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NATURE-BASED SOLUTIONS AND THE GEF
A STAP ADVISORY DOCUMENT

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1. Introduction

The GEF has a strong record of tackling the world's most pressing environmental challenges. Nature-based Solutions (NbS) are defined by IUCN 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." The former CEO of the GEF asked STAP to help with an analysis of lessons learned from the GEF portfolio to develop guidance for future GEF projects.

NbS have gained increasing visibility and support in recent years (particularly at the September 2019 Climate Summit) as a cost-effective measure to support climate change mitigation and adaptation while simultaneously addressing land degradation and biodiversity loss. By some estimates, NbS (or natural climate solutions) can provide over one third of the cost-effective climate mitigation needed between now and 2030 to help stabilize warming at about 2°C, achieving nature's mitigation potential of 10-12 gigatons of CO2 per year[1].

2020 was meant to be the 'Year of Biodiversity' and 2021 may be. The clarion call is loud and clear – nature is in crisis, as we are losing species at a rate 1,000 times greater than at any other time in recorded human history and 1 million species face extinction[2]. NbS will be discussed at the upcoming Conference of the Parties to the Convention on Biological Diversity, the IUCN's World Conservation Congress, the UN Climate Change Conference, and many other key events. The COVID-19 pandemic has highlighted the inextricable links between intact ecosystems and human well-being, and the current 'imbalance'. There cannot be resilient futures without nature-based solutions that focus on protecting, managing, and restoring ecosystems and the services they provide. The White Paper on a GEF COVID-19 response strategy considers how NbS can be integrated into the overall GEF portfolio. The World Economic Forum report concludes[3] that as we build back economies after COVID, "There is ample evidence that adopting green stimulus measures can generate even more effective economic and employment growth and build more resilient societies by aligning the global economy with planetary boundaries".

This paper identifies research and practitioner needs that will advance the field of NbS going forward, and suggests a brief checklist that GEF could employ to improve consideration of NbS in projects over the short term. These conclusions are based on:

- a review of some of the recent literature on NbS;
- an analysis of 30 GEF NbS projects; similar analyses by the Wildlife Conservation Society (WCS) and The Gordon and Betty Moore Foundation of their NbS projects; and
- a virtual workshop[4] of 40 experts from philanthropy, academia, NGOs, GEF Secretariat and agencies, and STAP, held in conjunction with WCS and the Moore Foundation.

[1] Griscom, et al., 2017 PNAS https://www.pnas.org/content/pnas/early/2017/10/11/1710465114.full.pdf and Griscom, et al., 2020 Philosophical Transactions of the Royal Society https://royalsocietypublishing.org/doi/10.1098/rstb.2019.0126

[2] IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages. https://doi.org/10.5281/zenodo.3553579

[3] http://www3.weforum.org/docs/WEF_The_Future_Of_Nature_And_Business_2020.pdf

[4] https://stapgef.org/sites/default/files/documents/FINAL%20NbS%20workshop%20summary-September4.pdf

2. What does the science say?

In the past decade, the rubric of Nature-based Solutions (NbS) has gained traction in global environmental agreements and the research literature, from 2008 where the phrase was in the title (but never actually used in the text) of a major World Bank report (MacKinnon et al., 2008) on its biodiversity and climate change portfolio, to being a key strategy of the IUCN and increasingly cited in the Convention on Biological Diversity (CBD), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the GEF. Whilst the simple idea of NbS as "working with and enhancing nature to help address societal challenges" (Seddon et al., 2020) is intuitive, the research literature continues to probe the scope and limits of the idea. STAP reviewed[5] eight recent, synthetic papers about NbS to summarise the current state of play relevant to a GEF context. This is a selective update to identify some key issues that are well-agreed, as well as some that are still contentious: it is not, however, a comprehensive literature review. Since beginning STAP's work, the 2020 update of the IUCN Global Standard for NbS and Guidance have been published[6].

Definitions

The NbS framework emerged from the Ecosystem Approach, which underpins the CBD and considers biodiversity conservation and human well-being to be dependent on functioning and resilient natural ecosystems (CBD, 2004). With 168 signatory nations to the CBD, the Ecosystem Approach has helped to shape the current conservation and natural resource management agenda (Cohen-Shacham et al., 2019). Cohen-Shacham et al. (2019) show how NbS broadly encompass a variety of other approaches to biodiversity and nature conservation, notably ecological restoration, ecological engineering, forest landscape restoration, ecosystem-based adaptation, ecosystem-based mitigation, climate adaptation services, ecosystem-based disaster risk reduction, natural infrastructure, green infrastructure, ecosystem-based management, and area-based conservation (Figure 1), and notably excluding approaches related to biomimicry, that is, the creation of interventions inspired by, but not based on nature.

[5] https://stapgef.org/sites/default/files/documents/NBS%20review%202020-05-15final.pdf

[6] https://www.iucn.org/theme/nature-based-solutions/resources/iucn-global-standard-nbs and https://www.iucn.org/resources/issues-briefs/ensuring-effective-nature-based-solutions. The guidance is at: https://portals.iucn.org/library/sites/library/files/documents/2020-021-En.pdf

Figure 1: a conceptual representation of how NbS acts as an umbrella for five categories of approach according to Cohen-Shacham et al. (2019).

Key principles and attributes

Cohen-Shacham et al. (2019) list eight principles that IUCN identified as underpinning an NbS approach:

1. *NbS embrace nature conservation norms (and principles)*. However, they note, while NbS embrace nature conservation, not all conservation actions necessarily qualify as an NbS (Watson et al., 2014)
2. *NbS can be implemented alone or in an integrated manner with other solutions to societal challenges (e.g., technological and engineering solutions)*
3. *NbS are determined by site-specific natural and cultural contexts that include traditional, local, and scientific knowledge*
4. *NbS produce societal benefits in a fair and equitable way in a manner that promotes transparency and broad participation*
5. *NbS maintain biological and cultural diversity and the ability of ecosystems to evolve over time*
6. *NbS are applied at a landscape scale*, taken to mean large spatial areas, such as watersheds or large forests, which usually combine several ecosystems (agricultural, inland waters, coastal, forest, etc.), and which might in some cases, be transboundary
7. *NbS recognize and address the trade-offs between the production of a few immediate economic benefits for development and future options for the production of the full range of ecosystem services*
8. *NbS are an integral part of the overall design of policies, and measures or actions, to address a specific challenge*.

STAP compares these 8 principles with key principles from other approaches for which NbS may be an umbrella and finds that the NbS framework goes beyond the other approaches in integrating other types of solutions, matching the scale of the solution to the scale of the problem, and having an explicit focus on integrating NbS in policy and actions. However, NbS is weaker than various of the other approaches in considering: adaptive management and governance; effectiveness of an intervention; change and uncertainty; multi-stakeholder participation; and clarifying the appropriate (especially longer) timeframes over which success should be determined (Cohen-Shacham et al., 2019: Table 3). (Multi-stakeholder participation and long-term durability are notably also major concerns for the GEF, on which STAP has produced papers[7].)

Scope and strength

The IUCN definition of NbS, like the simpler one cited by Seddon et al. (2020) above, emphasises that NbS should be implemented in such a way as to support both biodiversity and people. Despite this agreement, the examples and genres of NbS represented in the papers vary considerably as to how they treat this balance; this highlights the risk of NbS as a concept becoming all things to all people and consequently losing any definitional value, as 'sustainability' or 'resilience' often have. Most of the ideas have emerged from the biodiversity and conservation community, seeking to focus attention on an undervalued sector. Even the title, nature-based solutions, emphasises nature in service to social outcomes rather than an equal partnership.

This tension is recognised in the papers reviewed. For example, Roberts et al. (2020) press for higher environmental protection targets globally, arguing that these will contribute to many other benefits; but these arguments are more rhetorical than quantified and certainly not in an operationalizable form. Griscom et al. (2020), focusing on 'natural climate solutions', geographically disaggregates the cost-effective benefits for a net reduction of carbon dioxide (CO_2) emissions from NbS interventions. This is a valuable decision support analysis (see below), but, as they acknowledge, it does not account for many of the potential ecosystem services benefits. Furthermore, it classifies interventions under the IUCN's categories of 'protect, manage, restore'. Even neutral outcomes for nature must be defended from leakage in other geographies (cf. the issue of leakage under Land Degradation Neutrality, see below).

Wamsler et al. (2020) and Hobbie and Grimm (2020) address nature-based adaptation as a form of NbS in urban environments; both papers note diverse approaches, but Wamsler et al. (2020) question how to ensure these address 'deep leverage points' (*sensu* Meadows, 2010) rather than incremental benefits, and Hobbie and Grimm (2020) note the need to determine whether NbS can match the scale of the challenge. They provide plenty of examples of locally valuable nature-based adaptation interventions in cities, but only some of these meet the scale of adaptation challenges, most do not really meet the global scale of mitigation challenges or of biodiversity loss. Whilst providing habitat to species in cities may have local direct value to humans, it will rarely make inroads on the loss of endangered species or large-scale restoration of nature. Of course, this may not always be true – Smolders et al. (2020) provide an example where, at least in its final incarnation, a flood control plan addressed both flood surge protection and the restoration of marshes: where such habitats provide migration stepping stones, they could genuinely be of global biodiversity significance, which highlights the importance of context.

In summary though, whilst there is nothing wrong in achieving good societal outcomes with low global biodiversity benefits from street trees in cities or carbon sequestration in monoculture forestry in appropriate places, **for NbS to retain meaning as a true "co-benefits" intervention it should be seen as**

[7] https://www.stapgef.org/multi-stakeholder-dialogue and https://www.stapgef.org/achieving-enduring-outcomes-gef-investment

delivering significant global benefits to nature, especially in the context of GEF investments. This suggests the need for a conceptual model that makes the balance between benefits to humans and to nature more explicit.

Significantly, the 8 IUCN principles are reiterated and amplified in the updated IUCN 2020 paper. The revised IUCN guidelines add a greater emphasis on thinking across scales, achieving a 'net gain' to biodiversity and ecosystem services, ensuring that proposed solutions are economically viable, and employing adaptive management guided by monitoring and evaluation[8]. These are all characteristics that STAP encourages GEF to pursue, as well, and many have been previously described as 'enabling elements' of sound GEF projects[9].

Figure 2[10] compares **what is 'weak' NbS (lower left part of the graph) as opposed to 'strong' NbS (upper right), and to encourage the GEF to push projects towards the upper right of this figure**.

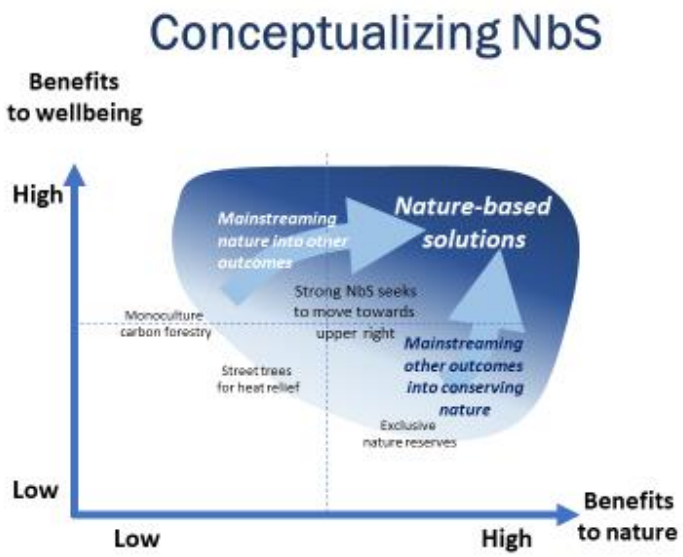

Figure 2: conceptualising the balance between (global) benefits to nature compared to (global) benefits to human wellbeing from NbS interventions. The NbS becomes stronger (in the sense of genuine co-benefits) towards the upper right-hand quadrant. Some examples of interventions which are perfectly legitimate in context – but weak in NbS terms – are provided in the other quadrants. (STAP, 2020)

[8] https://www.iucn.org/theme/nature-based-solutions/resources/iucn-global-standard-nbs
[9] https://stapgef.org/sites/default/files/publications/STAP%20Report%20on%20integration.pdf
[10] https://www.stapgef.org/sites/default/files/documents/Nature-based%20Solutions%20and%20the%20GEF-05-18-20-RB.pdf

3. GEF's experience with NbS

To examine how NbS principles have been implemented in practice by GEF projects, STAP, with graduate students from the University of Maryland and the University of Michigan, reviewed 30[11] out of a set of 50 completed and ongoing GEF projects identified by the GEF Secretariat as containing strong NbS components. The goal was to determine what lessons could be learned which could usefully inform future GEF investment in NbS.

Students examined CEO endorsements, mid-term and terminal evaluations (if available) against a set of questions to assess the extent to which projects had adequately addressed issues identified in the literature review, for example, trade-offs, and the balance between nature and societal benefits. This exercise also looked at important underlying design issues that STAP had previously identified as important enabling elements for the long-term success of projects. Appendix A summarizes the results and gives some examples of exemplary focal area projects, multi-focal area projects, and child projects of Integrated Approach Pilots (IAPs).

The most recent GEF projects (initiated after 2015, notably IAP child projects) paid more attention to these elements, including a theory of change, multi-stakeholder processes, and behavioral change (at the top-down or institutional level, as well as at the individual level), durability, and scalability.

Throughout the analysis it was clear that there were a number of persistent NbS challenges, which were also highlighted in the peer-reviewed literature:

- Most projects were generally stronger in describing the environmental components of nature-based solutions, than the **societal challenges**[12] being addressed, and were written from the GEF's perspective, because they were proposals for GEF funding, i.e. as if they were environmental projects, per se. The starting point of a nature-based solution is (or should be) "what is the societal problem to which nature can contribute?". A clear understanding of both and the links between them are important in developing a good theory of change.

- In GEF projects, societal benefits are regarded as **co-benefits**, and less prominent than global environmental benefits which are the GEF's mandate. Co-benefits are not usually specified in much detail and include local environmental benefits, for example, air, and water quality, as well as socio-economic benefits, such as health, and livelihoods.

- All projects refer to synergies, but few address **trade-offs** which were rarely considered, nor were explanations consistently provided on how these trade-offs had been resolved or managed.

- **Better recognition and balance between short and long-term** (e.g. intergenerational) **benefits** is needed. Benefits need to endure well beyond the timeframe of a project and be resilient to the effects of climate change.

[11] The 30 projects covered in depth included 8 types of NbS across all the GEF focal areas, except chemicals and waste, multi-focal area projects, and child projects under the Integrated Approach Pilot (IAP) programs. The 8 NbS types were: agroforestry, area-based conservation, biodiversity, ecosystem-based management, integrated coastal zone management, integrated water resource management, restoration and rehabilitation, and sustainable land management.

[12] The IUCN global standards identify the following societal challenges: climate change adaptation and mitigation; disaster risk reduction; ecosystem degradation, and biodiversity loss; food security; health; social and economic development; and water security.

- **Monitoring and evaluation** were more common in recent NbS projects, with much reporting on the numbers of people or species or hectares, but relatively little on why something worked or didn't, i.e. learning that could help advise on future best practices was missing. And, adaptive management was usually not mentioned.

There were also some consistent gaps in including important **enabling conditions that STAP has encouraged**:

Climate risk was recognized by many projects, but few had fully screened for the risk, and/or identified mitigation measures.

All projects referred to some sort of **multi-stakeholder dialogue**, but these were sometimes top-heavy with government and other official bodies seeming to dominate, and it was not always clear what were the roles and responsibilities of different stakeholders. Involvement from the bottom up and involvement of indigenous groups was less consistent.

All the projects expected **behavior change**, either at the individual level or at the institutional level. However, this was usually implicit, and not often stated as an explicit project objective. The outcome being sought was clear, as was whose behavior needed to change, but how this was to be achieved was not explained.)

Durability[13] and scalability were often mentioned as desirable, but sometimes without much information about how these were to be achieved.

In addition to this review of GEF NbS projects, the STAP workshop also considered reviews of NbS projects implemented by the Wildlife Conservation Society, and by The Gordon and Betty Moore Foundation that highlighted some of the same issues which arose in GEF projects – see Boxes 1 and 2.

Box 1: Review of Wildlife Conservation Society (WCS) NbS projects[14]

A review by WCS of 50 climate-focused NbS projects completed between 2015 – 2019 indicated that the three most common approaches were protection (37%), adaptation (31%), and resource management (24%), with a small number on restoration. The majority of the projects were focused on forest ecosystems, a third on marine systems, and a small number on montane ecosystems. The most common project elements were capacity building, policy change, and research and analysis. More than half of the projects included stakeholder engagement with local communities, about a third with local governments, and about 20% with indigenous peoples.

The WCS Climate Adaptation Fund contributes small amounts of funding to NGO projects focused on Ecosystem Function, Wildlife, and/or Social issues. Over 140 projects have been completed to date, and advances have been achieved in capacity building, innovation, mainstreaming, and policy reform. Criteria include that the projects are designed for long-term conservation impact, there is potential for impact at a landscape scale, they are grounded in the best available science, and conduct on-the-ground implementation (not research, planning, or tool development).

[13] https://stapgef.org/achieving-enduring-outcomes-gef-investment
[14] https://stapgef.org/sites/default/files/documents/WCS-NbS-GEF%20presentation%202020_v8.pdf

The overall conclusions from WCS's analyses included:

- mainstreaming climate NbS in policy is still a work in progress;
- the portfolio addresses multiple societal challenges beyond climate, specifically food security and economic development;
- there is a notable lack of climate NbS projects linked to health;
- Indigenous People and Local Communities (IPLCs) play a critical role;
- more comprehensive review and post-project interrogation is needed;
- many projects were initially focused on conservation; and
- the development of best practices for NbS would help to improve their impact on societal benefits.

Box 2: Review of The Gordon and Betty Moore Foundation NbS projects from two initiatives[15]

Moore analysed the relationship between interventions to deliver the benefits of NbS in biodiversity, food security, climate change, water security, human health, disaster risk, and social and economic development, organized by NbS categories, i.e. restorative, issue-specific (nature-based enterprises), infrastructure, management, and protection.

The goal of the **Andes-Amazon Initiative (AAI)** is to secure the biodiversity conservation and climate function of the Amazon basin, through the effective management of a core set of protected areas and their surroundings, as well as putting conditions in place for infrastructure development that safeguards the durability of protected areas, and long-term, basin-wide forest cover and free-flowing rivers. The Theory of Change is that communities will protect biodiversity more effectively when they are involved in managing their natural resources.

Key findings included:

- the strongest direct NbS benefits were in biodiversity, social/economic development, water, and climate;
- evidence indicates consolidated management increases biodiversity conservation;
- community resource management requires enabling conditions and recognition of the trade-offs between the interests of diverse stakeholders; strong policy/land tenure environment can support community effectiveness;
- NbS can provide a framework to help conceptualize 'projects' beyond the local scale for long-lasting integration into development models and economies.

The goal of the **Conservation and Markets Initiative (CMI)** is to decouple food production from Ecosystem Degradation. The Theory of Change is that the private sector will reduce natural resource use and limit expansion/habitat conversion when they can generate increased economic returns and deliver nature benefits. Key findings from a case study with shrimp farming concluded:

- sustainable intensification can generate an economic return for the private sector while also delivering nature benefits.
- however, cultural norms and entrenched behaviors can limit uptake.

A case study looking at Cerrado Soy, with jurisdictional sourcing approaches developed through a multi-stakeholder process, demonstrated:

- that enabling conditions for companies to engage in NBS is useful if the country where the production is occurring has a supportive policy.
- simultaneous economic, nature, and social benefits are not guaranteed when using supply chain interventions, and tradeoffs may need to be made.
- nonetheless, implementation of supply chain interventions has the potential to contribute to **scaling** NbS

[15] https://stapgef.org/sites/default/files/documents/Moore%20CMI%20Slides%202020-05-18.pdf and https://stapgef.org/sites/default/files/documents/Moore%20NbS%20Presentation_MAdeney_May2020.pdf

The STAP/WCS/Moore workshop also discussed three key questions: How can NbS projects balance the interests of nature and people? What are the barriers to implementing and scaling NbS? And, how can NbS be made operational in design, execution, and management?

The two-day workshop reached the following 9 conclusions about needed advances to improve both the practice of NbS and begin to quantify impacts. Some of these are in the research realm, and some in the development realm, and many require inputs from both worlds. These conclusions lay out an important agenda for NbS work going forward for practitioners, academia, business, and NGOs. GEF has an important role to play in furthering NbS.

1. The extant community of practice needs to be expanded to include leaders in the fields of health, infrastructure, planners, and the private sector.

2. The evidence base (admittedly still accumulating) should be tailored into actionable information for the different user communities – so that NbS is presented in language and terms that are relevant to the field of the practitioners, from engineers to ecologists to business to development agencies.

3. More case studies and better metrics for characterising the successes and failures, co-benefits, synergies, and trade-offs need to be developed.

4. There is much monitoring of 'numbers' (such as people or hectares), but evaluation of what works, doesn't work, and why, are required so that more learning takes place. (There may be different – or even opposite – outcomes across spatial, temporal, and sectoral scales.)

5. For NbS to be considered on an equal footing with other options, it is important to improve the quantification of the costs, and the benefits over both the short and the long-term, and, in particular, the benefits and co-benefits need to be better monetised.

6. There is a clear role for Natural Capital Accounting and "inclusive growth" concepts to be integrated into regional, national, and local planning efforts. NbS can be modular, flexible, and resilient to future shocks (such as climate change, extreme events, etc.) and could provide win-win solutions.

7. NbS should include options that the policymakers and the community embrace, so stakeholder engagement from the top-down and bottom-up in the design of actions and goals was essential. In many cases, there is a role for mesoscale or boundary organizations to help achieve coherence in options chosen across scales or jurisdictions.

8. NbS would benefit from more involvement of social and behavioral science to help design innovations that are wanted and acceptable to stakeholders, and to help with appropriate training and capacity building so that outcomes are more likely to be maintained and durable.

9. Scaling up the impact of NbS to achieve transformational change is urgent and the development community needs 'best practices' and 'lessons learned' to be collected and shared.

Ultimately, mainstreaming NbS or "conserving nature while enabling economic and social development that increases equity and ends poverty"[16] is an aspirational goal. The GEF defines **biodiversity mainstreaming** as, "the process of embedding biodiversity considerations into policies, strategies, and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved and sustainably used both locally and globally". NbS mainstreaming, like biodiversity mainstreaming, is intended to recognise and address the synergies and trade-offs between economic development and the maintenance of ecosystem integrity and to highlight the potential role of biodiversity in delivering developmental outcomes in ways that are also ecologically sustainable. In many ways, NbS can be considered examples of biodiversity mainstreaming in practice, with the caveat that they may be intended as responses to specific challenges (climate change, food security, etc.) rather than the broader mainstreaming objective of integrating biodiversity into established economic and production sectors. Box 3 provides details of STAP's advice on mainstreaming biodiversity, and its recent work on developing 'causal pathways' for mainstreaming biodiversity theories of change.

Box 3: Mainstreaming biodiversity

STAP has a long history of advising on biodiversity mainstreaming. STAP's 2004 advice on biodiversity mainstreaming[17] including several principles and conditions for effective mainstreaming: strong leadership dialogue and cooperation at all levels (multi-stakeholder dialogue)[18]; mutual supportiveness and respect between biodiversity and development goals (synergies and tradeoffs); a strong focus on economic sectors supported by cross-sectoral approaches (integration)[19]; analysis and understanding of changing motivations and opportunities in each sector (systems thinking)[20]; and sustained behavioral change of individuals, institutions, society, and public and private sector, as well measurable behavioral outcomes (behavior change)[21].

STAP's 2014 guidance on Mainstreaming Biodiversity in Practice[22] recommended that GEF projects on this subject should develop clear theories of change (ToCs) for achieving the intended impacts through mainstreaming. It further recommended that project designers: develop common indicators and measurement approaches that furnish data to test these hypotheses implicit in the ToCs; design project monitoring and evaluation (M&E) systems to align with the overall mainstreaming logical framework and standard indicators; and invest adequately in evaluation, synthesis, and publication to ensure that data are translated effectively into insight, learning, and progressive improvement. These recommendations remain valid and relevant.

[16] https://www.nature.com/articles/s41559-019-1022-z?proof=trueHere
[17] Peterson, C. and B. Huntley (2005). Mainstreaming Biodiversity in Production Landscapes. The Global Environment Facility. Washington, DC.
[18] Ratner, B.D. and M. Stafford Smith (2020). Multi-stakeholder dialogue for transformational change. Scientific and Technical Advisory Panel to the Global Environment Facility. Washington, DC.
[19] Bierbaum, R. *et al.* (2018). Integration: to solve complex environmental problems. Scientific and Technical Advisory Panel to the Global Environment Facility. Washington, DC.
[20] O'Connell, D., Abel, N., Grigg, N., Maru, Y., Butler, J., Cowie, A., Stone-Jovicich, S., Walker, B., Wise, R., Ruhweza, A., Pearson, L., Ryan, P., and M. Stafford Smith. (2016). "Designing projects in a rapidly changing world: Guidelines for embedding resilience, adaptation and transformation into sustainable development projects. (Version 1.0)." Global Environment Facility, Washington, D.C.
[21] Behavior change https://stapgef.org/why-behavior-change-matters-gef-and-what-do-about-it
[22] Huntley, B.J. and Redford, K.H. (2014). 'Mainstreaming biodiversity in Practice: a STAP advisory document'. Global Environment Facility, Washington, DC.

In 2016, **the GEF Secretariat developed a biodiversity mainstreaming theory of change (TOC)[23], drawing on STAP's 2014 advice**. Its analysis of GEF biodiversity projects[24] concluded that future projects should demonstrate how proposed activities would lead to the project's intermediate outcomes and expected impacts. In 2018, a review by the **Independent Evaluation Office (IEO) validated the GEF's ToC** but noted that it had not been systematically applied[25]. The IEO concluded that while this generalized ToC could be used as a reference**, project-specific ToCs would be needed in order to reflect complex contextual conditions and dynamic feedback loops.**

In 2020, STAP commissioned a literature review[26] to look for theories of change developed over the last five years, either in general or in specific contexts. Beyond the GEF-endorsed theory of change, this did not reveal any clearly articulated generic theory of change for biodiversity mainstreaming. However, there were some examples of approximate theories of change for: spatial and land use plans; sustainable production systems; policy, valuation of biodiversity and ecosystem services; and policy, regulatory, and planning reform. A review of GEF biodiversity mainstreaming projects[27] found that some had developed an explicit theory of change at some point during the project process (7 out of 21). Others had an implied theory of change in the narrative description of the project strategy, risks, and assumptions, but did not explicitly use the term.

STAP's paper on Developing Causal Pathways for Biodiversity Mainstreaming Projects[28] provides additional guidance on logical pathways for land use planning; producer and stakeholder capacity building for sustainable production practices; mobilizing financial flows to support biodiversity conservation; and reform, development, and implementation of policy and regulatory frameworks. The paper also illustrates the key lessons for constructing a theory of change set out in the STAP Primer[29].

4. Key NbS issues for the GEF and the broader development community

A. The societal challenge, and striking a balance with nature

The IUCN defines NbS as a solution to a societal challenge[30] to which nature can contribute, which places the emphasis in favour of society, whereas the GEF's objective is to maximise global environmental benefits; this creates a potential conflict and could be read as implying that trade-offs should be resolved in favor of society.

How should the GEF's strike a balance between nature and society? Or, should the GEF take credit for any socio-economic benefits which might arise, subject to this not diminishing global environmental benefits?

[23] Biodiversity Mainstreaming in Practice: A Review of GEF Experience. (2016). The Global Environment Facility. Washington, DC.
[24] Biodiversity Mainstreaming in Practice: A Review of GEF Experience. (2016). The Global Environment Facility. Washington, DC.
[25] Evaluation of GEF Support to Mainstreaming Biodiversity. (2019). Evaluation Report No. 134. GEF IEO. Washington, DC.
[26] Smith J, Bass S and Roe D (2020) Biodiversity Mainstreaming: A review of current theory and practice. IIED, London.
[27] Smith J, Bass S and Roe D (2020) Biodiversity Mainstreaming in Global Environment Facility projects: A review of current practice. IIED, London
[28] Nature-bases Solutions and the GEF
[29] Theory of Change Primer: A STAP Document. December 2019. Washington, DC.
[30] The IUCN criteria identify the following societal challenges: climate change adaptation and mitigation; disaster risk reduction; ecosystem degradation, and biodiversity loss; food security; health; social and economic development; and water security.

In practice, GEF sample NbS projects were usually weaker on describing societal challenges and stronger on nature, because the GEF seeks to fund only the additional environmental benefits and not the societal elements. It follows that global environmental benefits were better specified and enumerated than socio-economic benefits. And, projects usually reported only synergies, i.e. trade-offs were not addressed.

The GEF seeks, as a matter of policy, co-financing ratios of 5:1 for LDCs, and 7:1 for SIDS and MDCs. There is a risk that the GEF's investment in environmental benefits may not always be additional. (In the sample of 50 NbS projects the GEF had invested $377 million, and co-financing was an additional $2.7 billion.) Additionality requires that GEF not fund commitments that ought to be fulfilled in other ways, either because countries are supposed to be committed to them anyway (e.g. protecting uncleared forest), or by paying for things the private sector was going to do anyway. There was relatively little discussion of this in the GEF sample of NbS projects.

B. Defining and quantifying co-benefits

A consistent strand of concern in the scientific papers reviewed on NbS was the need to quantify co-benefits, particularly to the extent that these can be made bankable for market-based sources of finance. This included the lack of rigorous assessment of the potential of NbS to deliver intended benefits, the need for accurate and comprehensive cost-benefit analyses of NbS, and a robust evidence base. STAP's review of the GEF NbS projects had a similar problem with co-benefits.

The Global Commission on Adaptation (GCA)[31] included examples of projects where there are clear co-benefits that could be monetized, including:

- Farmer-led reforestation in the Maradi and Zinder regions of Niger, which has boosted crop yields, improved soil fertility, and lifted communities out of poverty. Tree cover has soared ten-fold and the daily time spent gathering firewood—a task that mainly falls to women—has dropped from 3 hours to 30 minutes.

- In the Demak district, on the northern coast of Java, Indonesia, diverse stakeholders have restored a 20-km belt of coastal mangroves, introduced sustainable aquaculture, and reduced groundwater extraction. The resulting increased protection from coastal flooding and improved aquaculture productivity have increased resilience for 70,000 people, with additional carbon storage, biodiversity, and fisheries benefits.

There remain challenges in even measuring effectiveness, meaning that it is very hard to mobilise private finance. This is a class of actions that are important now but have long payback times, where it is hard to aggregate value to pay a return, and where success is fundamentally about the absence of something bad happening.

Two consequences follow from this. First, the benefits of GEF investments may be under-reported which means that there are higher returns than those for which the GEF receives credit; and second, it is much more difficult to make sensible and informed trade-offs between benefits of different types.

[31] https://gca.org/global-commission-on-adaptation/report

C. Trade-offs

Some GEF investments may be win-win, with benefits for both nature and society in balance, and neither nature nor society foregoing any benefits, i.e. both are maximized. However, it would be foolish to claim that this is everywhere the norm.

Very few of the GEF sample NbS projects identified trade-offs, there were many references to synergies and co-benefits, but clearly, for example, in agricultural production landscapes, it is unlikely that biodiversity benefits and agricultural output would always both be maximized. In such projects, the trade-offs were implicit and subsumed in the design of the project.

Many GEF investments, therefore, involve trade-offs, for example, multi-focal area (MFA) projects, Impact Programs (IPs), and other large-scale, or landscape projects. And, when scaled up across space and time, trade-offs between regions, sectors, and benefits become particularly important to understand.

These trade-offs are more than just trading off societal against nature objectives. They include differential benefits for different groups in society, and also, between different environmental objectives. The latter are present even in projects that are wholly environmental in nature, so even without NbS, this is something with which the GEF has to deal.

Different actors will approach trade-offs with different perspectives, depending on their primary purpose; this underlines the importance of having a good multi-stakeholder dialogue process.

The important thing is to be transparent, recognize what trade-offs exist, and deal with them equitably.

D. Who benefits?

Consideration of global vs local benefits is important. There may be cases where there is a rationale for saying global benefits (e.g. for reducing carbon emissions whilst sustaining biodiversity) outweigh local disbenefits, but this cannot be argued on simplistic economic grounds.

Local involvement that results in **local livelihood benefits** enhances the likelihood of locals not undermining investments in reforestation or species protection, and hence the durability of these investments. Thus, the benefits for global outcomes from having local benefits should be factored in. If the emphasis is on the production of global benefits (as for the GEF), ways should be found of transferring part of those benefits to local actors equitably. There is plenty of experience in payment or incentive schemes, for example, payment for ecosystem services (PES). Costa Rica began to pioneer PES schemes in the 1980s that paid landowners to protect forests in return for the benefits they provide, such as conserving wild species, regulating river flows and storing carbon[32]. Related ideas on Payment for Watershed Services[33] and Water Funds[34] are taking root in Latin America and elsewhere.

The basic model is to estimate the value of upstream landscapes for downstream beneficiaries (in terms of maintaining water quality and regulating water flows, both dry season low flows and floods.) Each payment scheme involves a valuation of NBS, and many include optimization analyses of future climate scenarios to identify priority locations and magnitudes of investment for target ROI (return on investment) in terms of water amount and quality. Some started before climate considerations were primary, and many are now adding climate resilience as an additional aim[35].

[32] https://www.iied.org/markets-payments-for-environmental-services
[33] https://waterfundstoolbox.org/getting-started/what-is-a-water-fund
[34] https://www.iadb.org/en/sector/water-and-sanitation/founds-partnership/home
[35] Personal Communication, Nov. 19, 2020, Mary Ruckelshaus, Natural Capital Project (https://naturalcapitalproject.stanford.edu/)

Balancing short and long-term, e.g. intergenerational, benefits, whether local or global, is particularly hard, and the divergence in perceptions of benefits (both actual and prospective) among stakeholders further complicates this picture; this highlights the need for appropriate forms of multi-stakeholder processes to negotiate these different perceptions.

For example, NbS that do not harness ecological principles and support biodiversity (such as those involving non-native monocultures) are more vulnerable to environmental change in the long term and may also produce trade-offs among ecosystem services (e.g. carbon storage, erosion control, and water supply)[36].

E. Leakage

Avoiding leakage is essential to ensure that GEF investments contribute to reversing overall environmental change and that the benefits endure in the long-term. For example, projects which reduce deforestation in one area, but which serves only to shift this to another area, either in the next valley or another country. (Two projects in the GEF NbS sample recognized this as a risk.) This may be difficult to achieve at the individual project level but should be a very relevant consideration at the program level, and in scaling up.

The Land Degradation Neutrality concept addresses leakage, by carefully specifying that 'no net loss' should be achieved by countries within each category of land. If properly met, this provides a framework to measure and report on, and ideally avoid, leakage[37].

5. What could the GEF do?

This section offers some guidelines for GEF NbS projects to maximise the chances of projects being in the upper right quadrant of Figure 2. Project proponents should be able to explain how 'strong' a form of NbS they are aiming for, whether nature and social benefits are demonstrated, whether nature benefits are at GEB scale, whether both lots of benefits are credibly durable in the face of long- term trends like climate, and not subject to leakage.

Much of STAP's recent work has been about how to improve the design of projects, in particular by paying particular attention to several key **enabling elements** that are of equal applicability to nature-based solutions. These are listed below, with some additional issues for NbS projects called out in italics:

Apply systems thinking: devise a logical sequence of interventions, which is responsive to changing circumstances. Address inter-connected environmental, social, economic, and governance challenges across sectors in design and implementation, with an eye towards resilience, transformational, and enduring change.

Develop a clear rationale and robust theory of change to tackle the drivers of environmental degradation by assessing assumptions and outlining causal pathways, and by devising responses that are robust to future change and adaptive if desired outcomes do not materialize.

> *For NbS projects, there needs to be a clear understanding and documentation of the societal problem, as well as the nature problem, and the links between them. Systems thinking needs to cover both the societal problem and the nature elements, as does the theory of change. This*

[36] https://royalsocietypublishing-org.proxy.lib.umich.edu/doi/10.1098/rstb.2019.0120
[37] https://stapgef.org/guidelines-land-degradation-neutrality

means being involved upfront and having a hand in the design of the whole project. It is also important to be able to demonstrate that environmental benefits are truly additional, and would not accrue in the absence of the GEF investment, and to be clear about which benefits for which the GEF can reasonably claim credit.

Choose the innovations to be scaled (including technological, financial, business model, policy, and institutional innovation). Allow flexibility in project preparation to accommodate the additional transaction costs and time required to tackle complex issues through multi-agency teams.

Assess climate risk at the project development stage and develop ameliorative actions to ensure that project outcomes are achieved, and consider how co-benefits can be enhanced by adaptive actions.

NbS need to be resilient in the face of climate change, i.e. the risks of losing nature or societal gains if projects do not plan for this. All projects should: identify current and projected climate vulnerabilities; assess how the project will be affected by climate between 2020-2050, and address climate impacts adequately; and adopt sufficient measures to address the risk and expected impacts. STAP is pleased that all GEF projects will now review climate risk[38].

Maximise global environmental benefits, by improving effective integration, and by identifying positive synergies among multiple benefits, and avoid doing harm, by minimising negative interactions, and managing any **trade-offs**, including climate risk and other long-term changes.

More attention needs to be paid to the costs and benefits of interventions, assessed for the outcomes to both society and nature. Informed decisions should include an understanding of any trade-offs, balancing the outcomes for different beneficiaries at different scales in space and time.

Co-benefits should be identified and enumerated, including non-GEB environmental benefits, for example, improvements in air quality and water quality, and socio-economic benefits, for example, jobs, food security, and health benefits. Particularly where these can be made bankable for market-based sources of finance. Important considerations include thinking about maximising for whom or what, and at what cost to whom or what, and over what time frames.

NbS is one of the seven action tracks of the GCA. The GCA concluded that mangrove protection, improved dryland agriculture crop production, and water resources management have further economic, social, and environmental benefits that should be assessed and properly reflected in project design, implementation, and cost-benefit analyses[39].

Develop multi-stakeholder dialogue from inception and design, through to project completion, ideally building on existing platforms, and flexibly structured to extend and evolve over time towards enduring transformational change.

There is a special premium on good quality multi-stakeholder dialogue in NbS projects because they are likely to involve a wider range of stakeholders, with more divergent interests, e.g. actors more concerned with the societal problem, than nature, and need to bridge the gap. Inclusivity is important and there is a need to ensure that multi-stakeholder dialogues are not top-heavy (and -down) with national, regional, and local government, but include local communities and indigenous peoples, with a clear and equitable allocation of roles and responsibilities.

[38] https://stapgef.org/stap-guidance-climate-risk-screening
[39] https://gca.org/global-commission-on-adaptation/report

Analyse the barriers to, and enablers of, scaling and transformation, for example, institutional, governance, cultural, and vested interests. Assess the potential risks, including climate risk, and vulnerabilities to the system, to measure resilience to shocks and changes, the need for incremental adaptation, or more fundamental transformational change.

Establish a monitoring, evaluation, and learning process to track the intended innovations, integration, and transformation, as well as indicators of durability. Develop explicit plans and funding for good quality knowledge management including sustainable databases, simple, useful, and usable common indicators; this is essential for 'lessons learned', scaling up, and adaptive management.

> *STAP is working with the Gordon and Betty Moore Foundation to develop advice on how to take impact to scale in complex conservation projects with a special focus on nature-based solutions, and recommendations for measurement, evaluation, and learning.*

Ensure durability in project outcomes and impacts by applying all of the above key elements and engaging the right stakeholders; building the incentives for these key actors to act; incorporating adequate flexibility in project design and implementation; and underpinning it all with a systems-thinking approach. Climate risk (see above) and leakage (see below) also threaten the durability of benefits.

> *In reality, benefits on both axes of Figure 2 need to be durable. Ensuring that the social benefits endure will encourage the relevant actors to keep supporting the benefits to nature.*

Behavior change. STAP's new paper on behavior change provides advice and a six-point checklist of issues, and questions, to consider in designing GEF projects in order to explicitly consider expected behavior change[40].

In addition to employing STAP's enabling elements above, the GEF should consider:

(i) **Approaching NbS from the standpoint of solving societal problems**, rather than environmental problems, may open up different ways of delivering global environmental benefits that might otherwise have gone untapped.

> *NbS is not an end in itself but a better way to deliver nature benefits through dealing with societal problems, i.e. what is a nature-based solution solving? There may also be unexploited opportunities for synergies and for delivering co-benefits. Are there major societal challenges that are ripe for NbS consideration? For example, what are the big opportunities in NbS and agriculture, and what are the trade-offs, for example, lower production intensity versus extensification?*

(ii) Developing a concept equivalent to LDN to **avoid leakage**, which pertains to all global environmental benefits, and apply it to NbS interventions, and promote discussion of it in the MEAs, not just in land degradation.

> *Leakage is an issue for all global environmental commons. For greenhouse gas emissions, attention is increasingly paid to allocating emissions to end-users so that export of energy-intensive processing is tracked; for biodiversity, approaches emphasising very low net extinction rates are being proposed; for pollutants, recipient countries are starting to reject dumped waste. Land degradation neutrality (LDN)*

[40] https://stapgef.org/why-behavior-change-matters-gef-and-what-do-about-it

provides an example where there is a global commitment to LDN, and (gradually) each country also commits to it, such that, in principle, if every GEF project with land degradation benefits was lodged as part of a country's LDN commitment, those benefits would be secure locally and globally, and subject to structured monitoring.

(iii) **Improving valuation** and a better understanding of the true costs and benefits for both nature and people. GEF should ensure that its projects contribute to a growing **global database** of quantifiable (even 'bankable') costs. Natural capital should be included as an element in decision-making as GEF enhances financing; trade-offs with societal costs benefits are likely to require monetary valuations.

STAP's workshop on biodiversity mainstreaming early in 2021 will include discussions with production sectors on costs/benefits and natural capital.

For example, a meta-analysis of mangroves[41] suggests a median global economic benefit from fisheries, forestry, and recreation on the order of US $40 billion per year on top of avoided flooding benefits of US $80 Billion. GCA estimates a benefit/cost ratio for mangrove protection, conservatively, at 5.5. Improvements in dryland farming methods (such as greater uptake of modern varietals and hybrids that provide higher and more stable yields, better soil fertility management practices, and better water management) could have a benefit/cost ratio of 5[42]. Water resource management, particularly green infrastructure projects, are likely to have substantial co-benefits, through carbon sequestration, reduced air pollution, and improved health, healthier ecosystem services, and recreational services. For water resource management, a benefit/cost ratio of 4 is estimated[30]. Improving these kinds of analyses and building them into GEF projects is key to acceptance, private sector interest, and durability of NbS.

STAP intends to continue to help GEF refine methodologies to address this suite of NbS issues. As with STAP's iterative and evolving advice on climate risk screening and theory of change, a first step is intentional consideration of the goal – in this case, nature-based solutions, wherever possible, in GEF projects that benefit both nature and society. Therefore, in the very near-term, GEF projects could evaluate the potential for NbS solutions by carefully considering the following 6 questions:

- What is the *societal* problem to be addressed?
- Is there a *nature-based* solution to this societal problem? How would society benefit from the proposed NbS? What are the benefits for nature?
- What sort of solutions might be applied, and what are their intended outcomes?
- What would happen in the absence of GEF investment?
- Have co-benefits been identified and analysed? Are there trade-offs? How will these trade-offs be resolved, and losers compensated?
- How to deal with potential leakage of benefits?

[41] Salem, M.E., and Mercer, D.E. (2012).
[42] Brahmbhatt, M., et al., Estimating the Economic Benefits of Climate Adaptation Investments: Background paper for the Global Commission on Adaptation. Draft manuscript.