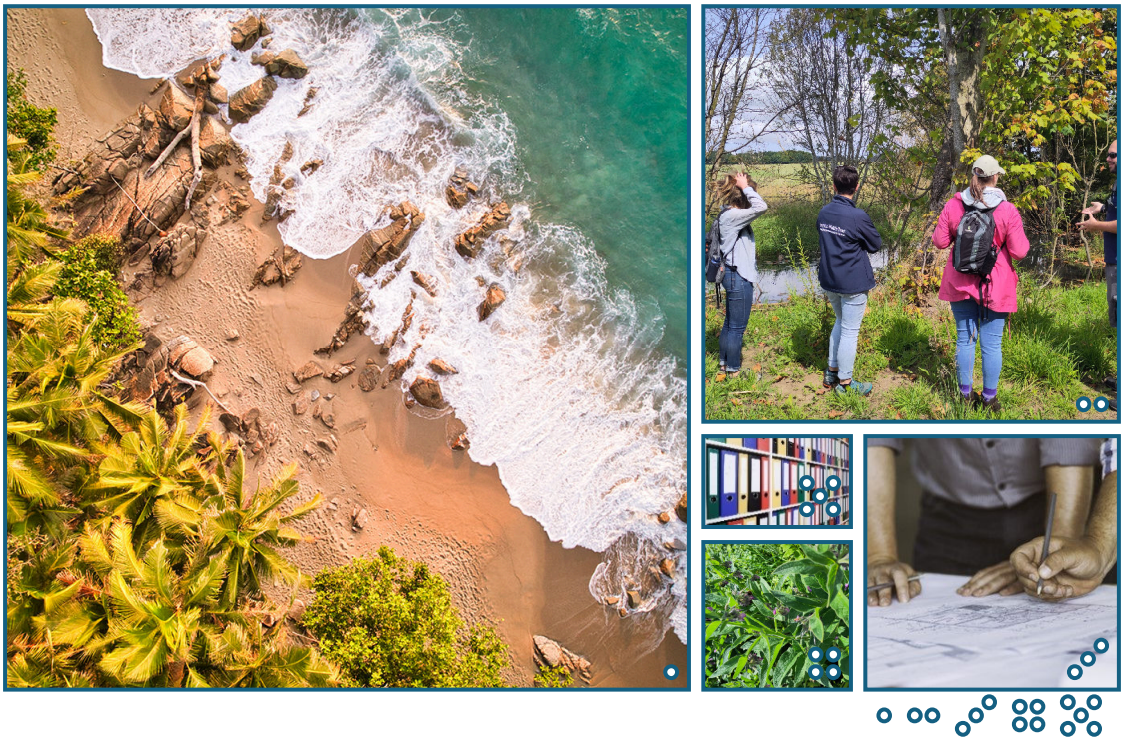
# Collecting, sharing, and using knowledge to inform Nature-based Solutions: Recommendations for those enabling and implementing interventions.

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Nature-Based Solutions (NbS) are interventions that work with nature to tackle societal challenges. They are an important but challenging concept to put into practice. However, attention to evidence and other forms of knowledge may help to enable and strengthen NbS. This briefing summarises priority recommendations for supporting knowledge sharing and use that have arisen from a collaboration between international experts on the implementation of Nature-based Solutions.



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The United Nations Environment Assembly (UNEA) Resolution 5/5 defines Nature-based Solutions as "*actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits*".

## What are Nature-based Solutions (NbS)?

At their simplest, Nature-based Solutions (NbS) are high-integrity interventions that aim to work with nature and people to tackle societal challenges. A Global Standard for NbS (IUCN, 2026) combines international expertise and state-of-the art learning to specify how to plan, implement, enable assess and upscale NbS. Using the NbS Global Standard provides clear criteria, indicators, and guidance for attention throughout the development of NbS. The criteria are shown in Annex I; all NbS initiatives should consider and work for these criteria[1]. Recent work has demonstrated that this Standard is relevant in diverse contexts worldwide (Cohen-Shacham et al., 2025) to address societal challenges that range from tackling flood risk to improving food security.

## Why did we write this briefing?

Nature-based Solutions are essential if we are to safeguard societies and economies as well as natural systems. However, implementing NbS can be very challenging (Martin et al., 2025). Part of the challenge is identifying what types of knowledge to use to plan, implement and evaluate NbS. A broad range of knowledge topics, types and sources may be needed, as these initiatives are holistic and inclusive, so should involve different groups, consider multiple goals and entail systems thinking. Thus, the collection, sharing and use of knowledge can seem a daunting challenge. This briefing was written to share the insights of international experts who have facilitated diverse NbS interventions, to highlight their shared experiences and implications for others.

## Who is the audience for this briefing?

This briefing is primarily relevant for those who plan, implement or evaluate NbS interventions; and also those who seek to enable, fund or shape NbS interventions. This typically includes individuals and teams in third sector organisations working for conservation and/or social development, and individuals or teams in public sector agencies linked to nature, welfare or planning. There are also insights for scholars of NbS and knowledge use, to be developed subsequently in an academic paper.

## What is the basis of this briefing?

This briefing is based on qualitative analysis of the views and experiences of individuals with experience of 13 different NbS interventions (Table 1). These 13 cases are not a globally representative sample, but exemplify the diversity of NbS' context and goals. The individuals who contributed – and who are coauthors on this report – are experts in NbS who had already contributed to an comprehensive evaluation of NbS interventions against the NbS Global Standard (Cohen-Shacham et al., 2025), as they were in the

[1] Many past and present initiatives bear similarities to NbS without necessarily having been labelled in terms of NbS. Appraisal in terms of the eight criteria and associated indicators of the Global Standard™ can distinguish whether initiatives described in other terms could also be equated with NbS.

team developing one o these NbS. We re er to them as 'representatives' o their respective case studies, as we asked them to reflect primarily on these interventions when sharing their experiences, but they do not represent the diversity o stakeholder experience in any o those cases.

Experiences o NbS and knowledge were shared in three ways: (a) an online survey (July-August 2025) designed to probe knowledge needs and challenges related to each o the Global Standard's 8 criteria (discussed ully in Waylen et al., 2025); (b) a Miro board (January 2026), designed to capture positive and negative experiences and recommendations or knowledge-sharing; and (c) two online workshops (February 2026), designed to collectively validate and deepen discussion on the key themes emerging rom the Miro board and survey. All these data were then urther analysed by the lead authors, to identi y key themes and recommendations in relation to (1) knowledge topics, ormats and knowledge-sharing activities, (2) the eight IUCN criteria (Annex I) and (3) intervention phases, and links between these. The resulting themes and recommendations are summarised in this briefing. Where we use quotes rom the discussions to illustrate our messages, we identi y contributors by their case study's abbreviated orm (e.g. CS1 or the representative o case study 1).

*Table 1* The 13 NbS interventions represented by the coauthors to this study. Representation in the three phases o data collection and deliberation is shown on the right: most o the cases have been represented by one person, but "x2" shows where two people input or some phases. For more in ormation about these initiatives, see Cohen-Shacham et al. (2025), noting that case study numbering differs in that report which appraises 21 cases.

| CS | NbS Intervention Title | Country | Data contributed: | | |
|---|---|---|---|---|---|
| | | | Survey | Miro | Workshop |
| 1 | Adapting to impacts o climate change on water regulation & supply | Colombia | Yes | Yes | Yes |
| 2 | Andean resilience: Strengthening small-scale agricultural production in areas vulnerable to climate change in the highlands o Ecuador | Ecuador | Yes | No | No |
| 3 | Co-designing Atlantic landscapes management to address societal challenges relevant to the Paiva River watershed | Portugal | Yes x 2 | Yes x 2 | Yes |
| 4 | Cross-cultural collaborative biodiversity research in Indigenous Protected Areas | Australia | No | Yes | Yes |
| 5 | Ecosystem Restoration in Portland, Oregon | USA | Yes | Yes | Yes |
| 6 | Fodder bank model to address de orestation, soil erosion, slope stability, & women drudgery - Western Himalayas, India | India | Yes | Yes | Yes |
| 7 | Living Seawalls | Australia | Yes x 2 | Yes | Yes x 2 |
| 8 | Mijikenda Kaya orests | Kenya | Yes | No | No |
| 9 | Nature-based solutions: Coastal dunes & wetlands | New Zealand | Yes | Yes | Yes |
| 10 | Restoration o the Danube River Basin Waters or Ecosystems & People rom Mountains to Coast | Austria | Yes | Yes | Yes |
| 11 | Urban GreenUP: Implementing & assessing the impacts o NbS in a highly urbanised environment – Liverpool, United Kingdom | UK | Yes | Yes | Yes |
| 12 | Using extensive livestock or vegetation control under high voltage power lines | Spain | Yes x 2 | Yes | Yes |
| 13 | Virginia Grassland Bird Initiative | USA | Yes | Yes | Yes |

## What ideas about knowledge did we build on?

The concept o NbS brings together several different ideas about how to work with natural systems to generate benefits or people. Each o these ideas builds on studies and experiences which gives us some idea o the relevant considerations:

- NbS should draw on in ormation across **multiple topics** (e.g. Carvalho et al., 2024). Collecting evidence or all 8 criteria o the Global Standard or NbS would encompass many social, economic and environmental issues. NbS aim to address societal challenges through effective ecosystems management, requiring understanding multiple dimensions o socio-ecological systems. This involves navigating and communicating complexity, which, while demanding, can stimulate learning (Fernández-Giménez et al., 2019).
- NbS should be based on the insights o **multiple knowledge-holders** (Ibrahim et al., 2025). Developing an understanding o many topics does not come solely rom the existing data or literature such as reports, academic papers or textbooks. This is especially true or the detail o societal challenges, economics, and governance – knowledge about these is o ten held by local stakeholders and may not be well represented in scientific or ormal sources like databases and reports.
- Sharing and applying knowledges or NbS is an **interactive process** (Sarkki et al., 2025). NbS requires different stakeholders and groups to work together to share, deliberate and decide how to manage nature. This entails sharing and connecting varied knowledge on varied topics and rom varied sources, which in turn can deepen mutual understanding. Several related ideas, such as 'co-production' and 'social learning' emphasise that knowledge use is a collaborative and social process. Skill is required to 'weave' together these elements within NbS (Hussain et al., 2022).

Combining these ideas should support more inclusive and holistic NbS: however, doing so can also add complexity and effort, at least in the short-term. This is especially the case i different knowledge systems are in tension or do not easily align (e.g. Colloff et al., 2019). There ore, it is important to understand the insights o those with experience implementing NbS, to clari y key challenges and priorities or supporting NbS.

## What are key challenges or sharing and using knowledge to strengthen NbS?

The most commonly mentioned challenge in our discussions was the difficulty o building **trust and shared understandings**. Local stakeholders might be reluctant to engage with externally led initiatives, particularly where previous interventions had generated atigue, unmet expectations or limited influence over decisions. In response, project teams must dedicate time to listen and share - approaches that align well with existing guidance on engagement, participation and empowerment (e.g. Kiss et al., 2022). However, some noted that stakeholder atigue could still occur, or stakeholders might eel overwhelmed by options or opportunities presented to them. Thus, **understanding the context** o prior interventions and the community's capacity to engage is important: NbS interventions are never created on a blank canvas. For

example, the CS7 representative noted that often "*a lot of indigenous groups are a little bit overwhelmed by the number of different people wanting to talk to them and their own capacity to be involved in that two-way sharing of knowledge is often challenged*." There is always a need to explicitly reflect on how to respect differing knowledges and varied capacities, even by teams who are not new to a place or community.

All NbS teams represented in this study had made efforts to gather a mixture of knowledges to inform NbS development: their ability to do this was influenced by their prior expertise as well as availability of prior studies for their NbS site and type. Many teams were led by local or international professionals with backgrounds in ecology; some by professionals in development studies. These starting points affected how easily they found it to understand and support all aspects of their NbS. However, nearly all teams struggled to understand **economic** aspects, or even to identify how more economic information could be collected. For example, the representative of CS13 recognised the limits of their natural science expertise "*You know, I'm a biologist, not a farmer. So, I'm the last person that knows anything about economic impacts on farmers. And you know, we really need their input to be able to really draw the reality of the economic impacts of these nature-based solutions*."

Careful engagement to build understanding of people and NbS context always needs **time** which can be challenging to safeguard when resources are limited. Constraints arise both from the timescales specified by funders of NbS, and from the staff resources and skills available. **Funding** for implementation of specific measures was sometimes sought separately – and might involve new consultants, information sharing or learning to achieve that. Project teams often had to seek and combine a mixture of funding types to sustain NbS development, which was itself time-consuming; and obtaining funding for **monitoring** was especially challenging, undermining learning and adaptive management.

**Geographic scale** affected both the ability to understand the system and the ability to share knowledge. Whilst smaller-scale interventions might struggle to achieve significant ecosystem benefits, interventions with a larger scope could face greater challenges in describing and characterizing the system, sharing that knowledge between all key stakeholders, and deliberating to prioritise societal challenges. Even where funding was for small-scale projects, it would be good to select and plan informed by wider context and goals.

## Did we find anything unexpected?

We found that our discussions gave additional emphasis to the following issues:

- **Knowledge needs will evolve over time**, as interventions evolve, community and context change and staffing shifts. All of our survey responses had noted that knowledge needs were different at every phase of NbS development; our subsequent workshop discussions confirmed the need to reconsider knowledge needs as interventions evolve, partnerships shift and new opportunities arise. "*it required constant clarification that the Standard must be interpreted differently depending on whether a project is in design, pilot or scaling phase*" (CS10). The need to consider how NbS develop over time over time has already been noted (Collier et al., 2023): this

perspective may also be helpful when considering knowledge. In other words, it can be helpful to reconsider priorities for collecting, sharing and using knowledge as interventions develop and move from planning, implementation to evaluation, alongside the 8 criteria of the NbS Global Standard. Our cases all experienced shifts in knowledge topics, sources and types as they evolved. For example, tools such as maps were reported as used during planning but not later, while topics such as governance were more prominent during implementation than during planning.

- **Recognising the knowledges of local and/or indigenous communities complements efforts for empowerment**. Better empowering citizens and communities is a central focus of much writing on NbS (e.g. Kiss et al., 2022), and recognising their rights and leadership is an emphasis of the Global Standard. Our experiences reinforce the need to recognise their knowledges. As in many of our cases, NbS are often led by a small core team with professional training in topics related to nature or tackling societal challenges. For example, this may be the staff of an environmental NGO; or a planning professional. Scientists, or staff with a scientific background, are also often involved. Their expertise and worldview shape interventions; so early involvement and empowerment of local knowledge-holders is important to secure as soon as possible. Local and indigenous knowledge holders also provide expertise that can improve the design of NbS, e.g. seasonal variability, disturbance regimes, historical use of resources or ecological thresholds.
- **"Know how" matters.** Many of our experiences demonstrated that developing NbS depended on "know how", i.e. the knowledge about how to carry out an activity. This could range from knowledge about how to successfully apply for grants, or organise a meeting, through to knowledge about how to plant and nurture seedlings of specific tree species. This form of knowledge or expertise may often be tacit. If there are knowledge gaps, sometimes consultants can provide useful expertise and 'know how', if resources exist to employ them. Common uses of consultants include for skills in stakeholder facilitation, technical advice on implementation, or resource economics.
- **Different teams will all have different starting points**, strengths and weaknesses, as well as different objectives. These depend on the composition of a team as much as the specific context and type of NbS envisaged. It is important to reflect on what topics is already confidently understood by a team and perhaps agreed by partners, and to reflect on what additional expertise or information may be required for a new NbS intervention.

None of these points contradicts ideas in the existing literature on NbS and related concepts, but they suggest topics that might benefit from more explicit reflection in future practice or research.

## What are our recommendations for strengthening knowledge-sharing to support the development of NbS?

These recommendations are primarily synthesized from written recommendations captured in the Miro board, supplemented by ideas voiced in discussion. They are interconnected and their ordering does not reflect prioritisation.

- **Foster collaboration and participation**
  - Existing guidance for collaborative and participatory processes can help different stakeholders share and use knowledge.
  - Building trust across different individuals and partners involved in NbS can ease other challenges.
  - Field visits are invaluable. The ability to 'touch and feel' the setting, interventions and other people can be powerful for building understanding and connection between different stakeholders.

"Sit down and discuss local priorities and preferred approaches. Local ways are not always the same as 'Western' scientific approaches." CS4

- **Expect diverse knowledges and views**
  - 'Evidence' tends to imply a focus on formal reports or databases: but expect that what is useful for NbS will go beyond these types of sources.
  - Expect that different topics will tend to be associated with a different balance of evidence sources: e.g. scientific models to predict the effect of measures to alter hydrology, stories to understand people's uses of natural resources. Discuss knowledge quality and what is judged appropriate to validate insights from different knowledge systems.
  - Identify and discuss conflicting or contradictory views as early as possible. Disagreements may be unavoidable.

"You can't just symptom solve and fix… you have to take a holistic approach" CS5

- **Embrace systems thinking**
  - NbS requires understanding many environmental, socio-cultural and economic topics, and how they are interlinked.
  - Sharing and communicating about systems can be complex, so needs care and time. A mixture of learning approaches (e.g. visual, written materials, field visits as well as formal meetings) and repeated interactions is required.
- **Check if you can expand expertise**
  - Skilled facilitators can help participatory or partnership processes to share and use knowledge.
  - Consider using contractors and/or upskilling NbS team members to complement any gaps in existing expertise and perspectives.
- **Don't hide challenges**
  - Celebrate progress but also report difficult experiences – these can be useful sources of learning.
  - If possible, share experiences with others in other NbS initiatives – this can be valuable form of peer support.

"support trust building measures…allow to discuss openly potential trade-offs and conflicts" CS10

- **Commit to monitoring from the start**
  - Discuss and document what issues will need to be understood, in order to track and understand the progress of the NbS intervention. The self-assessment framework of the IUCN Global Standard™ can help identify priorities for improving understanding, and for monitoring.
  - It is often challenging to resource or sustain monitoring, but additional fund-raising or partnering with researchers may help.
- **Review and revisit what you have learnt and will need to know**
  - It is likely that knowledge needs will shift as interventions move through planning, to implementation, to evaluation.
  - NbS interventions themselves require adaptive management and updating. Likewise, knowledge needs for NbS need to be collectively reconsidered over time.

> Allow projects to be honest about where they fell short - stop expecting reports to be all sunshine & rainbows (or else how can we learn?)" CS11

Responding to these recommendations will requires investment of resources, including time, expertise, and funding. The recommendations may also require a shift in the culture and practices involved in working with nature, and in what types of knowledge are considered relevant.

## Are certain challenges and priorities associated with certain types of NbS?

Every NbS initiative is completely unique, not only because social and ecological context always varies, but because interventions differ in what societal challenges they tackle. This is exemplified by the case experiences and representatives that form the basis of this study. The above priorities are common themes found across the initiatives and experiences, rather than aligning with specific case study type or characteristic. However, interpreting them for any specific initiative will depend on that initiative's unique circumstances and goals.

Our sample is too small and heterogenous to draw any confident assertations about patterns between types of NbS interventions, but we checked for any obvious patterns between different types of NbS. We considered two aspects in particular. Firstly we considered if those cases associated with higher governance scores in Cohen-Shacham et al. (2025) reported fewer challenges in finding and sharing knowledge, but there was no obvious pattern. Secondly, we explored if the experiences of those representing interventions set in the Global North differed from those in the Global South. We found signs that those in the Global South (CS 1,2,6,8) were especially constrained in what they could understand from the pre-existing evidence base and in their ability to access or collect new information. Additionally, in the Global South it tends to be more often the case that local communities have distinct indigenous or local ecological knowledge systems, and livelihoods that depend on local natural resources. However, access to information could constrain any project, depending on its funding type and constraints; and valuing and using local natural systems also occurs in the Global North. The experiences also suggest that the prior expertise of the team leading an intervention was important for determining what topics were perceived to be easy to understand and discuss. Exploring any differences between different 'families' of NbS may be productive focus for future research.

## What are our conclusions?

All those who seek to enable or plan NbS should explicitly think about knowledge: it is helpful to ask what knowledges are needed, who holds these, and how knowledges can be shared. These questions should be asked as early as possible, reflecting also on who has the authority to answer these questions. A variety of topics, formats and sources of knowledge will likely be relevant; and the precise mixture will shift as knowledges are shared, decisions taken, and NbS interventions move across phases. Knowledge is not something to consider 'just' when planning, or monitoring, and is relevant across all of the Global Standard's criteria.

For those who **lead interventions**, the goal of understanding multiple issues and handling multiple knowledge types may sound daunting, but this likely is already happening to some extent. Furthermore, it is useful to recognise that following pre-existing efforts and recommendations, especially on strengthening stakeholder participation and input into the process of design and NbS governance (Ibrahim et al., 2025) will tend to reinforce efforts for knowledge sharing.

Recognising what is already done can help validate and support the team to go further. So, teams should first consider their starting point – what is their own existing expertise? What goals have historically been the subject of any prior interventions? What topics were the focus of prior monitoring programmes? This is a positive legacy to build on but can also highlight what has not yet been given sufficient attention. The above recommendations may serve as a useful checklist when starting and later revisiting the progress of an NbS intervention.

We hope it may also be liberating and validating to explicitly question 'what counts' in terms of knowledge. Many professionals tend to implicitly focus on evidence in terms of datasets created using scientifically verified methods; whilst these can be important where available, there represent only one form of relevant knowledge. In particular local and practitioner knowledge can provide complement insights to enable planning. Indeed, their expertise and 'know how' is often essential for NbS.

For those who seek to **enable NbS interventions** such as programme and project funders, it is important to recognise and where possible respond to limitations arising from resource constraints. It may help to specifically designate resources for knowledge discovery, and for knowledge sharing, and later for monitoring and adapting. Additionally, where possible do not fund short and speedy interventions, as the quicker the timeframe expected for delivery, the more difficult it will be to ensure they are fully informed by all relevant knowledge and knowledge-holders. Attention to skillsets for identifying and facilitating knowledge-sharing could be considered as part of the criteria for selecting between proposed interventions. Lastly, prompting teams to report knowledge used, and negative as well as positive experiences may help to capture learning that can inform future NbS.

Recognising and responding to a variety of forms of knowledge – from diverse knowledge-holders and on diverse topics – will never be an easy or trivial issue. However, viewing knowledge as a core concern will complement stakeholder engagement and so enable future initiatives to go further in developing solutions that work with nature to tackle societal challenges.

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## Annex I

The criteria or NbS as per the IUCN Global Standard or Nature-based Solutions™. Each criterion is accompanied by between 3 and 5 indicators, and all are seen as interconnected (IUCN, 2026).

| |
|---|
| Criterion 1: NbS effectively address societal challenges |
| Criterion 2: NbS incorporate an ecological, economic, social and cultural systems perspective |
| Criterion 3: NbS result in positive change in the state o biodiversity and enhanced ecosystem integrity, including connectivity |
| Criterion 4: NbS are financially easible and economically justified |
| Criterion 5: NbS are based on inclusive, transparent and empowering governance processes |
| Criterion 6: NbS seek to equitably reconcile the achievement o their primary goal(s) with any intended and unintended impacts on the continued provision o multiple benefits. |
| Criterion 7: NbS are managed adaptively, based on evidence |
| Criterion 8: NbS contribute to the enhancement o the enabling conditions or their implementation, sustainability and mainstreaming |