURE-BASED SOLUTIONS PROJECT



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# WHAT ARE NATURE-BASED SOLUTIONS?

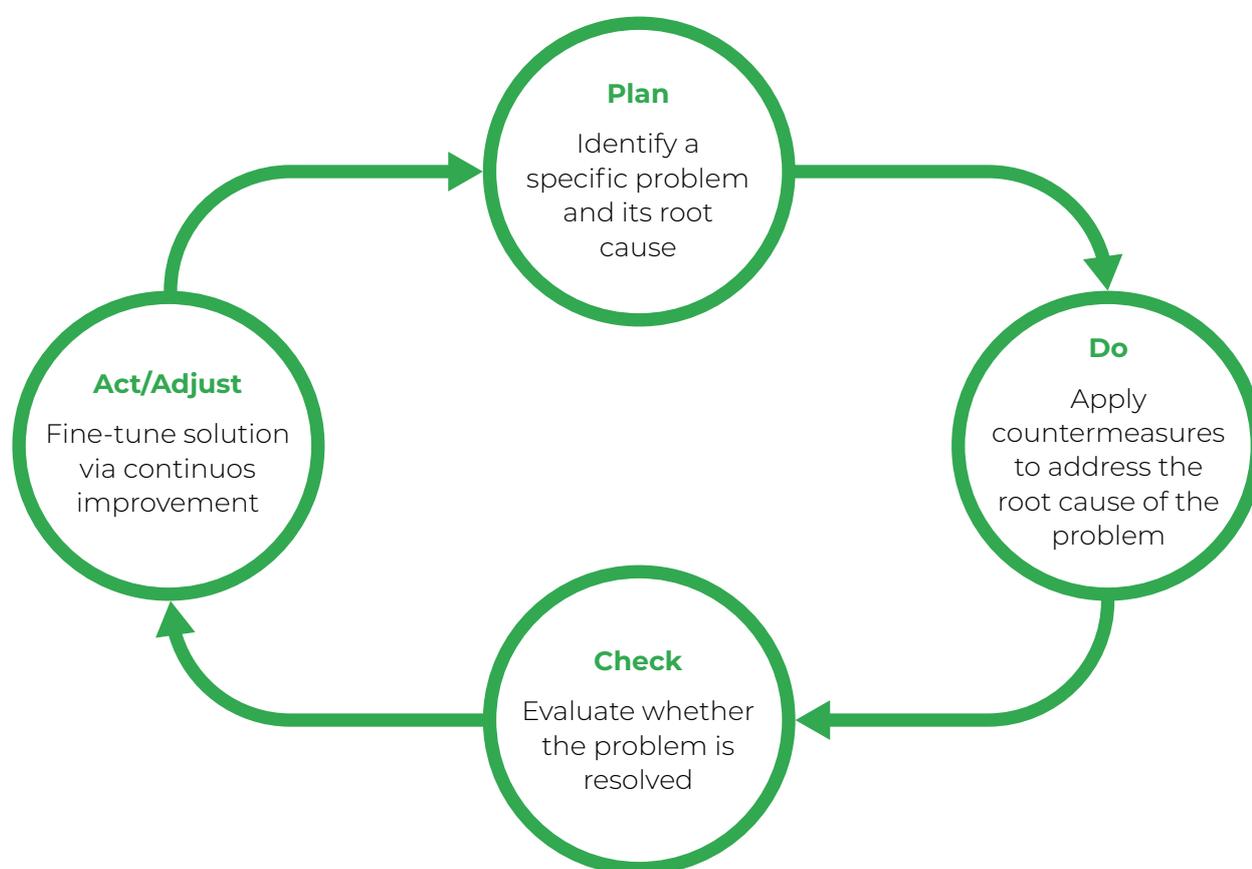
Nature-based solutions (NBS) are actions to protect, conserve, restore, sustainably use and manage natural or modified ecosystems<sup>1</sup>. NBS are co-created systems that utilise natural features and ecosystem-based processes to effectively and adaptively address social, economic and environmental challenges. In other words, NBS are able to protect, manage or restore ecosystems and

their services, thereby addressing a multitude of urban challenges posed by the world's changing climate and rapid urbanisation. These innovative solutions bring more diverse nature and natural features and processes into cities, landscapes and seascapes, thereby creating more sustainable and resilient societies.

# ADAPTIVE MANAGEMENT OF NATURE-BASED SOLUTION PROJECTS

Adaptive management is an iterative process for managing the whole lifecycle of a nature-based solutions project. The process of co-creating, implementing, monitoring and co-managing NBS is cyclical, thus requiring continuous evaluation and feedback at every stage in the process and identifying

needed adjustments for reaching the targets and objectives. The adaptive management cycle, or the PLAN-DO-CHECK-ACT cycle, aims to learn from the past actions to improve or adjust next steps and future planning of similar projects.



1. <https://www.naturebasedsolutionsinitiative.org/news/united-nations-environment-assembly-nature-based-solutions-definition/>

In its five summary documents of key resources for the adoption of NBS, the UNaLab project is presenting its main tools, handbooks, reports, lessons learnt and experiences that can be used by various stakeholders in the different phases of the adaptive management cycle. The aim of these summary

documents is to introduce urban stakeholders to resources that can provide them with inspiration, ideas, knowledge and practical tools in the different phases of the PLAN-DO-CHECK-ACT cycle, ultimately advancing the adoption of NBS in their cities.

## RESOURCES PRESENTED IN THIS SUMMARY DOCUMENT

The resources presented in this summary document are relevant to the CHECK phase. This phase is about comparing the achieved results to the set goals. During the CHECK

phase, the monitoring activities defined during the DO phase are implemented and the quality of data is reviewed.



# THE UNALAB PROJECT IN A NUTSHELL

The EU-funded UNaLab project is contributing to the development of smarter, more inclusive, more resilient and more sustainable urban communities through the implementation of nature-based solutions, which are co-created with and for local stakeholders and citizens.

Our three front-runner cities - Eindhoven, Tampere and Genova - are through the establishment of Urban Living Labs demonstration areas experimenting, demonstrating and evaluating a range of different nature-based solutions addressing climate- and water-related urban challenges. The front-runner cities actively collaborate and share their experiences with our seven follower cities - Stavanger, Prague, Castellón, Cannes, Başakşehir, Hong Kong and Buenos Aires – as well as our two observers - Guangzhou and the Brazilian Network of Smart Cities.

The project results will contribute to the growing evidence base on benefits, cost-effectiveness, economic viability and replicability of nature-based solutions, which will guide cities across Europe and beyond in developing and implementing their own co-creative nature-based solutions.

# MONITORING AND ASSESSMENT OF NATURE-BASED SOLUTIONS

## NBS performance and impact monitoring protocols



### TYPE OF RESOURCE:

Handbook



### TARGETED STAKEHOLDERS:

Practitioners, scientific/research/academic community



### LINK TO THIS RESOURCE:

<https://unalab.eu/system/files/2020-02/d31-nbs-performance-and-impact-monitoring-report2020-02-17.pdf>

### INTRODUCTION TO THE RESOURCE

The *Performance and Impact Monitoring of Nature-based Solutions* is a living handbook that provides guidance to cities for the monitoring of nature-based solutions. It introduces good monitoring practices, guides the process of indicator selection, and outlines the steps needed to acquire and process the data. The handbook presents key performance and key impact indicators and metrics grouped by societal challenges for transparent monitoring and impact assessment of nature-based solutions. The contents of this handbook contributed to the development of *Evaluating the Impact of Nature-based Solutions: A Handbook for Practitioners* publication, and its final version is to be found in the *UNaLab NBS Implementation Handbook* (to be published in November 2022).

### DESCRIPTION OF THE RESOURCE

The handbook aims to provide clear information on NBS monitoring with respect to what is measured, how is it measured, and what is the 'big picture' significance of the measurement. It discusses the NBS baseline establishment and design of NBS monitoring plans, and provides a suite of relevant key performance and key impact indicators and metrics. Careful design and implementation of NBS monitoring facilitates comparison across different locations and generates evidence on NBS performance and impact. The handbook primarily targets NBS practitioners, and scientific, research and academic communities involved in de-

veloping and implementing the monitoring strategies and impact assessment (such as qualitative, quantitative, or statistical analyses). The handbook is an essential component of the CHECK phase as it provides the knowledge necessary for evaluating the success of the implemented interventions with respect to the initial objectives and goals.

### EXPECTED IMPACT

Nature-based solutions have emerged as innovative and transforming solutions that can contribute to regenerating urban areas. To facilitate their financing and uptake, replication in other locations and environments, and upscaling, it is necessary to establish evidence on their long-term performance and impact. Monitoring helps understanding whether the implemented NBS achieve the intended outcomes, and what needs to be adjusted to maximise its impact. Adopting common indicators and methods for their assessment leads to a more comprehensive comparison across locations at various scales, and in different socio-economic contexts. Documented NBS performance is a straightforward way to influence policies, decision-making and an array of other activities directly influencing local adaptation to the impacts of climate change.

## NBS performance and impact modelling protocols



### TYPE OF RESOURCE:

User guide



### TARGETED STAKEHOLDERS:

Technical users, practitioners



### LINK TO THIS RESOURCE:

<https://unalab.eu/en/documents/d32-systemic-decision-support-tool-user-guide-for-municipalities>

### INTRODUCTION TO THE RESOURCE

The Systemic Decision Support Tool (SDST) allows to assess, ex-ante, the direct and indirect impacts of NBS measures (individual NBS) and strategies (suites of NBS) on urban heat and air quality, flooding and water quality, and sprawl, gentrification and real-estate valuation. The *Systemic Decision Support Tool User Guide for Municipalities* contains a technical user guide that provides a technical description of the SDST approach, including its structure, disciplinary component models and data organisation, as well as a practitioners' user guide that describes those stages of the NBS co-creation process that are essential for the preparation and use of the SDST.

### DESCRIPTION OF THE RESOURCE

From a technical user's perspective, the SDST integrates and builds upon data and information from disciplinary component models into a spatially-explicit framework at the landscape scale. Input and output data is organised and stored in a geodatabase, containing results for the reference baseline scenario (2015) as well as for the NBS scenarios under baseline (2030) and future (2050) conditions across spatial scales (local, neighbourhood and city). This systematic data organisation and storage allows the *NBS Simulation Visualisation Tool* (NBS-SVT), i.e. the user-interface of the SDST, to efficiently locate and retrieve data from the geodatabase server, according to the selected year, scenario and scale.

From a practitioner's perspective, the preparation and use of the SDST forms an integral part of a nature-based solutions project. In the CHECK phase, stakeholders can

co-experiment by checking the multiple environmental, social and economic impacts of the nature-based solutions co-designed in the DO phase.

### EXPECTED IMPACT

Sustainable urban landscape development requires decision-making that acknowledges the complex environmental, social and economic interactions that occur in landscapes. Thereby, scientific knowledge should inform stakeholders in the decision-making process regarding what to protect, sustain and/or develop. Active participation of stakeholders from the beginning of the planning process is crucial, especially in the situation where facts are uncertain, values are in dispute, stakes are high and decisions are urgent. The SDST allows to experiment with different NBS measures/strategies, assess their effectiveness and evaluate their multiple impacts as to, in turn, decide on the most desirable NBS to be implemented. Thus, the underlying principle of the SDST is that NBS are co-created in a transparent, transdisciplinary, multi-stakeholder and participatory context as well as systematically incorporated into urban landscape planning. It aims to facilitate the participatory planning process and public discussion by improving stakeholder awareness about the multiple impacts of NBS. Hence, the SDST enriches public discussion, adds transparency and increases public benefits.

## Nature-based Solutions Implementation Handbook



### TYPE OF RESOURCE:

Handbook



### TARGETED STAKEHOLDERS:

Municipalities, practitioners, scientific/research/academic community



### LINK TO THIS RESOURCE:

*Public version of the handbook to be published in November 2022*

### INTRODUCTION TO THE RESOURCE

The *Nature-based Solutions Implementation Handbook* aims to provide guidance on the NBS implementation process from co-creation, through governance and monitoring to co-management. It collects, aligns, and integrates the UNaLab project outputs to inform and inspire the replication of nature-based solutions. The handbook builds on other UNaLab resources, such as the *Nature-based Solutions Performance and Impact Monitoring* and *Nature-based Solutions Technical Handbook*, and is based on joint work of the EU-funded NBS projects and experiences from the UNaLab front-runner cities. Additionally, the handbook incorporates the IUCN standards for design and assessment of NBS and aligns this framework with the Key Performance Indicators identified by the UNaLab project and/or the NBS Impact Evaluation Framework.

### DESCRIPTION OF THE RESOURCE

The handbook can be used by practitioners and scientific, research and academic communities involved in NBS planning, implementation, monitoring and maintenance. It discusses all essential parts of the NBS project lifecycle, aiming to provide a holistic representation of the required considerations. The handbook reviews the NBS co-creation process to address specific local challenges and provides guidance on NBS technical specifications as well as updates to the Nature-Based Solutions Technical Handbook as the basis for designing the NBS interventions. It discusses the NBS monitoring strategies and considerations and guides the selection of appropriate indicators for tracking progress towards reaching the objectives. Further, it aligns the IUCN global standards with indicators, introduces

ways to manage and use the acquired data, and NBS operation and maintenance to support their co-management. Updates to Nature-Based Solutions Performance and Impact Monitoring indicators and methods together with the comprehensive discussion on monitoring scales serve as a basis for designing a robust and scientifically sound monitoring scheme. The handbook contributes to all steps of the PLAN-DO-CHECK-ACT cycle and can be used as a reference throughout an NBS project.

### EXPECTED IMPACT

Practitioners and other stakeholders involved in any step of an NBS project will benefit from the contents of the handbook, as it includes tips and good practices based on the experiences of UNaLab cities and knowledge generated throughout the UNaLab project. It serves as one of the primary sources in the UNaLab Replication Framework and refers to in-depth reports and handbooks for further reading. The handbook collects various case studies from the UNaLab front-runner and follower cities to illustrate the real-life examples tied to the contents of each chapter.

## Open Nature Innovation Arena



### TYPE OF RESOURCE:

Digital tool



### TARGETED STAKEHOLDERS:

Municipalities, citizens, businesses



### LINK TO THIS RESOURCE:

<https://onia.unalab.eng.it/>

### INTRODUCTION TO THE RESOURCE

The *Open Nature Innovation Arena* (ONIA) is an online collaboration environment ensuring active stakeholder participation in bottom-up innovation processes and deci-

sion-making. It allows stakeholders to collectively discuss and identify issues or concerns affecting the quality of life in the city and collaborate to propose possible ideas of solution.



### DESCRIPTION OF THE RESOURCE

ONIA is the co-creation tool included in the UNaLab ICT framework that facilitates the decision-making process by exploiting the collective intelligence and spontaneous collaboration of the local communities. Citizens, businesses and public administrations can share their opinions on the conditions of urban areas and collaborate on co-defining possible solutions to be implemented in the form of nature-based solutions. During the CHECK phase, ONIA facilitates the review and refinement of the initial problem and drafted ideas for solutions.

### EXPECTED IMPACT

ONIA supports the merging of bottom-up

and top-down processes in an online co-creation environment, by reducing the need for face-to-face interactions through scheduled meetings or workshops to identify local issues and brainstorm solutions. The tool contributes to building a more inclusive community by also involving individuals and communities with logistic or linguistic difficulties in the decision-making processes. Moreover, ONIA increases the sense of belonging within the local communities. Finally, ONIA allows public administrations to demonstrate their accountability in addressing civic issues and providing evidence of the work that has been done. The evaluations of the proposed ideas are transparently published on the challenge results page as well as through the chosen communication channels.

## City Performance Monitor



### TYPE OF RESOURCE:

Digital tool



### TARGETED STAKEHOLDERS:

Municipalities, citizens, businesses



### LINK TO THIS RESOURCE:

[https://unalab.eng.it/cpm\\_v2/](https://unalab.eng.it/cpm_v2/)

### INTRODUCTION TO THE RESOURCE

The *City Performance Monitor* (CPM) is the performance analytics and monitoring tool used by the UNaLab project cities. It increases stakeholder and citizen awareness of urban conditions through an easy-to-understand representation of the effectiveness of the nature-based solutions implemented in the city using social, environmental and economic performance indicators.

### DESCRIPTION OF THE RESOURCE

The CPM exploits the city's data sources - including IOT sensor devices, open data platforms and legacy services - to obtain environmental measures and to calculate indicators for the social, environmental and economic conditions of the city, and the effectiveness of the implemented NBS in addressing these issues. During the CHECK phase of an NBS project, decision-makers, with the assistance of volunteers and experts, monitor the indicators to evaluate if the implemented solution solved the issue.

### EXPECTED IMPACT

The CPM will provide an easy-to-understand representation of indicators allowing the involvement of non-expert users and volunteers in the monitoring and evaluation activities. The CPM will therefore give them an active role in co-creating and co-monitoring urban solutions including nature-based solutions.

The rapid exponential development and the concurrent reduction in costs for pervasive technologies will enable a rapid increase in the deployment of monitoring devices in cities. The CPM will facilitate the elaboration of key performance indicators based on the

huge amount of data produced by the increasing number of sensors and will allow city managers to have a more reliable holistic vision of the urban environment.



# CASE STUDY: LESSONS LEARNT

## Biofilter in Hiedanranta, Tampere

One of the nature-based solutions implemented in the Hiedanranta area in Tampere was a biofilter for seepage waters, which was co-created together with the local stakeholders. The biofilter was designed to treat strong leachate from an old pulp mill landfill as part of the city's efforts in enhanced stormwater management. The old landfill is situated near a lake and new residential areas are being built close to it.

Biochar was selected as a suitable media for treating the leachate, and a range of experts participated in the demonstration planning as the site conditions were challenging. In the beginning, the biofilter seemed to perform well, and it effectively removed substances from the leachate (N removal 90% and P removal 60–70%). The first challenges with the biofilter were related to its capacity problems, and further monitoring revealed a decrease of the removal efficiency. Improvements to the functionality were added and, finally, increased monitoring activities revealed a leakage of the bentonite layer.

This nature-based solution has presented many challenges and provided several les-

sons learnt during its lifetime, demonstrating that monitoring is an essential component of each NBS project. The lessons learnt from the Hiedanranta biofilter provided valuable information for the local stakeholders for improving the concept and the processes to build similar biofilters in Tampere. These lessons should also be carefully studied prior to replicating and implementing similar biofilters in other locations.

The seepage biofilter is described in several UNaLab reports and more detailed documentation about the lessons learnt can be found in the *Nature-based Solutions Demonstration Site Start-Up Report*. This example highlights the need for careful multidisciplinary communication, and the overall complexity of NBS interventions. This is a good example of the necessity of the feedback during each phase of the PLAN-DO-CHECK-ACT cycle. Throughout the UNaLab project, monitoring has demonstrated its importance for validating and ensuring the functionality of various NBS interventions and detecting and diagnosing the problems.





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