Implementing nature-based solutions at scale – prioritising decisions for maximising public gain

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Nature-based solutions (NbS) have gained recognition and popularity over the past decade as cost-effective, low-regret solutions to address a range of societal challenges. NbS is an umbrella term for a variety of measures that aim to "protect, sustainably manage and restore natural or modified ecosystems" (Cohen-Shacham et al. 2016: 5) to address societal challenges. NbS may address adaptation to the negative impacts of climate change (ecosystem-based adaptation, EbA), climate change mitigation through carbon sequestration and conservation of carbon sinks, and the reduction of disaster risk (ecosystem-based disaster risk reduction), while also contributing to biodiversity protection, reducing the risk of zoonotic disease occurrence and promoting physical and mental health and overall human wellbeing.

Given the various societal targets which can be addressed by NbS as well as the wide variety of co-benefits, NbS is recognised as a synergistic tool that contributes to making progress on several Sustainable Development Goals (SDGs) simultaneously, in particular climate change mitigation and adaptation (SDG 13), disaster risk reduction (targets under SDG 9 and 11), poverty eradication (SDG 1), food security (SDG 2), sustainable cities and communities (SDG 11), water and sanitation (SDG 6), biodiversity conservation (targets under SDG 14 and 15) and health (SDG 3). Development efforts guided by planetary guard rails are therefore well advised to build upon the key contribution of NbS actions such as (i) preservation of ecosystems in a good ecological status, (ii) improvement of ecosystems' sustainable management and (iii) ecosystem restoration. Strategies and

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policies need to be adjusted to unlock and enhance nature's potential to provide essential services for achieving the SDGs at scale and add value to society.

Status quo

Recognition and uptake of NbS is increasing globally but has not yet reached scale. At present, implementation comes nowhere near the scale, speed or scope required in rolling out NbS to harness potential multiple benefits for climate, biodiversity, disaster risk reduction and health. Adoption is hampered among others by (i) insufficient evidence on the cost-effectiveness or cost-benefit of individual measures, (ii) challenges to monitoring and evaluation of effectiveness, (iii) insufficient mainstreaming in long-term planning processes and (iv) lack of funding. Much time and effort has been spent over the past decade gathering evidence on the *effectiveness* (for non-financial benefits) of nature-based solutions, such as assessing the ability of mangroves to prevent coastal erosion and reduce coastal flooding compared to engineered coastal protection measures, so that decision-makers can compare these measures with conventional solutions. There are also strong calls to provide information on the *cost-effectiveness* or *cost-benefit* ratio of NbS. However, determining the *cost-effectiveness* and *cost-benefit* of nature-based solutions comes with a number of challenges.

Why is it challenging to determine the cost-effectiveness?

Ecosystems provide a variety of benefits to society. For example, when implementing a nature-based solution like removing a dyke and restoring a natural floodplain to reduce flood risk, a planner or decision-maker might compare the cost-effectiveness ('cost per non-monetary consequence') of the floodplain to that of the dyke based on their building, operating and maintenance costs versus their benefit, e.g. avoided damage to infrastructure or houses. This comparison will typically not be able to capture the overall societal benefits of NbS as they result from the multiple co-benefits generated by the re-connection of the river with its floodplain. Co-benefits may include an increase in the abundance and diversity of aquatic plant populations, which is a key for sustaining aquatic food webs. Most rivers are reliant upon their floodplains to maintain fish productivity.

Floodplains are productive and diverse ecosystems are sustained by the periodical deposition of nutrient-rich sediments. Floodplain restoration may also increase the recreational value of the area such as for fishing or bird watching.

To overcome this gap, *cost-benefit analysis* can be employed where all costs and benefits of a measure are captured by monetary terms. For this purpose, monetarised ecosystem service assessments are used. However, once the valuation process aims to include different types of use values and non-use values and aims to capture a wide range of co-benefits and spillover effects to other areas such as health, biodiversity and recreation, the valuation becomes very time- and labour-intensive and will be of limited applicability to standard decision-making processes and sectoral budgets. While monetary valuation is important and needs to be further developed to better capture the value of ecosystem services, the overall difficulty of capturing all benefits to demonstrate the true cost-benefits of nature-based solutions will continue to hinder their widespread adoption. However, a *cost-effectiveness approach* will continue to miss the co-benefits of NbS and will fall short to support multi-purpose decision-making.

Additionally, in valuation studies the *discount rate* applied has a major impact on how NbS solutions compare with conventional measures. Future benefits and costs are often discounted to the present value which is questionable in case of nature-based solutions since the benefits of nature protection or restoration will be seen mostly in the future and are therefore discounted, whereas the costs of intervention occur in present and are taken into consideration at their full extent. In other words, the extent to which the costs and benefits of future generations are included has a major impact on the outcome of the valuation. Aspirations to establish cost-effectiveness information for NbS likely also slow down their uptake as in many cases the respective studies and methodologies are still lacking precision or require a major time investment and interdisciplinary cooperation. The IPCC SROCC report, for example, concludes that there is still limited evidence on benefit-cost ratios for ecosystem-based adaptation (IPCC 2019: 33).

Do we need to increase focus on cost-effectiveness?

One possible way forward is to increase time and effort invested in studies proving the cost-effectiveness of NbS measures. The recently published IUCN Global Standard for Nature-based Solutions identifies cost-effectiveness as one of the criteria for successful NbS implementation (IUCN 2020:

12). In many areas of human development, however, cost-effectiveness as a tool did not prove to deliver the best outcome in times of crisis. It was "the focus on cost-effectiveness, which removed stores of medical equipment before the outbreak of COVID-19, and replaced ecosystems with monocultures" (TWI2050 2020: 75). Indeed, there is often a conflict between resilience building and cost-effective solutions. The primacy of cost-effectiveness considerations also favours interventions where cost-effectiveness is easier to establish, such as in hard infrastructure projects, or projects involving unidimensional interventions, such as reforestation with one or few tree species. Today there is a growing concern that the large number of NbS projects involving tree planting for carbon sequestration is driving the attention away from the protection of existing biodiverse ecosystems (Seddon et al. 2021: 1530).

What should we focus on?

Rolling out nature-based solutions at scale is ultimately a collective action problem. Instead of increasing time and financial investments into single-measure cost-effectiveness studies, we need visions on different scales for transforming our governance models and decision pathways for a large-scale roll-out of nature-based solutions. Governments should recognise their role in steering the development in a direction that is beneficial for society as a whole and addresses the grand challenges of society. This needs to involve science-based goals and target setting for nature and biodiversity which would have to be observed in public and private decision-making. By focusing on the overall goals and targets rather than on the cost-effectiveness of single measures, we could create inspiration and space for creativity and encourage collaboration across sectors, thereby thinking out of the box and linking multiple measures. It requires a mission or in other words a 'whatever-it-takes approach' to financing and planning, as we have seen, for example, during the pandemic, to solve common challenges and to address social inequalities. As Mazzucato (2019) shows in her discussion of the success of the Apollo mission to land a man on the Moon, by concentrating on a challenging, joint goal, not on short-term gains, the goals can be better achieved than with a strict focus on the economic costs and benefits. While the Apollo programme is well known, there are many other examples where ambitious visioning was instrumental to reach larger goals. For example, the 'Salmon 2000' and the subsequent 'Salmon 2020' programme, which is a part of the "Rhine 2020 programme for the sustainable development of the Rhine" (Froehlich-Schmitt 2004: 4),

formulated the visions to re-establish a self-sustained salmon population in the Rhine. Another example is Sweden's Vision Zero policy (1997). The vision was that no one should be killed or seriously injured in course of traffic accidents by 2020 (Mazzucato 2019: 15). Reaching the goal required a re-design of the road transport system. A multitude of single measures were necessary to reach these goals – many of them would not have passed a cost-effectiveness or cost-benefit evaluation seen as a single step and without keeping in mind the larger picture and overall societal vision and gain.

A large scale implementation of nature-based solutions could be enabled by a mission-oriented approach which would define clear implementation targets. Instead of insisting on cost-effectiveness of single steps to be implemented it would focus on the big picture. For example, the Global Deal for Nature (GDN) provides scientific evidence for a large scale plan to protect ecosystems and biodiversity to address climate change and biodiversity loss and to secure essential ecosystem services (Dinerstein 2019). The GDN targets 30% of Earth to be formally protected and an additional 20% designated as climate stabilisation areas, by 2030, to stay below 1.5°C global warming.

Since the protection or restoration of ecosystems needs to be addressed at sub-national, national or regional level, different 'missions' would be needed for the appropriate scale. They could be formulated when there is a window of opportunity to change the course of decision-making. In Germany, for instance, the resilience and health of forests is at serious threat. The 2018 drought and heat caused unprecedented tree mortality in Germany and lead to high vulnerability of the trees to insects and fungal pathogens with even more tree mortality in the consecutive years. As a large share of the forests is severely damaged and droughts and heat events are likely to occur more frequently with climate change, German forests and forest management need a substantial transformation. A mission-based forest strategy could aim for prioritising a healthy, biodiverse, climate-resilient forest, which is managed in a way that it provides a variety of essential services for society such as those for recreation, mental and physical health and risk reduction. Natural forests buffer against the adverse impacts of climate change by not only providing cooling in summer but also retaining excess rainwater and moderating extreme run-offs (European Environment Agency 2015: 5). These services are currently not considered in decision-making and planning, e.g. in the German Forest Strategy 2020. Many of the measures which would enhance societal benefits provided by the forest are not cost-effective for the forest owner. There

needs to be leadership at national level to change the course and set a mission for a biodiverse and climate-resilient future of forests in Germany.

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