

Checklist for Nature-based Solutions Monitoring & Indicators

Monitoring & Indicators (M&I) help document and evaluate the process, progress, performance, and impact of the implementation of Nature-based Solutions (NbS), as well as track whether targets are being met. To support the uptake of M&I in planning practice, this factsheet provides a checklist with key aspects to consider in implementing NbS monitoring processes.

Background

M&I is the process of evaluating, assessing, and monitoring NbS with indicators. In NbS planning, design, and management, M&I can provide valuable information to understand and communicate the progress, performance, benefits, and impacts of NbS projects. In this sense, M&I processes allow learning from successes and failures. However, implementing M&I of NbS can be challenging in practice due to a lack of resources, financing alternatives, knowledge, and capacity. Thus, many urban planners and other local stakeholders

need help implementing monitoring indicators for NbS, which ultimately complicates the possibility of making the necessary changes and adaptations to enhance NbS implementation. Other implications are missed learning opportunities to upscale NbS, inability to evidence the effectiveness and benefits of NbS, reduced funding commitment, and stakeholder support for NbS. Apart from the limited use of M&I due to various challenges, existing M&I guidance materials may not meet the needs of practitioners.

Key Facts



1. Lack of knowledge, capacity, resources, and limited financing alternatives are some of the challenges for NbS M&I in practice.
2. There is limited guidance material to support practitioners in NbS M&I processes.
3. The consideration of practitioners' needs on M&I has so far been limited.

Standards and guidelines to implement M&I on NbS concerning local conditions could increase knowledge and build capacity on M&I, yet are still limited. To improve support for practitioners, the CONEXSUS project aimed first to understand the information needs of practitioners on M&I and, second, how these needs were addressed in current guidelines, handbooks, and manuals. With this aim in mind, through interviews and surveys with practitioners from the project, the needs for M&I from practitioners were identified and categorized.

Checklist for NbS Monitoring & Indicators

Practitioners' needs for M&I processes are further synthesized in a checklist for NbS M&I. This checklist aids NbS practitioners in understanding the main aspects to note in NbS M&I implementation and better develop and manage M&I processes in practice. In addition, it can be used as an inspiration to improve M&I guidelines.

The most relevant practitioners' needs for M&I processes were categorized into five categories, each further divided into four or five sub-categories. Each of the categories and sub-categories are explained below.

1. Adapting M&I in its context

To make M&I relevant, legitimate, and feasible, it is recommendable to tailor M&I at the start of the process to the local context by linking it to local challenges and objectives through a Theory of Change, by setting monitoring goals, selecting indicators in a participatory way, and considering project management and planning.

Checklist for NbS Monitoring and Indicators



1. Adapting M&I in its context

- ✓ Define a theory of change
- ✓ Set monitoring goals
- ✓ Indicator selection
- ✓ Project management



2. Methodology

- ✓ Define a monitoring methodology
- ✓ Define monitoring sites
- ✓ Define monitoring frequency
- ✓ Data interpretation



3. Data

- ✓ Data availability
- ✓ Data accessibility
- ✓ Data uncertainty
- ✓ Data management
- ✓ Data sharing



4. Resources

- ✓ Financial resources
- ✓ Time resources
- ✓ Personnel required
- ✓ Monitoring equipment and installation
- ✓ Knowledge transfer and exchange



5. Social topics

- ✓ Communication with different stakeholders
 - Public sector
 - Citizens & general public
 - Civil society
 - Academia
- ✓ Collaboration and cooperation with different stakeholders:
 - Public sector
 - Private Sector
- ✓ Participation of:
 - Citizens
 - Children or other sensitive groups.
- ✓ Social demand
- ✓ Social acceptance

Defining a Theory of Change aims to connect local social and environmental challenges through objectives with desired results and the actions needed to achieve those (Garcia et al., 2018). Indicators are defined based on the objectives and actions to track whether they are met and progressing according to plan.

Setting monitoring goals is needed to ensure that the monitoring efforts are focused, relevant, and effective in tracking the progress and achieving desired outcomes. A monitoring goal is a specific objective or target established to guide the monitoring process of NbS. The formulation of goals should be a dynamic and transdisciplinary process, allowing for adjustments based on progress.

The **indicator selection** must be based on local challenges, objectives, and actions (Theory of Change) or monitoring goals. Engaging the stakeholders in indicator selection offers several benefits, including stakeholder commitment, shared ownership, enhanced sense of place, promotion of bio-cultural diversity, and increased social learning (van der Jagt, A. et al, 2023). For indicator selection, the following criteria are recommended: credibility, saliency, legitimacy, and feasibility (see Factsheet “Monitoring NbS together for greater uptake and upscaling”).

Project management for monitoring involves coordinating and planning all activities related to the monitoring process. Project management ensures that monitoring efforts are systematic, efficient, and yield accurate data. Effective project management helps maintain consistency,

promptly address issues, and achieve the NbS monitoring goals within the allocated resources and timeframe.

2. Methodological aspects

Different methodologies can be used to evaluate NbS. Although quantitative methods are prevalent, qualitative and mixed methods can also be applied. When selecting the best method for data collection, local context and time need to be considered. Data analysis and interpretation methods also play an important role in methodology. Therefore, they should be carefully chosen based on the objectives of the M&I.

In **defining a monitoring methodology**, a range of quantitative methods, like surveys and transect checklists; qualitative approaches, such as interviews and focus group discussions; and mixed methods that combine quantitative and qualitative methods, can be explored. The selection of these data collection and data generation methods needs to be supported by solid planning, technical expertise, and knowledge of the local context (Dumitru & Wendling, 2021).

Defining a monitoring site involves critically assessing the NbS M&I implementation area’s physical, environmental, and social characteristics. The defined monitoring site should be well-suited and representative, as the site’s unique features directly affect the feasibility, accuracy, and relevance of the monitoring data.

Defining the monitoring frequency is crucial for understanding the outcomes of NbS. A key factor that affects the frequency of monitoring is the project’s geographical



scale of implementation. Typically, local NbS projects require frequent, short-term monitoring, while larger-scale projects need more extended evaluation periods (Nesshöver et al., 2017).

The **data interpretation** step comes after identifying and collecting data, following defined frequency protocols and other requirements discussed above. It is the stage where the data is analyzed and interpreted to evaluate NbS performance according to the initial objectives or goals. This process might involve different assessment stages and multi-criteria analyses. While interpreting the monitoring results, it is essential to take note of any data gaps (Dumitru & Wendling, 2021).

3. Data

Data for NbS M&I can be of different forms and types, such as environmental, socio-economic, demographic, or behavioral data, and in different formats, including documentary, pictorial, and

audio-visual. What is important is that they are relevant for NbS M&I and usable for practitioners, regardless of the type or format.

Some key facets of data worth considering are **data availability** issues, which refer simply to data existence. Compared with the Global North, studies in the Global South often lack data availability. Yet, data availability does not imply data accessibility (Dumitru & Wendling, 2021). **Data accessibility** refers to the possibility and easiness to retrieve data (Dumitru & Wendling, 2021). Access to data can be restricted due to, for example, security or data protection reasons. There may be issues with data uncertainty. **Data uncertainty** refers to the level of data quality, which can be related to the level of detail, coverage, extent, reliability of sources, and others. (Dumitru & Wendling, 2021).

Other aspects are related to the handling of the data itself, including data

management. **Data management** refers to setting different practices and procedures for data processes. Data for NbS M&I can be of multiple types, formats, and even sources and involve different disciplines, such as social and natural sciences. For this reason, practitioners need to establish comprehensible data management processes for NbS M&I. Voluntary International standards, like ISO 19156, can be helpful in data management (Dumitru & Wendling, 2021). There is also a need to foster **data sharing** to facilitate M&I processes as well. As multiple data types are needed for NbS M&I, data sharing can effectively enable comprehensive NbS M&I while addressing data availability and accessibility constraints.

4. Resources

Several resources are needed for NbS monitoring. Some are **financial resources** through budgetary allocations or grant acquisitions for M&I and can cover time, personnel, and equipment. However, there are also nonfinancial ones, including personnel, time, and equipment resources. **Time resources** refer to defining time capacities needed for M&I processes. **Personnel required** for monitoring processes need to consider the required number of persons and the required specialized skills and knowledge in monitoring tools and technologies relevant to the monitored NbS. Then, the monitoring equipment and installations for measuring the indicators must also be determined. Equipment can have specific requirements regarding place and time to measure the indicators accurately.

Moreover, **fostering knowledge transfer and exchange** on M&I results is key to ensuring the impact of M&I in NbS planning, implementation, and management. Establishing clear communication channels and reporting mechanisms helps to maintain transparent knowledge transfer and exchange throughout the monitoring process. With publicly available results, relevant stakeholders and local communities can benefit from knowledge transfer and exchange (Clever Cities, 2023).

5. Social topics

Social-related aspects, like, stakeholder participation and collaboration, are vital in environmental and social assessment processes. **Communication with different stakeholders**, such as the public sector, citizens and general public, civil society, and academia, helps to effectively convey the outcomes of M&I of NbS benefits to engage stakeholders and to gather support for sustainability practices. The next step is collaboration and **cooperation with different stakeholders**, “a social practice that brings individuals together in search of complementarity of interests” (Cittolin, 2018). Collaboration and cooperation with different public and private stakeholders enhance support for different M&I steps and roles. External actors can take part in or also lead M&I activities.

The **participation of citizens, children, or other sensitive groups** in NbS M&I fosters collective action and active engagement

towards sustainable practices and promotes setting up locally relevant M&I. In particular, involving citizens, children, and other sensitive groups ensures that the processes are locally appropriate, legitimate, inclusive, and tailored to the community’s needs. In addition, there should be **social demand** for M&I, which refers to the need for NbS M&I within society. Fostering social demand for NbS M&I processes allows their success in the long term. In addition, M&I and its outcomes require **social acceptance**, which refers to the extent to which NbS M&I is approved by society, especially where it is implemented. Social acceptance ensures that NbS M&I processes align with local

values, priorities, and needs. There is a need to have guidance on how to achieve social acceptance.

Addressing M&I needs in NbS guidance

Besides the checklist of practitioners’ needs on M&I processes, the study done in CONEXUS also evaluates how the identified M&I needs are addressed in present NbS guidance materials, such as handbooks, toolboxes, and manuals. From the initial, 49 identified needs, only 20 were covered in the 34 analyzed guidance materials.

Also, from the findings of this study, the following categories require more attention to support M&I in practice: Social

M&I aspects covered in NbS Guidance



1. Adapting M&I in its context

- 1.1 Define a theory of change - 62%
- 1.2 Set monitoring goals - 56%
- 1.3 Indicator selection - 85%
- 1.4 Project management - 41%



2. Methodology

- 2.1 Define a monitoring methodology - 71%
- 2.2 Define monitoring sites - 44%
- 2.3 Define monitoring frequency - 35%
- 2.4 Data interpretation - 59%



3. Data

- 3.1 Data availability - 35%
- 3.2 Data accessibility - 24%
- 3.3 Data uncertainty - 26%
- 3.4 Data management - 41%
- 3.5 Data sharing - 38%



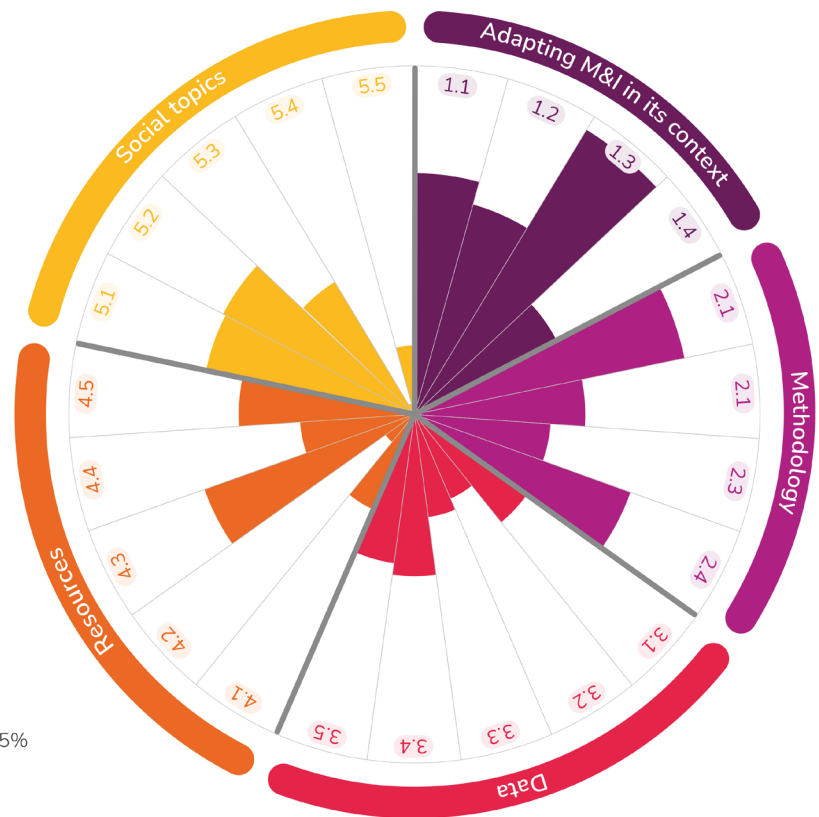
4. Resources

- 4.1 Financial resources - 26%
- 4.2 Time resources - 9%
- 4.3 Personnel required - 57%
- 4.4 Monitoring equipment and installation - 29%
- 4.5 Knowledge transfer and exchange - 46%



5. Social topics

- 5.1 Communication with different stakeholders - 55%
- 5.2 Collaboration and cooperation - 56%
- 5.3 Participation - 40%
- 5.4 Social demand - 3%
- 5.5 Social acceptance - 1%



topics, Methodology, and Data. Some aspects, such as Indicator selection (85%), are well addressed, whereas aspects like Social demand (3%) and Data accessibility (24%) are not. Even though not all aspects of NbS M&I were sufficiently covered in existent guidance materials, there are several good examples of guidance supporting NbS M&I processes. These examples include many of the needs from the checklist. In particular, the needs from 1. Adapting M&I in its context, 2. Methodology and 4. Resources are covered in these examples.

Guidance developers need to address the needs of practitioners in NbS guidance better. They should take a broader perspective on M&I, where indicators and methods are considered, as well as the local political and social context and practicalities, such as data accessibility and equipment. To better address user needs, guidance developers need

Good examples of M&I



Connecting Nature Guidebooks, in particular:

- Impact Assessment Guidebook
- Reflexive Monitoring Guidebook

Geographical Focus: Europe

<https://connectingnature.eu/guidebooks>



Evaluating the impact of nature-based solutions

Geographical Focus: Europe

<https://op.europa.eu/s/zPcU>



Guía metodológica: diseño de acciones con enfoque del Nexo entre agua, energía y alimentación para países de América Latina y el Caribe

Geographical Focus: Latin America & the Caribbean

<https://hdl.handle.net/11362/46078>



Urban Nature Labs project's deliverables, in particular:

- NbS Performance and Impact Monitoring Report
- NbS Impact Simulator and Monitor

Geographical Focus: Europe

<https://unalab.eu/en/publications>



ThinkNature Nature-Based Solutions Handbook

Geographical Focus: Europe

<https://ewn.erc.dren.nl/nbs-guidance/guide/thinknature-nature-based-solutions-handbook/>



to evaluate practical examples and use these to explain M&I aspects. A feedback and testing period of NbS guidance can help incorporate feedback from potential users and assess if the guidance covers users' needs.

Beyond guidance materials, online databases are available, including different case studies of NbS that can guide practitioners on M&I implementation.

Examples of online databases



Nature-based Solutions – City Case Studies:
<https://oppla.eu/nbs/case-studies>



NbS Case Study Platform:
<https://casestudies.naturebasedsolutionsinitiative.org/>



Urban Nature Atlas:
<https://una.city/>



Phusicos:
<https://www.phusicos.eu/case-studies/>

Key messages



1. To implement M&I successfully different aspects prior and after indicator measurement need to be considered.
2. The needs of practitioners require to look how M&I can be integrated in its wider governance context.
3. Guidance material can support practitioners in conducting M&I processes, and although good examples are there, in general guidance on M&I is limited.
4. The following aspects require more attention to support M&I in practice.

References

CLEVER CITIES. (2023). Principles for setting up long-term monitoring plans. <https://clever-guidance.clevercities.eu/questioning-what-makes-co-governance>

DUMITRU, A., et al, (2021). Evaluating the impact of nature-based solutions: A handbook for practitioners. EU Publications Office. <https://data.europa.eu/doi/10.2777/244577>

GARCIA, I, et al. (2018). CLEVER Cities D4.1 CLEVER Monitoring and Evaluation Framework. https://clevercities.eu/fileadmin/user_upload/Resources/181130_D.4.1_Monitoring_Framework_TEC.docx.pdf

NESSHÖVER, C., et al. (2017). The science, policy, and practice of nature-based solutions: An interdisciplinary perspective. *Science of the Total Environment*, 579, 1215-1227. <https://doi.org/10.1016/j.scitotenv.2016.11.106>

VAN DER JAGT, A. P. N., et al. (2023). An action framework for the participatory assessment of nature-based solutions in cities. *Ambio* 52, 54–67. <https://doi.org/10.1007/s13280-022-01772-6>



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