Framing Nature-Based Solutions

Collaborative cross-organizational learning, to understand the value of an NbS approach for achieving cost effective benefits for biodiversity, climate, and society, and to drive conservation actions.

Prepared for the Conservation Measures Partnership

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About this review

This review seeks to answer the following questions based on a review of published materials and interviews with key practitioners:

> What makes nature-based solutions different from other approaches the conservation community has used in the past (e.g., integrated watershed management, sustainable development approaches, ecosystem-based adaptation)?

> What are the benefits (or not) of framing something as nature-based solutions?

> What evidence is there that nature-based solutions are delivering benefits (e.g., biodiversity, climate) at a large or small scale? If possible, under what conditions do they tend to work or not work?

> Are there examples of cost-benefit analyses that show that nature-based solutions are an efficient and effective alternative for addressing societal challenges (for example, an alternative to grey infrastructure in watershed management)?

> Are there generic theories of change that exist or could be developed that teams could use as a starting point?

Approach

This report was developed using a collaborative learning approach, including a desktop review, interviews with key people working in the Nature-based Solutions (NbS) space and engagement with the CCNet and CMP network. The desktop review included identifying key NbS stories and case studies that demonstrate the values and show cost benefits. Key resources for further reading are listed in Appendix 3. Interviews were conducted with a selection of key stakeholders globally to understand why they use a NbS approach and how it adds value to the outcomes of their projects, see Appendix 4. The key stakeholders selected were chosen in discussion with the CMP Board, though not all were available to be interviewed, given the short timeframes for the project (4 months). Standard questions were used to conduct semi-structured interviews, see Appendix 5. Particular focus was placed on engaging with CMP and/or CCNet members in the process, including reaching out to CCNet and CMP via email, presenting to the November 2021 CCNet Rally, which included a breakout session to elicit feedback on key questions.

Contents

Executive Summary

The Nature-based Solutions learning initiative aimed to understand the value of a Nature-based Solutions approach for achieving cost effective benefits for biodiversity, climate, and society. This report was developed using a collaborative learning approach, including a desktop review, stakeholder interviews with key people working in the Nature-based Solutions (NbS) space, particularly with CMP members who have experience retrofitting existing projects with an NbS framework or designing new NbS projects in a range of contexts. CMP members were asked why they use an NbS approach, how it adds value to the outcomes of their projects, the lessons learned in making the transition to NbS, the enabling conditions for successful implementation, and for evidence of cost-effectiveness compared to previous approaches.

Nature-based Solutions are an approach to integrated conservation and development planning intended to support the achievement of society's development goals and safeguard human well-being through the protection, maintenance, and enhancement of ecosystem services (e.g., Cohen-Shacham 2016, 2019, FAO 2018, Brears 2020, Dhyani, S., Gupta, A. K and Karki, M. 2020, IUCN 2020, Sang N. 2020, Pérez-Cirera et al. 2021). NbS are based on an ecosystem approach and intended to complement, mediate the negative impacts of, or even replace, purely technological and engineering approaches to these challenges. Building on previous versions of the ecosystem approach, much of the impetus for formalising and refining NbS has been driven by members of the IUCN Commission on Ecosystem Management, and the Global Standard for Nature-based Solutions was developed by IUCN in 2020. NbS is best considered an umbrella concept that covers a range of different approaches rather than a qualitatively different to existing approaches.

The breadth of issues raised by the CMP members shows that NbS has implications for almost every aspect of activity in the conservation and development sectors. Observed benefits of NbS that are gaining increased donor attention include: a clear indicator framework, integrated co-benefits to communities, potential for landscape scale impact, empowering community led action and breaking down silos between sectors and between ministries. Concerns and emerging issues include internal resistance to change, lack of capacity within governments and communities, inconsistency in application, potential for greenwashing, and the idea of NbS as a short-lived trend. While many CMP practitioners said that it is still too early to know the impact of NbS projects due to their long-term nature, the evidence base is rapidly expanding. As financing and government ambition increase, CMP members identified an urgent need for greater co-ordination between practitioners and donors. This needs to occur across all sectors, particularly where government and community capacity is low. In relation to climate change financing, practitioners stated that the focus needs to be on the quality, rather than volume, of the investment. Valuing ecosystem services and monitoring the social co-benefits of NbS activities was identified as key to achieving scale and cross-ministry collaboration. The most important emerging issue according to CMP practitioners was community involvement and local knowledge. There is strong support for the view that high quality NbS planning goes beyond awareness and support to focus on true participation and codesign of activities and indicators. Governments and communities must have the capacity and opportunity to drive the solutions based on their priorities and local knowledge. In this way NbS is all about best practice on ground project management and providing an improved framework for planning and measuring.

Recommendations for further learning and exploration include:

- ongoing learning within the conservation sector to process NbS developments and evidence;
- stronger coordination and collaboration between practitioners and between donors; and
- facilitating consistent approaches to complex place-based projects by translating emerging evidence into locally relevant guidance in line the IUCN Global Standard.

What makes Nature-based Solutions (NbS) different?

Current definitions of Nature-based Solutions

Many variations on the definition of Nature-based Solutions have emerged over time. However, the common theme is that NbS are solutions to societal challenges, particularly climate change, that are "inspired and supported by nature" (e.g., European Commission 2021) and involve "working with nature" (e.g., Nature-based Solutions Initiative, Oxford University). Bringing together these variations, the 2016 World Conservation Congress (WCC-2016-Res-069), defined Nature-based Solutions as:

> *"actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits."*

Following the 2016 WCC, the IUCN published the most definitive explanation of the NbS approach: *Nature-based Solutions to address global societal challenges.* (Cohen-Schacham et al. 2016, see Figure 1). This report states that:

> *"By unifying NbS approaches under a single operational framework, it becomes possible to scale up their implementation and strengthen their impact in mitigating the world's most pressing challenges."*

Figure 1 "Nature-based Solutions are actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits" (IUCN, 2016).

NbS are therefore an approach to integrated conservation and development planning intended to support the achievement of society's development goals and safeguard human well-being through the protection, maintenance, and enhancement of ecosystem services (e.g., Cohen-Shacham 2016, 2019, FAO 2018, Brears 2020, Dhyani, S., Gupta, A. K and Karki, M. 2020, IUCN 2020, Sang N. 2020, Pérez-Cirera et al. 2021).

Consolidating integrated approaches under the NbS umbrella

NbS are based on an ecosystem approach and intended to complement, mediate the negative impacts of, or even replace, purely technological and engineering approaches to these challenges. **NbS is best considered an umbrella concept that covers a range of different approaches.** Building on previous versions of the ecosystem approach, much of the impetus for formalising and refining NbS has been driven by members of the IUCN Commission on Ecosystem Management. Cohen-Shacham and colleagues produced a series of publications in which the basic principles of the NbS approach were developed and refined (Cohen Shacham et al. 2016, 2019).

Subsequently, the **Global Standard for Nature-based Solutions** (the Standard) was developed by IUCN in 2020 to provide a rigorous and reliable framework for designing, implementing and evaluating NbS (IUCN 2020). Further work by IUCN includes the ongoing refinement of the Standard through global and regional groups of practitioners, the development of self-assessment tools, and eventually an NbS certification system. NbS has evolved from ongoing application and development of ecosystem-based approaches to sustainable development and conservation of the natural world, particularly the Ecosystem-based Approach to Climate Change Adaptation (EbA) (Cohen-Shacham et al., 2016). Several other terms (e.g., such as "Natural Infrastructure[1]") also seem to fall within the framework of NbS and Seddon et al. (2021) provide a comprehensive assessment of different approaches that can be framed as NbS.

Developing consistency in understanding of NbS

The IUCN Global Standard for Nature-based Solutions has eight criteria (Figure 2) and 28 associated indicators, along with guidance on their application. Appendix 1 presents the eight criteria and their associated guidance for users, including examples used by IUCN to illustrate each of the criteria. Cohen-Shacham et al., (2019) considered the development and characteristics of NbS in relation to other ecosystem-based approaches. They argue that NbS emerged from the ecosystem approach and encompasses previously developed ecosystem-based approaches such as Ecosystem-based Adaptation (EbA), Forest Landscape Restoration, Ecological Restoration and Protected Areas. The eight core NbS principles they defined (Figures 2 and 4) were found to stand out from these approaches in three specific ways:

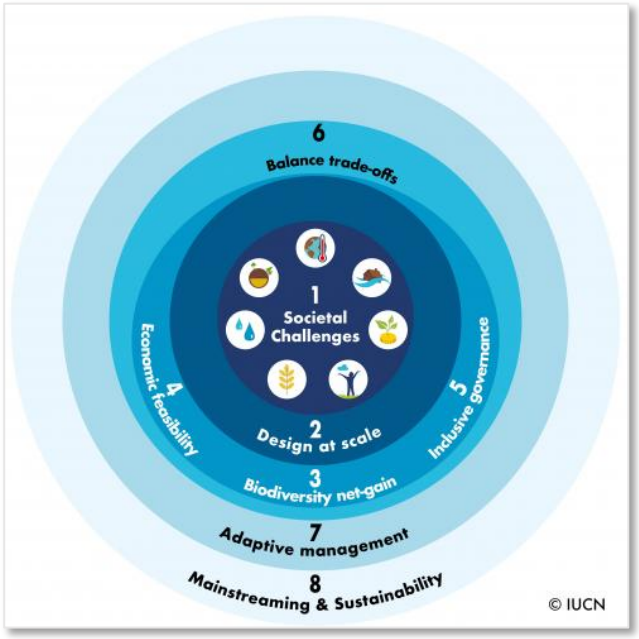

Figure 2 IUCN Criteria and indicators provide a framework for designing high quality NbS, based on self-assessment

1. NbS can be implemented alone or in an integrated manner with other approaches;
2. NbS should be applied at a landscape scale; and
3. NbS are integral to addressing societal challenges.

The authors also identified several positive features of other ecosystem-based approaches, such as a greater focus on adaptive management and temporal scale, and these were incorporated into

[1] https://www.iisd.org/articles/multiple-benefits-natural-infrastructure

following iterations of NbS. It is therefore more accurate to consider NbS as an umbrella approach that captures many aspects of other ecosystem-based approaches (as illustrated in Figure 1), rather than a qualitatively different approach.

Discussions with the CMP members aligned with these findings: a lot of work that is already being done could be framed as or considered to be NbS. In some cases, implementing NbS was a matter of renaming and refining of activities.

NbS in Practice: Emerging benefits and concerns

The NbS practitioners from the CMP community were interviewed to gain insight into their lessons learned implementing new NbS or retrofitting existing projects into the NbS framework. The breadth of issues raised shows the NbS has implications for almost every aspect of activity in the conservation and development sectors. Figure 3 shows some of the key benefits observed and the emerging issues and concerns – this list is not exhaustive, and many issues are developing quickly as the evidence base for NbS expands.

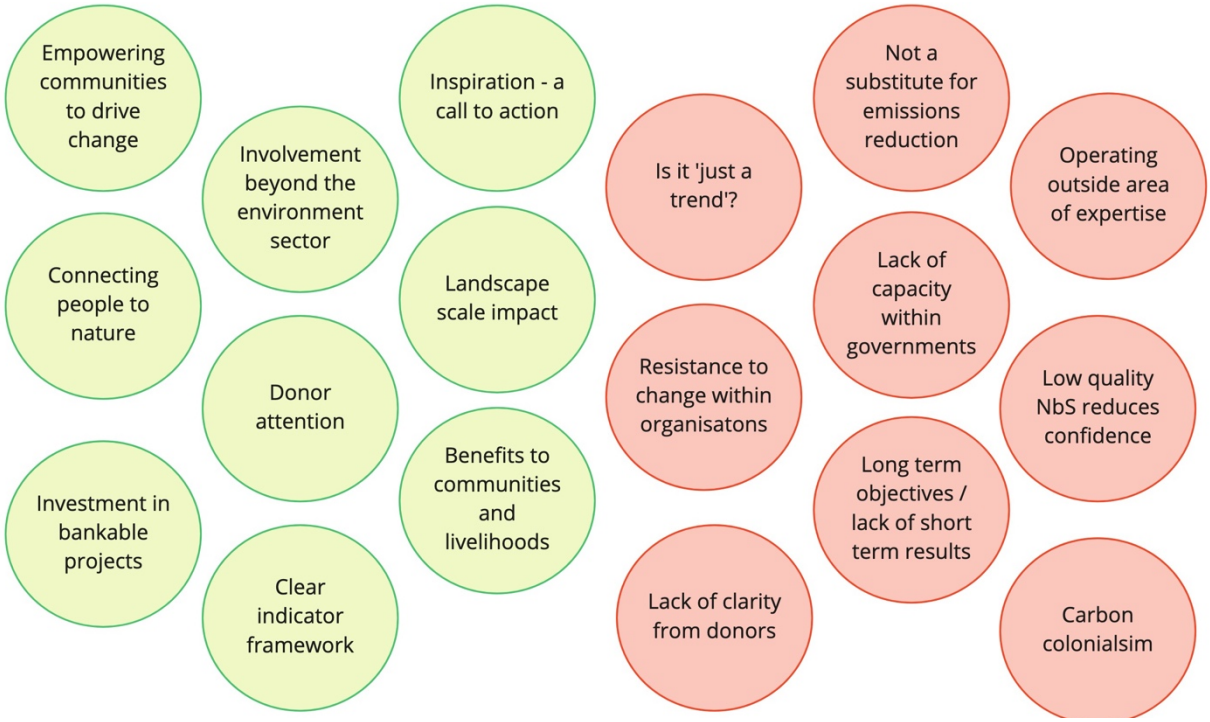

Figure 3 Lessons learned from CMP experience - the benefits of using NbS framing, in green, and key risks/concerns, in red.

Cross-sector recognition of integrated approaches

There is a vast body of evidence that demonstrates that environmental degradation is occurring, and even accelerating, despite many attempts to harmonise human needs for economic development with protection of the environment (e.g., MEA 2005). The development of NbS is a recognition that without a paradigm shift in how we view the relationship between humans and nature, these trends will continue. NbS is a part of this paradigm shift and explicitly attempts to maximise the likely success of conservation and sustainable development initiatives, by increasing the alignment between conservation and sustainable development objectives. This is perhaps most well acknowledged in terms of climate change mitigation efforts. Research by Griscom et al. (2017), for example, indicated that NbS have the potential to provide over one-third of the cost-effective climate mitigation needed between now and 2030 to stabilize warming to below 2°C. However, it has subsequently been

suggested that although this may be an over-estimate, and subject to multiple assumptions, it is still a highly significant component for achieving national and global climate mitigation targets (Griscom et al. 2020). Seddon (2019, 2020) has also indicated the importance of NbS in meeting the National Determined Contributions of (primarily) countries of the Global South (see Appendix 2 for examples).

Increasing recognition of the double crisis of climate change and biodiversity loss is pushing governments and international authorities to reconsider their approach to conserving and protecting natural resources and creating resilient communities and ecosystems. In rural settings and/or developing countries where people rely heavily and more explicitly on natural resources for their livelihoods, and have higher vulnerability to climate change, NbS provides a broad-based approach and multiple co-benefits that can bring sustainable change and go beyond the short-term project cycle. In urban settings NbS can provide natural alternatives to grey infrastructure that bring co-benefits to biodiversity and communities. NbS can also foster the connection between people and nature and fuel 'green/blue economy' growth.

CMP members and others consulted recognise the increasing profile of NbS globally and the opportunities it provides for a broader discussion on the value and role of nature. There is a recognition that various kinds of conservation approaches used in the past have not always been successful and there were some gaps. The NbS approach attempts to address these concerns by (among other things) explicitly incorporating socio-economic concerns such as traditional knowledge, public private partnerships, and payments for ecosystem services in a way that allows measurement of multiple benefits. At the system level, NbS is also an attempt at a more cohesive and codified framework that aims for a more comprehensive, broad and holistic approach to nature conservation and sustainable development at scale.

Increasing investor and donor interest

The CMP members reported increased interest from donors in NbS and that working closely with donors is critical. The interviewees agreed on the need to respond to the mobilisation of funding for nature and increased donor recognition of the interconnected nature of societal challenges. Some donors are not providing specific details on what they want to see in NbS implementation, so while there may be some flexibility, there is also a risk that developing the details takes longer than expected or may become too focused on short term gains and low hanging fruit. A key challenge raised was balancing donor expectations for short term outcomes versus a recognition that under NbS, outcomes may not be realised until the medium or longer term.

In relation to climate change financing, practitioners stated that the focus needs to be on the quality, rather than volume, of the investment. When in discussion with impact investors, practitioners recommend advocating for quality (i.e., effective targeting using robust analysis of issues and potential solutions) over quantity (i.e., "throwing money at the problem"), and the need to demonstrate that we can put that money to good use - NbS is a pathway to demonstrating that, but it may take time.

Managing the organisational transition to NbS

The CMP members described varied experiences of transitioning to an NbS approach. Despite the global attention that NbS is receiving, and the fast-developing evidence base, there are still barriers raised by CMP members. Often the transition to NbS is less to do with changing practice, and more to do with framing. NbS means a lot of different things and the understanding can differ depending on the benefits focused on and on the language used. Some CMP interviewees stated that their organisations did not necessarily have an internally consistent understanding or definition of NbS when they started using NbS language, for a variety of reasons; including the speed of change, the lack of a standardised approach (until the IUCN standard), and the wide range of concepts that fit

under the NbS umbrella. Some CMP practitioners have noticed resistance because it is not technically a "new concept" and could be considered a buzzword or trend, although others view the change as a maturation of previous approaches, particularly when coupled with comprehensive indicators. It was recommended to understand that developing internal consistency and overcoming misconceptions can take time, particularly if the shift is seen as simply a reaction to donor expectations and interest. For those that have retrofitted existing projects to NbS, there was positive feedback on the use of the IUCN developed self-assessment tool that allows practitioners to design and evaluate the extent to which NbS projects meet the eight criteria (Figure 4)[2].

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

Figure 4 The eight criteria for NbS (IUCN 2020)

Undertaking the IUCN NbS criteria self-assessment was described by CMP members as a valuable opportunity to promote internal discussions on programmatic strengths and weaknesses and subsequently refine activities. Lessons learned included the need to ensure sufficient resources and time are available, because of the level of detail and difficulty in self scoring. Having an independent facilitator can be helpful, but the key finding is the importance of internal discussions and determining how to address the concerns identified. One CMP member shared that engaging with NbS has increased confidence in their approach:

> *"It has evolved our thinking – it has created confidence within our organisation, I think it has increased knowledge about the issues. I think that global leadership and the development of new approaches that are very measurable and integrated in nature in this space gives confidence to organisations, and that confidence will have a direct change to impact on the ground. For example, our on-ground M&E framework is completely based on the standards, we look at how we are achieving each standard using a percentage. We have done it for a long time, but the quality is important – I would like to see organisations also understand what NbS is not about. We need to learn that too."*

Concerns with NbS terminology: what NbS is not?

There was a high level of agreement among CMP members that the broad range of intervention types and varied ecosystem and social contexts suitable for NbS brings risks of scope creep, concept fatigue/confusion amongst communities, can result in poorly designed projects, or misuse of the NbS concept. The most discussed examples were the use of large-scale monocultures for afforestation-based carbon sequestration/mitigation projects being called NbS, when in fact they can have negative

[2] The self-assessment tool is currently available from IUCN by emailing: NbSstandard@iucn.org

impacts on biodiversity. Thus, there is a need to understand 'what NbS is not', how to identify low quality NbS, and the risk factors for low quality NbS, particularly as it expands beyond the conservation sector and funding flows increase the speed and scale of new projects. Low quality NbS risks damage to confidence in the concept, as stakeholders, donor/investors and practitioners must be able to trust the integrity of NbS approaches.

Another key issue raised was the need for clarity on a conceptual starting point, i.e., 'Nature-based Solutions *to what?'* Here we found some differences between the CMP members with some taking carbon mitigation as the starting point and some taking the societal challenges as the starting point (including resilience and adaptation). These conceptual differences have real implications for project design, particularly in the quantification of benefits and co-benefits and the development of a rigorous science-based best practice monitoring framework. Also, it was recommended to be wary of the implications of providing a 'solution' to climate change or any other issue and to be mindful of the expectations being created ("solution" = "fixes everything") in a rapidly changing environment.

Maintaining control of the narrative

The adoption of NbS approaches (or variations therefore) around the world have been rapid. International NGOs including IUCN, WWF, TNC, CI and Birdlife International among others have adopted NbS as a framework for much of their work.

Governments and development agencies are also adopting NbS approaches, both within the domestic context (e.g., The European Commission) and in their multilateral environment, aid, and development assistance programs. Multilateral funding initiatives have been established to support the implementation of NbS. The Kiwa Initiative for example:

> *"aims to strengthen the resilience of Pacific countries and territories' ecosystems, economies and communities by setting up a dedicated one-stop-shop for funding projects that promote Nature-based Solutions (NbS).[3]"*

The rapid uptake of NbS rhetoric highlights the importance of a globally accepted definition and set of verifiable criteria and indicators. For example, some major corporations have adopted NbS language, including fossil fuel companies, leading to concerns about the potential for "green-washing". Similarly, there are concerns about the temptation to adopt "quick fixes" through the rubric of NbS, such as the mass plantings of monocultures to offset greenhouse gas emissions.[4] In response, several organisations have prepared policy statements or signed declarations outlining both what they believe are NbS, and what they are not. For example, many NGOs and others have stated that:

> *"NbS are not a substitute for the rapid phase-out of fossil fuels and must not delay urgent action to decarbonize our economies[5]."*

As a result of this widespread adoption of the term NbS and multiple interpretations of the meaning, NbS remains a controversial topic within global climate change debates[6]. Indeed, the term Nature-based Solutions was dropped from a revised text from the 2021 United Nations Climate Change Conference (CoP 26) meeting and replaced with the phrase "protecting, conserving and restoring nature"[7]. Several countries have since been seeking to reinstate the term into the final text.

[3] https://www.iucn.org/regions/oceania/our-work/deploying-nature-based-solutions/kiwa-initiative
[4] E.g. https://news.globallandscapesforum.org/48171/what-are-and-arent-nature-based-solutions/
[5] E.g. https://nbsguidelines.info/
[6] https://www.climatechangenews.com/2021/11/11/nature-based-solutions-prove-divisive-glasgow-climate-talks/
[7] https://unfccc.int/sites/default/files/resource/Overarching_decision_1-CMA-3_0.pdf

Coordination and collaboration

As financing and government ambition increase, CMP members identified an urgent need for greater co-ordination between practitioners and donors. This needs to occur across all sectors, particularly where government and community capacity is low.

- More coordination and collaboration is needed between NbS practitioners especially in the transferring of knowledge and expertise, and reducing the competition for resources.
- There is considerable work required by donors and governments to coordinate and collaborate in the delivery of NbS, and not to overwhelm intended recipients. This is particularly the case for small island developing states who have limited capacity.
- When engaging with corporations, be careful to ensure activities/practices are appropriate to the scale of the problems, rather than "soft options".

Beyond engagement: Local knowledge and codesign

The most important emerging issue according to CMP practitioners was community involvement and local knowledge. There is strong support for the view that high quality NbS planning goes beyond awareness and support to focus on true participation and codesign of activities and indicators. Governments and communities must have the capacity and opportunity to drive the solutions based on their priorities and local knowledge. In this way NbS is all about best practice on ground project management and providing an improved framework for planning and measuring. Key points raised by those interviewed included:

- Ensuring local stakeholders are involved in the planning stages from the beginning and that the project pipeline is driven by communities.
- Increasing organisational capacity for engagement and codesign on the ground and thinking about how to build and strengthen relationships.
- Expanding scope for stakeholder engagement beyond 'the usual suspects' and encouraging cross-sector relationships.
- Free and Prior Informed Consent (FPIC) is necessary, together with economic and social visibility in the implementation.
- Formal agreements between conservation agencies and communities with agreed responsibilities on both sides.
- Trust building needs to be part of foundational work, including trust in local knowledge and people. Trust builds confidence, motivation, and ability to lead.
- Paying attention to very early and deep community engagement, including thorough research into what communities already know about the societal challenge the project is looking at addressing.
- Understanding existing local governance structures and associated social and cultural issues such as existing gender dynamics and allowing them to be incorporated into the project.
- Aligning with and meeting all government protocols, including agreement on the geographic scope of projects and which communities are to be included.
- Building in a realistic pace of change. This may involve the use of incremental development options which progressively result in better conservation and development outcomes for communities.

- Being aware of local politics, and social sensitivities such as concept fatigue and resistance. It may be necessary to use different terminology with different stakeholders in the same project.
- Managing the trade-offs that may be inevitable between working at scale and localised ownership.

Lessons learned from CMP experience: Land tenure

Land tenure issues were also raised by CMP members, particularly the importance of understanding who has decision making authority, ensuring local support of communities and decision makers, and who owns, or has a direct say over land and other resources. When NbS are located on public lands, expert advice may not always be incorporated into decision-making as recommended and efforts are required to influence processes and adaptively manage outcomes.

Lessons learned from CMP experience: Human rights, justice, and inclusion

CMP practitioners were concerned to ensure that safeguarding and ensuring human rights, and benefits to communities, are at the heart of NbS project design. This includes effective engagement of Indigenous peoples with their FPIC, and the ethical use of Indigenous and Traditional knowledge. Justice, equity and inclusion should be key considerations. There is a need to look at whose voice is marginalised when you frame something as NbS. For example, who isn't included in crafting the concept?

Being aware of the emerging issues of 'carbon colonialism' and 'carbon corruption' was also identified as important. There is some concern about inappropriate partnerships with governments and the private sector and that can lead to "green-washing" and tarnish those involved in genuine attempts to use NbS appropriately.

NbS is an opportunity to build confidence

NbS is seen as an opportunity to unite around a common approach with explicit criteria and indicators to measure multiple co-benefits for the first time.

> *"We need to show confidence in the approach, and through that we will get resources, and through recourses we will get collaboration, and through collaboration we will get more impact on the ground. We have to get away from debating terminology and we have to get away from talking about ourselves all the time. We are in a crisis, and NbS is a call to action - I look at it as a call to action, it has been carefully developed, it has not been rushed and pulled out of thin air, we need to get on with it, we need government to put money into it and government needs integrated policy and targets."*

Evaluating the impact of NbS

Many CMP practitioners said that it is still too early to know the impact of NbS projects, due to their long-term nature or because monitoring systems were previously not set up to measure co-benefits. However, major studies and meta-analysis of the impacts of NbS have begun appearing in the past few years. These studies show that NbS tend to have positive impacts on societal challenges such as climate change, development, as well as biodiversity conservation, and are cost-effective in comparison with largely technologically driven and grey infrastructure approaches. However there remain major gaps and biases in the evidence (e.g., more evidence from the Global North than the Global South).

Choosing the right indicators – measuring impact and co-benefits

The CMP practitioners actively using the Standard identified the indicator framework as a key difference between NbS and previous approaches such as EbA. CMP members expressed approval of the process that was undertaken to create the IUCN criteria, indicators, and self-assessment tool – indicating that it was thorough and based on expert advice. Practitioners not using the Standard tended to have the scientific and organisational capacity to develop their own indicators and monitoring systems. There was agreement that quantifying the additional benefits to communities/society is needed for maintaining the momentum of the acceptance and mainstreaming of integrated and cross-sector approaches. The need for 'early wins' was raised, as learning/engagement opportunities with stakeholders and as stepping-stones to long term goals.

Rapidly expanding evidence base

The Nature-based Solutions Initiative (University of Oxford) provides a comprehensive on-line data base and other resources on NbS, including analysis of the evidence based for effectiveness of NbS based on a review of hundreds of published studies. Using the NbS Evidence platform it is possible to:

1. Explore evidence on how effective different nature-based interventions are for addressing climate change impacts.
2. Compare social, economic, and ecological effects of different nature-based interventions.
3. Filter by region, country, ecosystem type, intervention type, or type of outcome.
4. Generate maps, graphs and download data.
5. Directly link from science to national climate policy.

For example, considering 108 published studies involving all intervention types where ecological outcomes were reported, 77 (71%) showed positive outcomes and only 4 (3.7%) showed negative outcomes. Outcomes in the remaining examples were either mixed, unclear, or had no-effect. Of those examples showing positive ecological outcomes, 26 (34%) were a combination of intervention types and 22 (28%) were restoration interventions.

The following is a selection of recent studies that also evaluate the impact of NbS.

- Kuhle and Boyle (2021) examined evidence from 15 projects in UNDP's Latin America and Caribbean project portfolio to assess what data UNDP-supported projects are currently collecting on the benefits and costs of NbS. The analysis found that projects are reporting a range of benefits of NbS, but there are important gaps in data collection which means the full value (and costs) of NbS are not being captured.
- The European Commission initiated an evaluation program in 2019 and has published a comprehensive handbook on evaluating NbS in the European context, together with six sectoral reports valorising the impacts of EU-funded projects in the area of NBS[8].
- Chausson et al. (2020) produced *"the first global systematic map of evidence on the effectiveness of nature-based interventions for addressing the impacts of climate change and hydrometeorological hazards on people."*. The study found that most of the interventions in natural or semi-natural ecosystems were reported to have ameliorated adverse climate impacts. Nature-based interventions were most often shown to be as effective or more so than alternative interventions for addressing climate impacts, although gaps and biases in the evidence were acknowledged.

[8] https://ec.europa.eu/research/environment/index.cfm?pg=nbs.

- Seddon et al. (2020) reviewed the contribution being made by NbS toward meeting Nationally Determined Contributions (NDCs) under the Paris Climate Agreement and concluded that NbS are key to meeting global goals for climate and biodiversity. Appendix 2 shows the examples of how NbS approaches helped countries to achieve NDCs through a variety of mechanisms.
- Using the framework of NbS, Roe et al (2021) conducted a review into the relationship between a wide range of nature-based interventions (including protection, management, restoration, and harnessing nature for food production) and human development outcomes. The study targeted low and lower-middle income countries to explore evidence that nature-based interventions can deliver tangible development outcomes for local people, including jobs, food security, empowerment, as well as resilience to climate change. Overall, the study found a wealth of evidence that investments in nature can be a 'win-win' for biodiversity and development and where different types of development outcomes strengthen each other. However, the report also states:

  "We also found evidence of trade-offs: between stakeholders, between development outcomes, and between biodiversity and development objectives. And we found very little reported evidence of investments in nature resulting in a change in poverty status — although it may be that the datasets we used did not cover this issue comprehensively. For the few studies we did find, some found poverty was alleviated or reduced, but a similarly small number reported that it was exacerbated".

Cost benefit comparisons of NbS with non-NbS approaches

Although it is too early to judge whether NbS are a cost-effective approach compared to non-NbS approaches over the long term, this question is being investigated by several institutions, notably including the European Commission, UNDP, WWF, IUCN, and the Nature-based Solutions Initiative (University of Oxford), among others.

In a policy briefing note[9] The Nature-based Solutions Initiative summarised an extensive analysis conducted by the Royal Society[10] of the relative costs and benefits of NbS approaches for building community resilience against extreme weather. The study compared an NbS approach (ecosystem-based adaptation), with hybrid and engineered approaches to reducing risk from extreme weather events (coastal and riverine flooding, heatwaves, drought). The study compared the effectiveness of each option (encompassing both the magnitude and spatial of the event and against which the intervention can be effective) versus its affordability (initial costs and long-term to 2050).

The analysis showed that engineered approaches have immediate, measurable impacts and are particularly effective in reducing the impacts of specific hazards over the short-term. However, they are expensive and deliver few, if any, co-benefits. NbS approaches in contrast provided a wide range of ecosystem services and offer protection from multiple hazards, which is important as hazards seldom occur in isolation. The study also concluded that, in contrast to engineered approaches, NbS also involve and benefit local people, can be more adaptive to new conditions, and are less likely to create a false sense of security. However, NbS are also less effective in the short-term, can require large areas of land and may rely on ecosystems that are also vulnerable to climate change over time.

[9] http://www.naturebasedsolutionsinitiative.org/wp-content/uploads/2018/06/AreNBSeffective.pdf
[10] https://royalsociety.org/about-us/

Hybrid approaches were found to be intermediate in terms of effectiveness and affordability but may bring positive additional consequences. Overall, hybrid approaches were found to have the most positive consequences and are slightly more beneficial for all the factors considered in the assessment.

A study of the economic rationale for investment in NbS for freshwater ecosystems in Europe (van Wesenbeeck et. al. 2021) also found that hybrid approaches, combined with non-structural interventions, were the '*most likely to result in strategies that meet multiple management objectives in a cost-effective manner'* in this context, including providing ongoing employment. The authors found that most cost effectiveness evidence is related only to flood mitigation, with further research needed on other ecosystem services, and a lack of monitoring data on many projects.

In a major analysis of the NbS approach as applied to cities, the European Commission concluded that "*biodiverse NbS are highly adaptable to effectively respond to changing local conditions and are often more cost and resource efficient than purely technological approaches (EC, 2015)*[11]*."*

Lessons learned from CMP experience: Monitoring and evaluation

Some CMP member interviewees reported that is it "too early to tell" the cost effectiveness of their NbS activities and agreed that more monitoring data is needed. There is a high level of agreement on the need for monitoring and evaluation to improve practices and build the evidence base for NbS, and, for allocating sufficient resources to monitoring and evaluation. Having a strong monitoring system allows for early detection and a rapid response to problems and unintended consequences, but also the ability to capture benefits early. Effective monitoring and evaluation will also build confidence in the use of NbS by building the evidence-base and allow for the identification of interventions that are inappropriate or ineffective in a particular context. It was recommended that NbS projects include strong metrics for biodiversity conservation, or risk focusing too narrowly on financial results or carbon credits. Conversely, it was also recommended that too broad a focus may lead to 'scope creep', dilution of effort or reduced overall impact.

Policy application of NbS and the enabling environment

Evidence from NbS is being used to inform policy making on a range of issues, notably climate change adaptation (e.g., Seddon 2020, Hou-Jones et al. 2021, WWF 2021), ecosystem-based adaptation and climate related disaster reduction (e.g., United Nations Environment[12]).

Governments and NGOs are turning to NbS to inform a range of policy debates and to overcome challenges to the implementation of NbS at scale. WWF, for example, published a report in 2021[13] that *"proposes a systemic enabling framework to effectively implement, scale up and mainstream nature-based solutions".* WWF focussed on three categories of structural barriers to implementing effective ecosystem-based approaches – sociocultural, institutional, and economic. They present a set of policy levers that are available to decision-makers to overcome these barriers, organised around three overarching categories of systemic enablers: inclusive governance, smart planning and progressive economic and financial regulation. WWF proposes that action in these three areas represents an important step towards an integrated whole-of-government approach to social and economic policy, which is *"the most effective way to power nature-based solutions."* The 10 Chapters of the report each address a specific issue relating to NbS, such as Indigenous people and local communities, financing, and the use of indicators. With the use of case studies from across the world,

[11] EC (2015). Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities. Final Report of the Horizon 2020 Expert Group on 'Nature-Based Solutions and Re-Naturing Cities'. European Commission.

[12] https://www.unep.org/explore-topics/disasters-conflicts/what-we-do/disaster-risk-reduction/ecosystem-based-disaster-risk

[13] Pérez-Cirera, V., Cornelius, S. and Zapata, J. Powering Nature: Creating the Conditions to Enable Nature-based Solutions. WWF. 2021.

the report presents recommendations for overcoming barriers to the implementation of effective NbS.

An IUCN report found that NbS projects were not large enough in scale, that the NbS approach was insufficiently integrated into policy, and that more collaborative NbS projects were needed for increased efficiency (Cohen-Shacham, 2019). There was a high level of recognition among CMP interviewees that government capacity and policy integration are a key enabling factor for NbS to be quickly scaled up globally. Some countries are already NbS champions – they recognise the value already, are supportive of the concept and are more willing to share results (although change of government or policy is still a risk). It is not clear what the most effective approach is for quickly building the capacity of governments, particularly in developing nations and at subnational and local levels. Both capacity building and training needs to be targeted and specific, considering how many types of NbS projects are available, with a focus on ensuring consistency in approach against the Standard.

For sustainable change, governing bodies must have the capacity to maintain implementation of NbS over the long-term, including developing the required policy frameworks and, ideally, formalised targets for biodiversity and ecosystem health. For most governments there is an urgent need to have training for decision makers, and to identity focal points/champions. While environment ministries are the obvious starting point, all ministries need to be engaged on NbS for the necessary scaling of implementation across all sectors. Where governments still work in silos - facilitating cooperation and demonstrating effective collaboration is an important step towards a more whole of government/holistic approach.

Lessons learned from CMP experience - creating an enabling policy environment

The CMP experts recommended focusing on the following areas:

- Capacity building and training for key decision makers, to enable codesign;
- Integrating long-term thinking into policy and regulatory frameworks;
- Formalised targets for biodiversity and ecosystem health;
- Breaking down silos to enable a more whole of government approach; and
- Cross-organisation and cross sector collaboration to avoid duplication/confusion.

Constructing an NbS Theory of Change

The European Commission Handbook (2021) addresses the usefulness of developing a Theory of Change when developing interventions based on NbS, particularly in the process of developing an impact evaluation plan and provides several examples. Figure 5 is a simplified example of a Theory of Change from the EC Handbook. Appendix 6 shows a generic high-level NbS Theory of Change and sample Theories of Change from existing NbS activities.

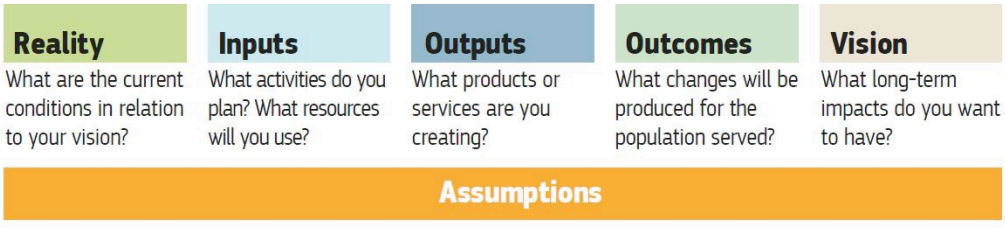

Figure 5: A simplified Theory of Change (Source European Commission 2021).

The EC Handbook provides guidance on constructing a Theory of Change for NbS interventions and states that:

> *"The development of a theory of change enables planners and decision-makers to establish a clear relationship between key local context challenges, strategic objectives and the actions through which these will be reached, and fosters clear identification and reflection on the linkages, or pathways, between them. Developing a good theory of change takes time, but this effort will pay off in subsequent stages of monitoring and evaluation planning, by saving considerable time and money, through the anticipation and mitigation of errors."*

To be consistent with the NbS Standard, it is recommended that the eight criteria are applied throughout the Theory of Change at the relevant stage(s). For example, *Criterion 1: NbS effectively address societal challenges* is critical to establishing the ultimate Intervention Goal of the NbS project. The remaining seven criteria can all be used to check that the Theory of Change meets all the criteria at the intermediate Outcome Levels and the Intervention/Activity levels developed for the NbS project.

Recommendations for further research and exploration

Recommendation 1: There is a need for ongoing learning within the conservation sector to process NbS developments.

The speed of change is extremely fast, particularly around private sector investment and a rapidly expanding evidence base. For example, it would be valuable to understand the developments in best practice finance mechanisms, and the barriers to investment from a private sector perspective as well as how NbS is being used to scale outcomes to drive a nature positive, net zero emissions world. Valid concerns were raised about the need for the conservation sector to adapt more quickly, and to build expertise in high quality NbS design, including communities of practice and learning from each other's experiences. It would also be useful to understand how the development sector is embracing NbS and whether benefits are different to those through environment sector led projects. Cross learnings in this regard would also be very useful.

Recommendation 2: There is an urgent need for coordination and collaboration between practitioners and between donors.

Valid concerns were raised about the risk of duplication due to rapid expansion in supply of funding, particularly around the UNFCCC COP26. New grant facilities, investment opportunities and projects will continue, and potentially accelerate, as the economic case for NbS is strengthened and both countries and the private sector increase their climate ambitions. Greatest concern was for developing countries with high mitigation potential and low government capacity, particularly at the subnational and local level. Exploration on how to best coordinate funding into regions such as the Pacific and other areas with small island developing states is needed to determine how best to manage the interest and priorities of donors with local capacity to reduce duplication, improve collaboration and minimise capacity burdens on governments and local communities.

Recommendation 3: A consistent approach to complex, place-based projects.

A lot of projects are just starting, or are being retrofitted to an NbS framework, and the indicators are not set up to measure co-benefits. As the economic case for investing in NbS is still developing, it was the view of some CMP members that it is still 'too early to tell' and that value of co-benefits will make the difference for future investment. As project implementation ramps up around the world, there is

an urgent need to enable the emerging practical knowledge to inform best practice. For example, by facilitating knowledge sharing between practitioners, establishment of technical working groups or producing locally relevant and contextualised technical guidance based current evidence and the IUCN Global Standard. A community of practice within the CCNet and CMP communities could be established to address this.

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Appendix 1. A summary of the NbS criteria and guidance for users with case-study examples.

(Source: IUCN 2020. Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS. First edition. Gland, Switzerland: IUCN. https://doi.org/10.2305/IUCN.CH.2020.08.en).)

NbS Criteria	Guidance for users	Examples
Criterion 1: NbS effectively address societal challenges	The purpose of this Criterion is to ensure that the NbS is designed as a response to a societal challenge(s) that has been identified as a priority by those who are or will be directly affected by the challenge(s). All stakeholders, especially rights holders and beneficiaries of the NbS, must be involved in the decision-making process used for identifying the priority challenge(s) (Criterion 5).	**Climate change impacts on agriculture: Senegal.** Senegal faces tangible risks from climate change and disasters. Climate change impacts are characterised mostly by erratic rainfall events driving soil salinisation and degradation and contributing to the risks to agricultural productivity and economic development posed by drought and desertification. Using the Promoting Local Innovations method, the community members defined their societal challenges as disaster risks, food security and ecosystem degradation. While, initially, the project design had a strong focus on climate change adaptation and disaster risk reduction, following the community planning process, project managers redesigned activities to include all the challenges identified. Sustainable agricultural practices and strengthening the local resilience of people and nature to floods and the impacts of land salinisation were the resulting NbS solutions, co-designed with the communities and collaboratively implemented by all stakeholders involved in the consultation process. Making the project priorities more inclusive of local needs was relatively simple and yielded co-benefits like soil rehabilitation, biodiversity gains and higher food crop yields. Ref: Monty, F., Murti, R., Miththapala, S. and Buyck, C. (eds). (2017). Ecosystems protecting infrastructure and communities: lessons learned and guidelines for implementation. Gland, Switzerland: IUCN. https://doi.org/10.2305/IUCN.

NbS Criteria	Guidance for users	Examples
Criterion 2: Design of NbS is informed by scale	The purpose of this Criterion is to encourage NbS designs that recognise the complexity and uncertainty that occur in living dynamic land/seascapes. Scale applies not only to the biophysical or geographic perspective but also to the influence of economic systems, policy frameworks and the importance of cultural perspectives. NbS design will be informed by what stakeholders know about the interactions between different aspects of a land/seascape using a three-scale framework that considers the parts within the land/seascape; the land/seascape itself; and the wider environment around the land/seascape. One example would be households within villages within a local authority area. Understanding the interactions which affect attributes like cultural values, laws, soils, forests and water are important in this regard, as they are relevant to the assessment of the risk of undesirable change, or the probability of creating desirable change. NbS design seeks to maintain the productive capacity of ecosystems as well as the	**The benefits of Natural Infrastructure: Kenya.** Through applied research under the WISE-UP to Climate project, the results demonstrated that natural infrastructure is a vital national asset that supports livelihoods, sustains economic development and helps climate change adaptation in the Tana basin (95,000 km^2), Kenya. A simulation model for the Tana basin system was developed to investigate the impacts of changing the operation of existing built infrastructure, of adding new infrastructure (e.g., the Northern Water Collector Tunnel, the High Grand Falls Dam, large new irrigation schemes near the Tana Delta) or of investing more in natural infrastructure. To achieve this, natural infrastructure benefits were recognised and valued, including: the seasonal fish catch across the floodplain, flood recession agriculture, reservoir fisheries, estuary fisheries, floodplain cattle grazing, and sediment transport through the delta to the coast. On average, they accrue to more than US$ 170 million per year, mainly to subsistence smallholder farmers and pastoralists in the lower Tana basin. The removal or degradation of these benefits risk further heightening tensions over land and water resources in the lower basin. Natural infrastructure in the Tana basin also benefits the provision of water and biodiversity related services derived from current built water infrastructure worth on average US$ 139 million a year. The cascade of dams in the Tana basin provides significant economic benefits: in terms of electricity sales of at least US$ 128 million a year and from irrigation, US$ 9 million a year. The basin provides 65% of the national electricity needs through hydropower, and nearly all of Nairobi's domestic water supply for 4 million people. WISE-UP results show that scaling-up current investments in natural infrastructure in the upper catchment, such as those being undertaken by the Nairobi Water Fund, would likely further improve dam performance and safeguard benefits even in the face of future climate change. Ref: http://www.waterandnature.org/sites/default/files/wise_up_nibi_final_infographic.pdf

NbS Criteria	Guidance for users	Examples
	production of benefits necessary for human well-being.	
Criterion 3: NbS result in a net gain to biodiversity and ecosystem integrity	NbS are derived as goods and services from ecosystems, therefore strongly depend on the health of an ecosystem. Biodiversity loss and ecosystem change can have significant impacts on the functioning and integrity of the system. Therefore, NbS design and implementation must avoid undermining the integrity of the system and instead, proactively seek to enhance the functionality and connectivity of the ecosystem. Doing so can also ensure the long-term resilience and durability of the NbS.	**Coastal re-alignment and biodiversity: United Kingdom** After 50 years of learning from traditional responses such as levees and seawalls, the United Kingdom is changing its approach in how it deals with coastal flooding and storms. The Medmerry project is one such large-scale managed realignment of coastal protection infrastructure, which combines the use of natural coastal vegetation as physical protection with the realignment of engineered infrastructure to retreat and move the coastline inland. This lets the waters further inland yet reduces the risks of flooding of neighbouring towns, while the surrendered land is increasingly becoming a biodiversity habitat for many species. The initiative has involved systematic and repeated scientific studies to generate the lessons learnt from the failure of engineered infrastructure and the costs associated with losses from the impact of natural hazards, as well as the knowledge and experience of local stakeholders including 360 residents or property owners, many of them coastal farmers. The realignment initiative is co-managed by the government and local stakeholders with a strong commitment to inform ongoing implementation from other such experiments and experiences. Ref: Thomas, A. Medmerry Coastal Realignment: Success for People and Wildlife. (RSPB, unpublished). Pethick, J. (2002). Estuarine and tidal wetland restoration in the United Kingdom: policy versus practice. Restoration Ecology 10: 431–437. https://doi.org/10.1046/j.1526-100X.2002.01033.x
Criterion 4: NbS are economically viable	The return on investment, the efficiency and effectiveness of the intervention, and equity in the distribution of benefits and costs are key determinants of success for an NbS. This	**Coastal ecosystem management and climate change: Barbados.** The potential economic loss in Barbados from climate risks may rise to US$ 279 million per annum by 2030, considering an estimated additional US$ 84 million in potential average yearly loss generated by the increase in asset accumulation because of economic

NbS Criteria	Guidance for users	Examples
	Criterion requires that sufficient consideration is given to the economic viability of the intervention, both at the design stage and through monitoring the implementation. For NbS to be sustainable, there must be strong consideration of the economic aspects as, most likely, long-term gains must be balanced against short-term costs, with short-term actions developed within the context of long-term (over generations) goals and plans. If the economic feasibility is not adequately addressed, NbS run the risk of being short-term projects, where, after closing, the solution and benefits provided cease to exist, potentially leaving the landscape and communities worse off than before. Innovative and evidence-based tools for the valuation of nature, along with ideas for NbS contributions to markets and jobs, encourage creative (blended) financing of NbS, thereby increasing the likelihood of their long-term success.	development during that period. Additionally, a high climate change scenario featuring rising sea levels, more severe hurricanes and land subsidence adds another US$ 56 million for a total amount of US$ 279 million expected annual losses by 2030. Overall, expected loss as a proportion of GDP could rise to between 2% and 9% in the high climate change scenario by 2030. Barbados could cost-effectively avoid more than a third of expected losses by implementing risk mitigation initiatives such as beach nourishment and reef and mangrove revivals. Protecting the Folkestone Marine Park on the west coast of Barbados and ensuring reef and mangrove revivals can lower losses by US$ 20 million annually for an annual cost of only US$ 1 million. Additional benefits are natural restoration and habitat rebuilding, together with ecotourism attractions. In addition, mangrove forests trap sediment therefore reducing erosion and may withstand waves of 5 to 7 m or higher. However, mangrove revival in Folkestone Marine Park not only requires financial resources, but also a cultural shift – mangroves are currently viewed as a nuisance because they are mosquito breeding grounds, have an unpleasant smell, and block access to the sea. Early efforts to cultivate mangroves may be wiped out in storms until the mangroves have become established. Finally, the full effectiveness of mangroves for damage reduction requires mature mangrove forest. Mueller, L. and Bresch, D. (2014). 'Economics of climate adaptation in Barbados – Facts for decision making'. In: R. Murti and C. Buyk (eds.), Safe Havens: Protected Areas for Disaster Risk Reduction and Climate Change Adaptation, pp.15-21. Gland, Switzerland: IUCN. https://portals.iucn.org/library/node/44887
Criterion 5: NbS are based on inclusive, transparent and	This criterion requires that NbS acknowledge, involve, and respond to the concerns of a variety of stakeholders, especially rights holders. Good governance arrangements are	**Collaborative planning and implementation of urban NbS: Belgium** Urban planners need to be open to collaborative governance mechanisms when planning and implementing NbS in cities.

NbS Criteria	Guidance for users	Examples
empowering governance processes	proven to not only reduce an intervention's sustainability risks, but also to enhance its social 'license to operate'. Conversely inadequate governance provision for otherwise well-intended actions can adversely affect the legitimacy of benefit and cost sharing arrangements. At a minimum, NbS must adhere to and align with the prevailing legal and regulatory provisions, being clear on where legal responsibilities and liabilities lie. However, as often is the case with natural resources, basic compliance will need to be complemented with ancillary mechanisms that actively engage and empower local communities and other affected stakeholders.	This not only involves processes that include different actors in the design and execution, but also considerations of establishing new institutions for operationalising and enabling NbS in the long term. In Antwerp, a 'dreaming' exercise in 2017 for a green corridor to connect different NbS for water security, involved authorities and citizens of the district of Sint Andries. This was used to co-create and initiate an experiment on identifying spaces for introducing different NbS solutions for water retention, such as bioswales, vegetated ditches with porous bottoms. People with different backgrounds, qualifications and knowledge systems were included and their visual and verbal inputs were collected in the process. This shared narrative and vision of NbS has triggered changes in the way citizens perceived local institutions and led to strong NbS ownership amongst actors. Through the analysis of cases such as Sint Andries, collaborative governance versus investor driven governance has been identified as one of seven critical factors in the successful implementation of NbS in cities. Ref: IUCN 2020.
Criterion 6: NbS equitably balance trade-offs between achievement of their primary goal(s) and the continued provision of multiple benefits	Trade-offs in land and natural resource management is inevitable. Ecosystems provide a wealth of different benefits and not everyone values each of them in the same way. While trade-offs cannot be avoided, they can be effectively and equitably managed. This Criterion requires that NbS proponents acknowledge these trade-offs and follow a fair, transparent and inclusive process to balance	**Food security and fish conservation: Bangladesh** In Bangladesh, where the livelihoods of 11% of the population depend on fisheries, the hilsa fish is one of the country's main staple foods, contributing 1% to the country's GDP in 2016. Hilsa populations declined dramatically in the 1990s, threatening the livelihoods of three million fishers. The main drivers of this species decline were identified to be overfishing and habitat degradation. To address the main societal challenges of food security and socio-economic development, the Hilsa Fisheries Management Action Plan was put in place in 2003, which included establishing sanctuary sites for nurseries and spawning, implementing a temporary annual fishing ban to allow population recovery, and enforcing the Protection and Conservation of Fish Act. Simultaneously, after assessing trade-offs and to address the

NbS Criteria	Guidance for users	Examples
	and manage them over both time and geographic space. This involves a credible assessment, full disclosure and agreement among the most affected stakeholders on how the trade-offs should be addressed. Fair and transparent negotiation of trade-offs and compensation among potentially affected parties for any damages or trade-offs to local opportunities and livelihoods provides the basis for successful long-term NbS outcomes. Critically, it is important to recognise that trade-offs have social and ecological limits beyond which point certain values or benefits can be lost in perpetuity. This means that safeguards will be necessary to ensure, *inter alia*, that the integrity of ecosystems and the long-term stabilising properties of ecosystem services are not exceeded.	costs associated with the ban, a payment for ecosystem services scheme was set up, providing affected fisher communities with rice in return for not fishing in affected areas. Over time, as fish populations grew, this increased the availability of food and income from catch, providing additional co-benefits such as better human health by providing more cash to buy medicine and increased resilience to climate change. There were, however, unexpected negative consequences and knowledge gaps: fisheries were not recovering as quickly as anticipated, lack of protein in the diets of those most affected and fishers being forced to seek loans during the fishing bans. Trade-offs varied greatly across affected stakeholders. The benefits and costs were dependent on such aspects as where in the supply chain of fisheries one was, whether fishers were upstream or downstream of intense fishing areas, and how close one was to sanctuary sites. Short-term costs, such as the drop in fish prices when fish flooded the market, were felt to outweigh long-term benefits. A re-assessment of trade-offs supplied the knowledge needed to alter compensation and increase support and access to microfinance. As a result, the fishers were incentivised to cooperate to protect the hilsa voluntarily. Ref: Reid, H. and Ali, L. (2019). Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy: Research results from the Incentive-based Hilsa Conservation Programme, Bangladesh. London, UK: IIED. http://pubs.iied.org/17625IIED
Criterion 7: NbS are managed adaptively, based on evidence	This Criterion requires that NbS implementation plans include provisions to enable adaptive management as a response to uncertainty and as an option to effectively harness ecosystem resilience. A degree of uncertainty is inherent when managing most ecosystems due to their	**Forest restoration, Tanzania** Shinyanga, in northwest Tanzania and south of Lake Victoria, supports over 2.25 million people in an area of just 50,000 km2. High population densities have exacerbated serious problems of land clearing and degradation. A national restoration initiative (HASHI) started in 1985 involving the planting of exotic trees. Over 1 million exotic seedlings from one centralised tree nursery were distributed to about 700 villages. However, this met with little success, in some part due to the villagers' lack of

NbS Criteria	Guidance for users	Examples
	complex, dynamic and self-organising nature. This also means that ecosystems have greater resilience which confers a wider range of options to respond to unanticipated social, economic or climate events. The foundation of adaptive management is the evidence-base provided by regular monitoring and evaluation, drawing on scientific understanding as well as Indigenous, traditional and local knowledge. By proactively adopting an adaptive management approach, the NbS can continue to be relevant through the lifecycle of the intervention and the risk of redundancy and stranded investments minimised.	ownership of the project. Through adaptive management, a more participatory approach was taken, a choice pivotal to long-term success. Local villagers did not want "HASHI trees" but their (mostly indigenous) trees. Top-down approaches failed as HASHI did not involve local people and their institutions. Building the local capacities of villagers and working with the people and their traditional institutions to re-design restoration efforts became new priorities. The ingredients for successful forest restoration came together by respecting formal and informal local institutions. By 2004, over 300,000 ha were restored, valued at US$14 per person per month. Nearly every family had restored areas. Landless people and female-headed households were allocated land, and groups and villages had larger restored areas. HASHI adopted pioneering participatory approaches to replace the top-down processes. From one centrally managed government tree nursery in 1986 and a region referred to as the 'desert' of Tanzania, over 1,000 small community and individual tree nurseries had been established by 2004 with over 300,000 ha of restored woodland. Additionally, HASHI was a process that began as a project, became a programme and then a movement from about 1986 to the present (35 years) by maintaining its relevance through adaptive management responses. Barrow, E. (2014). '300,000 Hectares Restored in Shinyanga, Tanzania — but what did it really take to achieve this restoration?'. SAPIENS 7(2). https://journals.openedition.org/sapiens/1542
Criterion 8: NbS are sustainable and mainstreamed within an appropriate	This Criterion requires that NbS interventions are designed and managed with a view to long-term sustainability and that they take account of, work with and align with sectoral, national and other policy frameworks.	**Landscape Restoration, El Salvador** El Salvador has pledged to restore 1 million hectares of land by 2030, through a Bonn Challenge commitment. In December 2018, a total of 122,093 hectares are under restoration via 227 restoration projects, using Forest Landscape Restoration (FLR). The associated benefits include direct

NbS Criteria	Guidance for users	Examples
jurisdictional context	There are various approaches to mainstreaming NbS; however, all rely on strategic communications and outreach. Audiences to consider include individuals (e.g., the public, academics), institutions (e.g., national government, start-ups, businesses, and organisations) and global networks (e.g., Sustainable Development Goals, Paris Agreement).	and indirect jobs, estimated emissions reductions of 3,647,060 tCO2e, and approximately 32,812ha restored in protected areas or key biodiversity areas (KBAs), to reverse biodiversity loss. FLR directly contributes to 10 different national policies, plans and strategies of El Salvador and actions are facilitated through the country's National Ecosystem and Landscape Restoration Programme, which seeks synergies amongst the 10 policies, etc. to mobilise action at scale (time and space). Entities such as the Cabinet for Environmental Sustainability and Vulnerability as well as the National Council for Environmental Sustainability and Vulnerability serve as mechanisms for coordination, learning, adaptive management and importantly, for institutionalising FLR as an NbS for climate change impacts. The FLR target is part of the country's national commitment to the UNFCCC (National Action Plan for Climate Change). Dave, R., Saint-Laurent, C., Murray, L., Antunes Daldegan, G., Brouwer, R., de Mattos Scaramuzza, C.A., Raes, L., Simonit, S., Catapan, M., García Contreras, G. et al. (2019). Second Bonn Challenge progress report. Application of the Barometer in 2018. Gland, Switzerland, IUCN. https://doi.org/10.2305/IUCN.CH.2019.06.en

Appendix 2. Examples of countries using NbS to meet climate adaptation goals (from Seddon 2020).

Climate Change adaptation outcome obtained from NbS	**Examples of the NbS approach (from Seddon 2020).**
Protection from soil erosion	**Ethiopia:** Farmer-managed natural regeneration of 2728 ha of degraded native forests with living tree stumps in Humbo reduced soil erosion and flash flooding and increased groundwater recharge, which was associated with higher crop productivity. In 2006–2036, the project will remove an estimated ~870,000 tonnes of CO2 equivalent, while diversifying livelihoods (Brown et al., 2011). **China:** A combination of afforestation, reforestation and conservation of existing natural forests over 25 years in the Poyang Lake basin halved heavy soil erosion while increasing net carbon sequestration five-fold and net income for local farmers six-fold (Huang et al., 2012). Meanwhile, restoration of natural herbaceous and shrubland vegetation on the Loess Plateau reduced soil erosion to a comparable or significantly greater extent than low-diversity tree plantations across a range of soil erosion indices. Compared to afforested slopes, these naturally re-vegetated slopes also had 1.3–2.0 times higher soil water content (Jia et al., 2017).
Protection from inland flooding	**Europe:** Restoration of all but one of six rivers reduced flood damage and was associated with increased agricultural production, carbon sequestration and recreation, with a net societal economic benefit over unrestored rivers of €1400 ± 600. Interventions included floodplain re-wetting, restoration of riparian vegetation, assisting upstream fish migration and the re-meandering and re-connection of channels (Vermaat et al., 2016). **Canada:** Reforestation in the headwaters of a river basin significantly reduced peak stream flows compared to an adjacent deforested basin, offering greater protection against flooding during spring snow melt (Buttle, 2011). **USA:** Natural regeneration of mixed-species hardwood watersheds following forest clear-cutting reduced flood risk in lowland areas, reducing stream flows during periods of high precipitation by >104 L/ha/day (Kelly et al., 2016).

Buffering natural resources against drier and more variable climates	**Panama:** Agroforestry systems yield up to 21% higher economic returns than farm mosaic approaches (i.e., where trees and crops are on separate parcels), including under a climate change scenario of more frequent droughts, in models that account for market and climate uncertainty (Paul et al., 2017). **Europe:** Agroforestry has reduced erosion, increased soil fertility, increased precipitation and reduced temperatures, with greatest effects in hotter, drier regions such as the Mediterranean basin (which is suffering from soil damage through increasing aridity under climate change) (Torralba et al., 2016).
Protection from coastal hazards and sea-level rise	**Global:** Natural coastal habitats significantly reduce wave heights, with coral reefs and salt marshes being most effective, causing a reduction of 70%, followed by seagrass and kelp beds (36%) and mangroves (31%). Across 52 sites harnessing these habitats in coastal defence projects, nature-based solutions were two to five times more cost-effective at lowering wave heights and at increasing water depths compared to engineered structures (Narayan et al., 2016). Globally, mangroves protect 15 million people from flooding every year and provide over US$65 billion in flood protection services (Menendez et al., 2020). **Gulf of Mexico:** Construction of 'living shorelines' by aiding the natural recruitment of oyster reefs can reduce vegetation retreat by 40% compared to unprotected sites, stabilizing the shoreline from the effects of waves and erosion and increasing the abundance and diversity of economically important species (Scyphers et al., 2011).
Moderating urban heatwaves and heat island effects	**Global:** Green spaces are on average 0.94°C cooler in the day than urban spaces, with stronger effects the larger the green space, according to a meta-analysis of 47 studies comparing the cooling effects of green spaces in cities (parks, areas with trees) with those of purely urban areas (Bowler et al., 2010).
Managing storm-water and flooding in urban areas	**Italy:** The establishment of wetlands and green recreational space has been effective at reducing flood risks, with a 10% higher reduction of downstream flooding and 7.5% higher reduction of peak flow compared to potential grey infrastructure alternatives. Nature-based solutions also outperform grey infrastructure in terms of water purification and provide greater social-ecological benefits such as recreation and habitat for biodiversity (Liquete et al., 2016).

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Appendix 3. Resources/Further reading

Theory of Change

- Climate Analytics guide for the use of Theory of Change in Climate-adaptation projects link
- Constructing Theories of Change for Ecosystem-Based Adaptation Projects | A Guidance Document *Conservation International (2013)* link

IUCN Global Standard

- NBS Group Website link
- IUCN Guidance Documents link
- Recording of the official launch event link
- Synopsis of the IUCN consultation process for the development of the standard link
- IUCN Standard Self-assessment sheet link

Case Studies

- The Urban Nature Atlas. A collection of more than 1000 inspiring nature-based solutions from European cities and beyond link
- UNEP NbS Contributions Platform link
- Urban NbS UNEP link

EU – European Commission

- Evaluating the impact of NbS: A handbook for practitioners link
- Evaluating the impact of NbS: Appendix of methods link

University of Oxford Nature Based Solutions Initiative

- NbS Evidence Platform link
- NbS Guidelines link
- Getting the message right on NbS link

WWF

- Bankable Nature Solutions link
- Beyond cardon credits: A blueprint for high quality interventions link
- Economic rationale of NBS in freshwater ecosystems link

TNC

- The Playbook for Climate Action link
- The Playbook for Climate Finance link

Appendix 4. Interviewee Details

Name	Title/Position	Organisation	Date
Sanja Pokrajac	Senior Freshwater Expert, Nature-based Solutions Coordinator	WWF – Living European Rivers Initiative	18/10/21
Lisa Ernoul	Research Scientist - Management and restoration of Natural and Agricultural Ecosystems Theme Manager	Tour du Valat	11/10/21
Peter Skidmore	Senior Program Manager – Colorado River Initiative (previously freshwater Program Director for TNC)	The Walton Family Foundation	21/9/21
Christian Nielsen	Executive Director	Live & Learn International	15/10/21
Merinda-Lee Hassall	Senior Policy Advisor	New Zealand Ministry of Foreign Affairs and Trade	5/11/21
Nat Burke	Senior Manager, Social Development	WWF Australia	26/10/21
Robert McDonald	Lead Scientist, Nature-Based Solutions	TNC (The Nature Conservancy)	23/9/21
Catherine Fitzgerald	Strategy Analyst, Natural Climate Solutions	TNC (The Nature Conservancy)	19/10/21
Rachel Pasternack	Senior Advisor, Natural Climate Solutions	TNC (The Nature Conservancy)	19/10/21

Appendix 5. Interview Guiding Questions

NBS Theory

1. How much experience have you had with NBS?
2. In your opinion, what is the main difference between NBS and past approaches?
3. Why did you adopt NBS? What was the most challenging aspect of transition?
4. What are the benefits (or not) of framing something as NBS?
5. How did you talk to your stakeholders/donors/partners about NBS?
6. Are you using the IUCN NBS standard? Other?

Practice

7. How has NBS changed your on-ground approach?
8. How have you used NBS to deal with the key issues of your project?
9. Have you seen benefits delivered? Large or small scale? Sustainable?
10. Under what conditions do NBS tend to work or not work? Where are the weaknesses with this approach?

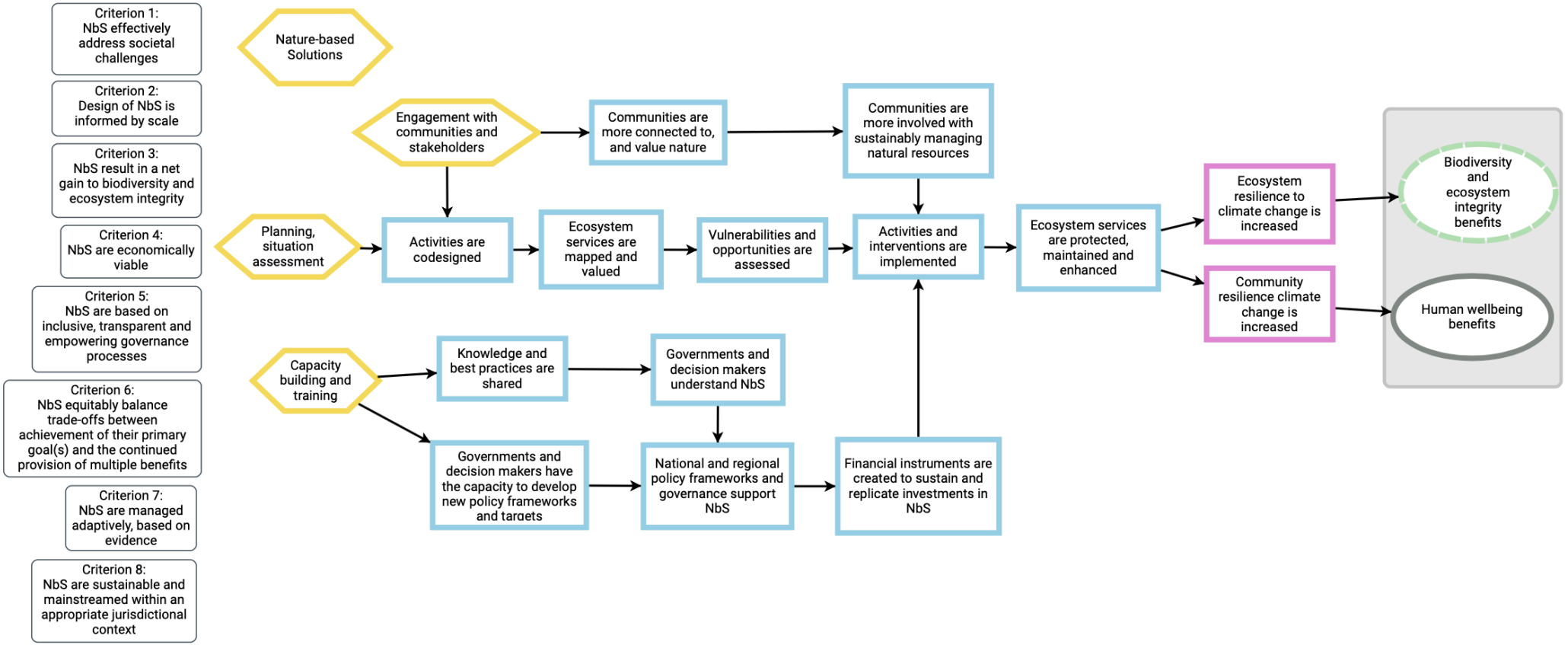
Cost-benefit analysis

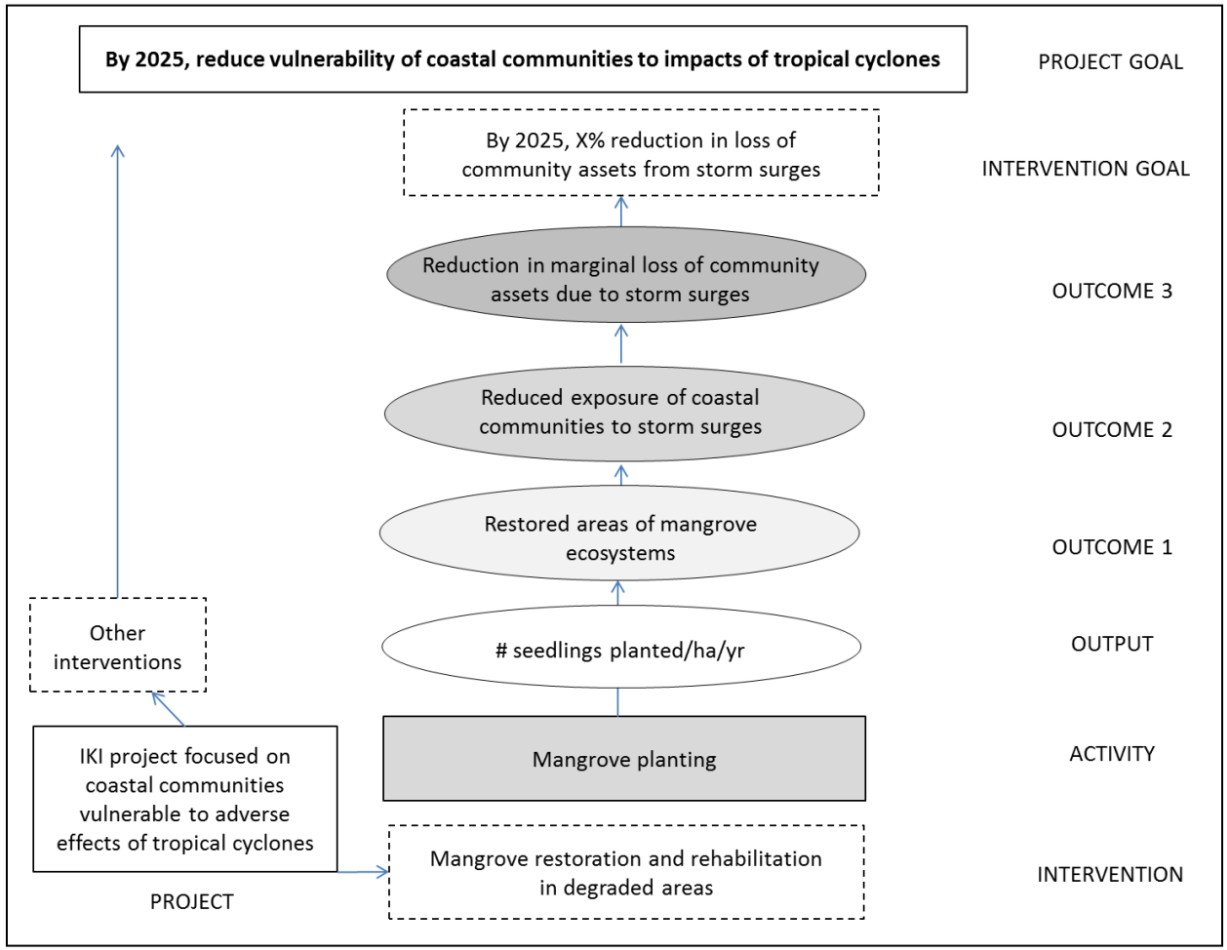
11. Do you think that NBS are more cost efficient and cost-effective approach for addressing societal challenges than alternative approaches (for example, an alternative to grey infrastructure in watershed management)? If so, how?
12. What factors impact cost efficiency or cost effectiveness?

Theory of Change

13. What are your lessons learned for using / implementing NBS?
14. What are the enabling conditions or activities needed for success?

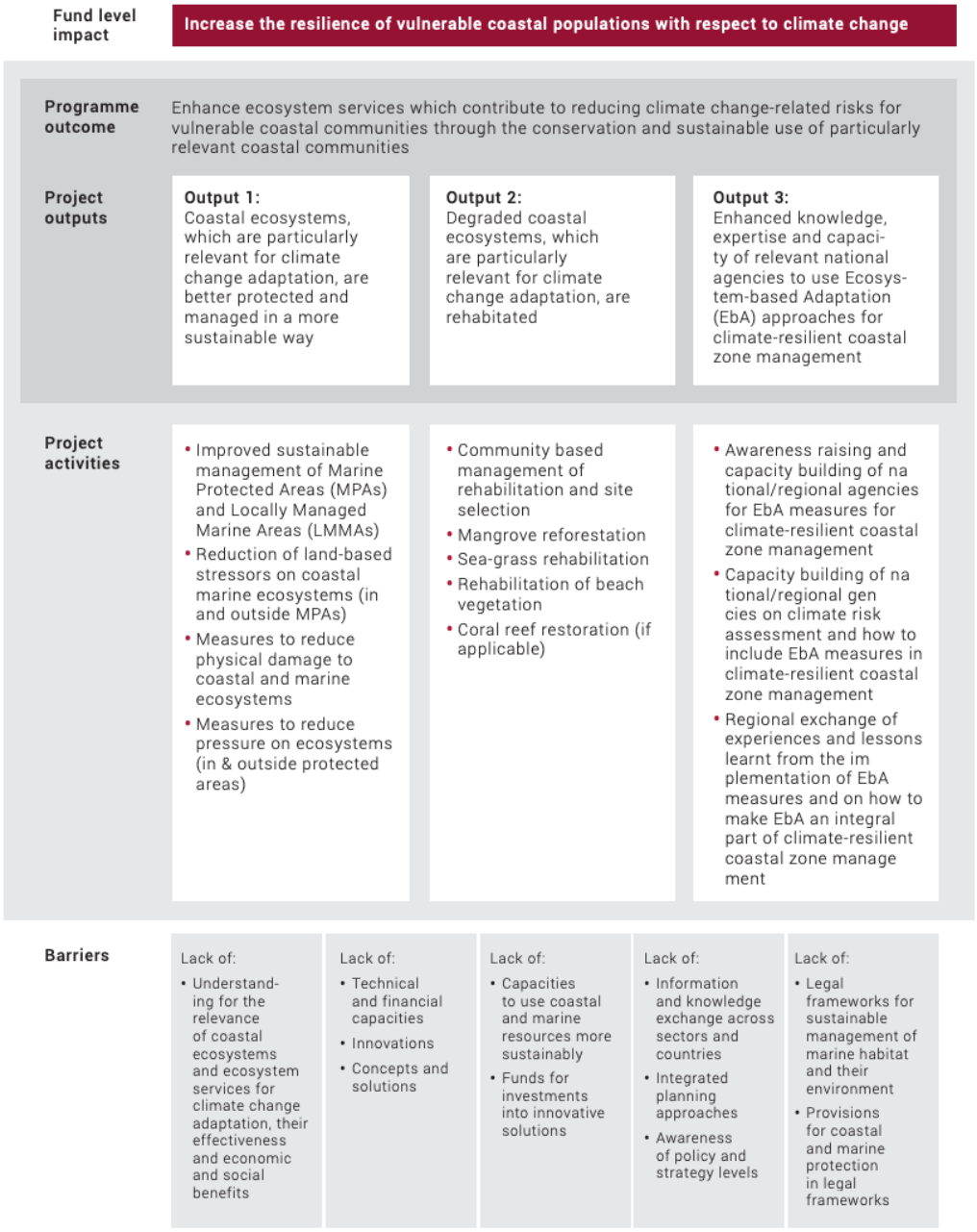
Appendix 6. A High-level Generic NbS Theory of Change





Sample Theory of Change, for an IKI EbA project in the Philippines from the Conservation International Theory of Change Guidance Document.

Conservation International and The Betty and Gordon Moore Center for Ecosystem Science and Economics (2013) "Constructing Theories of Change for Ecosystem-Based Adaptation Projects: A Guidance Document" *Available at* https://www.conservation.org/docs/default-source/publication-pdfs/constructing-theories-of-change-for-ecosystem-based-adaptation.pdf?Status=Master&sfvrsn=1fd83348_3



Sample Theory of Change, for a KfW Ecosystem Based Adaptation Programme in the Western Indian Ocean, from the GCF Funding Proposal Toolkit 2020.

Fayolle, V. and Dhanjal, M. (2020) Green Climate Fund Proposal Toolkit 2020. London: Acclimatise and Climate and Development Knowledge Network. Available at https://cdkn.org/wp-content/uploads/2020/07/GCF-Funding-Proposal-Toolkit-2020.pdf