FNI REPORT 3|2022

CHRISTIAN PRIP

Nature based Solutions for Biodiversity, Climate and People

FRIDTJOF NANSENS INSTITUTT
FRIDTJOF NANSEN INSTITUTE

FNI REPORT 3|2022

Nature based Solutions for Biodiversity, Climate and People

Christian Prip
Fridtjof Nansen Institute
cprip@fni.no

FRIDTJOF NANSENS INSTITUTT
FRIDTJOF NANSEN INSTITUTE

Abstract

Nature-based solutions (NbS) require a decisive change in people's relationship with nature and decisive action across sectors and governing bodies to release their full potential. This report discusses the need to implement nature-based solutions to combat biodiversity loss as well as climate change and to fulfill the UN's development goals, and on what the relevant global governing bodies are undertaking to promote these solutions. Nature-based solutions fit well with the approach to holistic management of ecosystems as established by the UN's Convention on Biodiversity from 1992. In recent years, it is increasingly recognized that this approach is also necessary to achieve the Paris Agreement's goal of keeping the global temperature as a result of global warming below 2 degrees. NbS are necessary to improve people's living conditions because the impoverishment of nature leads to soil depletion, drought, floods, food insecurity, infectious diseases, and refugee flows, among other things. NbS have been given the blue stamp by the global scientific bodies for biodiversity and climate, IPBES and IPCC, and by the UN environmental assembly UNEA, but still not by the Biodiversity and Climate Convention. The concept also still lacks effective methods to measure its effect. Upcoming and highly profiled meetings of the conferences of the parties in the two conventions provide golden opportunities to give full political recognition to the concept.

ISBN 978-82-7613-745-3
ISSN 1893-5486

FNI Report 3|2022
Nature based Solutions for Biodiversity, Climate and People
Christian Prip

The Fridtjof Nansen Institute is a non-profit, independent research institute focusing on international environmental, energy and resource management. The institute has a multi-disciplinary approach, with main emphasis on political science and international law.

1. Background

Climate change, biodiversity loss and many other environmental challenges are interlinked. The speed, scale and scope of the planetary changes that have unfolded as a result, and particularly in the past 60 years, has motivated some scientists to declare a new formal geological epoch, the Anthropocene.[1] Human societies and ecological systems have long influenced another, but not at the scales and speeds of the Anthropocene. The dramatically changing baselines for climate and biodiversity are altering the fundamental frame of reference humans have been operating under for millennia. This creates a new kind of planetary uncertainty for which we have no real guide[2]

The IPBES 2019 global assessment report on Biodiversity and Ecosystem Services demonstrates that the rate of decline of biodiversity – the diversity within species, between species and of ecosystems – corresponds to previous geological periods on the globe with mass extinctions. Around 1 million species are facing extinction, many within decades, unless action is taken to reduce the intensity of drivers of biodiversity loss. The fast decline in biodiversity includes among other, corals, which are of great importance to the world's fish stocks, and insects, which pollinate 75 per cent of the world's crop plants. 75 per cent of the land surface is significantly altered while over 40 per cent of ocean area was strongly affected by multiple drivers in 2008, and 66 per cent was experiencing increasing cumulative impacts in 2014. Over 85 per cent of wetlands have been lost. [3]

Some other stunning figures: Now only 4% of the mass of mammals on our planet are wild. The remaining 96% are we human beings and - to a much larger extent - the livestock we bring up to feed us. 70% of all birds are poultry.[4]

Besides violating the inherent value of the natural world that many people feel, this nature degradation leads to degradation of human livelihoods in the form of for example soil depletion, erosion, drought, floods, food insecurity, infectious diseases conflict and refugee flows.

It could be argued on a positive note in terms of livelihoods, that the value of agricultural crop production has increased approximately threefold and timber harvest has increased by 45 per cent since 1970. However, this production increase comes at an unsustainable cost since crucial regulating ecosystem services like soil organic carbon and pollinator diversity at the same time have declined seriously. [5] This also illustrates the difficult trade-offs that often need to be made in the production and use of nature's contributions.

Behind the direct causes of this development in the form of changes in land and sea use, overexploitation, climate change and invasion of alien species, there are an array of underlying causes that differ among regions and countries. These include among others production and consumption patterns, human population dynamics and trends, harmful economic incentives and policies, trade and technological developments.[6]

Climate change is not only a direct cause, but it also increasingly exacerbates the impact of the other causes. The IPCC estimates that a world that is 2°C warmer would be catastrophic for biodiversity, causing increased species losses and extinctions and the spread of invasive species – and much more

[1] Crutzen, P. J. (2006). The "anthropocene". In *Earth system science in the anthropocene* (pp. 13-18). Springer, Berlin, Heidelberg.

[2] UNDP (2021) The 2021/2022 Human Development Report

[3] 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.).

[4] Dasgupta, P. (2021), The Economics of Biodiversity: The Dasgupta Review.

[55] Ibid.

[6] Ibid.

damaging than a temperature rise of "only" 1.5°C.[7] Conversely, continued nature degradation is a major contributor to greenhouse gas emissions and, therefore, an additional driver of climate change.[8] Besides, ecosystems with high biological diversity are generally more resilient to climate change and variability than impoverished ecosystems.[9] Thus, maintaining and restoring ecosystems represents a serious opportunity for win-win-win benefits for carbon sequestration and storage, adaptation and disaster risk reduction as well as biodiversity protection. A fourth winner in this context is human well-being because of the invaluable services for people that nature provides.

All this speaks strongly for not working against nature as before, but with nature - to enhance the natural capital rather than deplete it. With Nature-based Solutions (NbS) human development can be advanced while at the same time safeguarding the integrity of ecosystems. Thus, NbS have a great potential as means to meet the Sustainable Development Goals (SDGs).[10] This applies in particular to SDG 2 (food security), 3 (health and well-being), 6 (clean water and sanitation), 11 (sustainable cities and communities), 13 (climate change), 14 (conservation and sustainable use of oceans, seas and marine resources), and 15 (protection, restoration and promotion of sustainable use of terrestrial ecosystems).[11]

NbS is not a concept that was just invented, and its importance has only been gradually recognized by international and regional institutions and some governments. However, it is so new that it is still mainly addressed on a conceptual basis and less in the form of action on the ground. Also, it still lacks a final, official recognition in important international forums such as the UN conventions on climate change and biodiversity.

This report will address NbS in an international context. It will first seek to identify what the NbS concept is about and then discuss its importance for respectively biodiversity, climate and human well-being mindful of the fact that this is not a fully accurate division of the concerns. What is good for biodiversity and climate is mostly also good for people. It will move on to address how NbS are being addressed in relevant international forums before summing up and drawing conclusions.

2. What are NbS?

A wish for innovative solutions to manage natural systems in a way that can balance the benefits for both nature and society and contribute to a resilient, resource-efficient economy was how the NbS concept emerged.[12] It was first mentioned in 2008 in the title of a report by the World Bank, "Biodiversity, Climate Change, and Adaptation: Nature-based Solutions from the World Bank Portfolio".[13] As part of its Strategic Framework for Climate Change and Development, the World Bank had helped secure investment of appr. $6 billion between 1988 and 2008 in climate change mitigation and adaptation projects that fully or partially support what became known as NbS for enhanced conservation and sustainable use of "natural capital". Since then, several attempts have been made to define and clarify the concept.

[7] IPCC (2019). Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.

[8] Pörtner, et al. (2021). IPBES-IPCC co-sponsored workshop report on biodiversity and climate change.

[9] van Asselt, H. (2011). Managing the Fragmentation of International Environmental Law: Forests at the Intersection of the Climate and Biodiversity Regimes, p. 18.

[10] Cohen-Shacham, E., Andrade, A., Dalton, J., Dudley, N., Jones, M., Kumar, C., ... & Walters, G. (2019). Core principles for successfully implementing and upscaling Nature-based Solutions. Environmental Science & Policy, 98, 20-29

[11] Vasseur, L., Horning, D., Thornbush, M., Cohen-Shacham, E., Andrade, A., Barrow, E., ... & Jones, M. (2017). Complex problems and unchallenged solutions: Bringing ecosystem governance to the forefront of the UN sustainable development goals Ambio, 46(7), 731-742.

[12] Sowińska-Świerkosz, B., García, J. (2022). What are Nature-based solutions (NBS)? Setting core ideas for concept clarification. *Nature-Based Solutions*, *2*, 100009.

[13] MacKinnon, K., Sobrevila, C., & Hickey, V. (2008). Biodiversity, Climate Change, and Adaptation : Nature-based Solutions from the World Bank Portfolio. (No. 46726, pp. 1-112). The World Bank.

Box 1. **3 definitions of Nature-based Solutions**	
Organisation	Defintion
European Commission (2015)	Solutions inspired and supported by nature, designed to address societal challenges which are cost-effective, simultaneously provide environmental, social and economic benefits, and help build resilience,
IUCN (2016)	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.
UN Environmental Assembly (2022)	Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits.

Already in 2015, NbS were for the first time officially defined by the European Commission (EC) (Box 1). The most recent EC report on NBS states that the "concept of nature-based solutions embodies new ways to approach socio-ecological adaptation and resilience, with equal reliance upon social, environmental and economic domains".[14]

Science-based nature organisations such as The Nature Conservancy and the International Union for Conservation of Nature (IUCN), have been particularly active in promoting the concept and integrate it into policy debates. The IUCN definition of NbS from 2016 (Box 1) has been most frequently quoted and for long seen as the most authoritative among other attempted definitions [15] The definition is accompanied by a set of 8 principles stating that NbS,

1. embrace nature conservation norms (and principles);

2. can be implemented alone or in an integrated manner with other solutions to societal challenges (e.g. technological and engineering solutions);

3. are determined by site-specific natural and cultural contexts that include traditional, local and scientific knowledge;

4. produce societal benefits in a fair and equitable way, in a manner that promotes transparency and broad participation;

5. maintain biological and cultural diversity and the ability of ecosystems to evolve over time;

6. are applied at the scale at a landscape;

7. recognise 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 ecosystems services;

8. are an integral part of the overall design of policies, and measures or actions, to address a specific challenge.

IUCN considers NbS as an umbrella concept that covers a range of different approaches having emerged both from the scientific research domain and from practice or policy contexts, but share a common focus on ecosystem services and aim to address societal challenges.[16] Among the different concepts under the umbrella are the ecosystem approach, ecological restoration, ecological engineering, agroecology, Ecosystem-based Restoration (EbA), REDD+, forest and landscape restoration

[14] A. Dumitru, L. Wendling. (2021). Evaluating the impact of nature-based solutions: A Handbook For Practitioners. European Commission,

[15] Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S. (eds.) (2016). Nature-based Solutions to address global societal challenges. IUCN.

[16] Ibid.

(FLR), ecosystem-based disaster risk reduction (eco-DRR), and more recently, natural climate solutions (NCS).[17]

Both the IUCN and EC definitions of NbS highlight the multiple benefits that can be derived by working with nature. The IUCN frames these in terms of biodiversity and human wellbeing while the EC emphasizes innovation and economic cost effectiveness, aiming to "harness the power and sophistication of nature to turn environmental, social and economic challenges into innovation opportunities", including through biomimicry and urban green infrastructure as well as working with rural ecosystems.[18]

Definitions of NbS have been criticized for being somewhat general and blurry with too little indication of which solutions could be categorized as NbS. [19] This has led to debate on the scope and types of interventions that can be classified as NbS.[20] Adding to the lack of clarity, is the fact that definitions of NbS integrate multiple scientific fields and experts with different backgrounds and perceptions about NbS from the point of view of their own base discipline.[21] Thus, definitions have emerged for varied purposes, such as of carbon sequestration, disaster risk reduction in relation to natural hazards, and provisioning of benefits by green spaces in cities.[22] Lacking detailed criteria for NbS, a number of actions that today would be regarded as measures complementary or related to NbS but that do not fulfil all the criteria to truly be regarded as NbS, were still branded as such.

Few studies and practical guides have evaluated the effectiveness and efficiency of NbS. Despite this general lack of relevant research, NbS specialists generally suggest the use of performance and multi-metric indicators as the best tools for evaluation, because they help assess the performance of solutions, increase the measurability of effects and enable the systematic evaluation of NbS projects.[23].

To avoid the lack of clarity described above and that NbS remain a general concept with no effect on the ground, IUCN in 2020 developed a NbS Standard to "support users to apply, learn and continuously strengthen and improve the effectiveness, sustainability and adaptability of their NbS interventions."[24] The Standard consists of 8 Criteria and 28 Indicators. (See box 2).

Box 2.
Criteria for using Nature-based Solutions (NbS):

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

Source: IUCN (2020) Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS.

[17]Seddon, N., Smith, A., Smith, P., Key, I., Chausson, A., Girardin, C., ... & Turner, B. (2021). Getting the message right on nature-based solutions to climate change. *Global change biology*, *27*(8), 1518-1546.
[18] Bauduceau, N., Berry, P., Cecchi, C., Elmqvist, T., Fernandez, M., Hartig, T., ... & Tack, J. (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'.
[19] Sowińska-Świerkosz and García, (2022).
[20] Sowińska-Świerkosz, B., Wójcik-Madej, J., & Michalik-Śnieżek, M. (2021). An assessment of the Ecological Landscape Quality (ELQ) of Nature-Based Solutions (NBS) based on existing elements of Green and Blue Infrastructure (GBI). *Sustainability*, *13*(21), 11674.
[21] Sowińska-Świerkosz and García, (2022).
[22] Dorst, H., van der Jagt, A., Raven, R., & Runhaar, H. (2019). Urban greening through nature-based solutions – Key characteristics of an emerging concept. Sustainable Cities and Society, 49, 101620.
[23] Ibid.
[24] IUCN (2020) Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS.

As further discussed below, the blurriness and lack of an official multilaterally agreed definition of NbS, has also led to reluctance in relevant international forums to endorse the concept. A resolution adopted by the UN Environmental Assembly (UNEA) in 2022 may have rectified this deficiency. The decision provides a definition of NbS (Box 1) very close to the wording of the IUCN definition of 2016.[25] Inger Andersen, Executive Director of UNEP, stated on this occassion: "Having a universally agreed definition of nature-based solutions is important. When countries and companies claim that their actions are supporting nature-based solutions, we can now begin to assess whether this is accurate and what it entails. This is especially true given the just-released report by the Intergovernmental Panel on Climate Change on the need to scale-up adaptation, for which nature-based solutions will be crucial."

3. NbS and Biodiversity

From a common understanding of the concept, NbS appears to have a close connection with safeguarding biodiversity. Biodiversity also appears as a concern in the definitions of NbS by the IUCN and UNEA as discussed above. The fact that biodiversity does not appear in the definition from the European Commission is a reminder that NbS could also be performed without or with less concerns for biodiversity,as further discussed below.

Since biodiversity is widely considered essential to secure ecosystem services now and into the future, it makes good sense that NbS must deliver benefits also for biodiversity. [26]

NbS is also well related to the general approach of the UN Convention on Biological Diversity (CBD) of 1992 and its three objectives of conservation, sustainable use and the fair and equitable sharing of benefits derived from genetic resources. The original developed countries proponents of the CBD spoke for a traditional nature protection approach of conserving threatened species and habitats, but soon realised that the biodiversity-richer developing countries were not prepared to consider protection only in a strict sense. This led to a convention with a comprehensive, cross-sectoral, socio-economic oriented approach far beyond traditional nature conservation.[27]

Two years after its entry into force in, the CDB in 1995 adopted the Ecosystem Approach (EA) as the primary framework for action under the Convention and a further elaboration of the paradigm shift that the CBD already in itself represented.[28] This approach advocates the integrated management of land, water, and living resources and promotes their conservation and sustainable use in an equitable way. It considers biodiversity conservation and human well-being to be dependent on functioning and resilient natural ecosystems. The EA has helped to shape the current conservation and natural resource management agenda and thereby also the concept of NbS. It could even be argued that NbS have their roots in the EA.[29] While the EA, like NbS, focuses on integrated management, NbS goes a step beyond to also address broader social, economic, and environmental challenges such as climate change adaptation and disaster risk reduction. [30]

The CBD was quick to embrace the Millennium Ecosystem Assessment (MEA) when it was released in 2005, and to mainstream its key concept "ecosystem services" across future CBD decisions. The MEA provided strong evidence of the interdependence of people and nature linking global ecosystem degradation to the reduced provision of ecosystem services and a decline in human well-being.

The launch of the initiative "The Economics of Ecosystems and Biodiversity (TEEB)" in 2007,[31] focussing on "making nature's values visible", in-

[25] Resolution adopted by the United Nations Environment Assembly on May 2022. 5/5. Nature-based solutions for supporting sustainable development.
[26] Seddon et al. (2021).
[27] Prip, C. (2018). The Convention on Biological Diversity as a legal framework for safeguarding ecosystem services . *Ecosystem Services*, *29*, 199-204.
[28] CBD COP Decision V/6. Ecosystem Approach
[29] Cohen-Shacham et al. (2019).
[30] Ibid.
[31] The Economics of Ecosystems and Biodiversity (TEEB)

duced further momentum to the CBD for making explicit the benefits that human beings receive directly and indirectly from nature. [32] This is prominently reflected in the CBD Strategic Plan 2011–2020 adopted in 2010 with its 20 "Aichi Targets".[33]

NbS is not an alternative to or a substitute for nature conservation in a strict sense, like designation of protected areas, which remains an important global priority in its own right. However, not all conservation actions necessarily qualify as a NbS with its focus on integration with other types of solutions. [34] Through this integration a broader range of social and environmental benefits can be supported which may help in removing barriers between existing frameworks to better integrate learning from different approaches. This places NbS away from mainstream biodiversity conservation approaches that predominantly focus on species or ecosystem conservation.[35] On the other hand, since biodiversity loss not only affects wildlife but also human well-being, it is important that NbS either maintain or improve the state of biodiversity.

The close connection between CBD approaches and NbS has not automatically implied an endorsement by the CBD of NbS. This will be further discussed below.

4. NbS and Climate

The attention to NbS has evolved not least because of a new realization of their potential for climate change-related challenges to substitute technological solutions and provide synergies and mutually supportiveness with other considerations. In fact, climate-related challenges are the most commonly discussed in the existing literature on NbS .[36]

The interlinkages between climate and nature and the value of associated NbS are plentiful:

Marine and terrestrial ecosystems are the sole sinks for anthropogenic carbon emissions, with a gross sequestration of 5.6 gigatons of carbon per year (the equivalent of some 60 per cent of global anthropogenic emissions).[37] Carbon sequestration in nature varies with types of ecosystems, including forest, bog, meadow and agricultural land, altitude, latitude as well as with weather conditions. The same area may have a net sequestration of carbon and a net emission depending on the weather conditions at any given time. Oceans, tropical forests, peatlands and wetlands are the largest carbon stocks. Greenhouse gas absorption is greatest in the ocean, but the effect decreases with the increasing acidification that follows climate change.[38]

NbS have been estimated to provide provide 37 per cent of cost-effective CO2 mitigation needed through 2030 for a >66% chance of holding warming to below 2 °C.[39] Conversely, continued ecosystem degradation through land-use changes is a major contributor to CO_2 emissions and, therefore, an additional driver of climate change.[40]

To reduce the risks of natural disasters caused by weather extremes, NbS (including restoring lost ecosystem functions) are also well suited. Maintaining

[32] Neßhöver, C., Prip, C., & Wittmer, H. (2015). Biodiversity governance: a global perspective from the Convention on Biological Diversity. In *Biodiversity in the green economy* (pp. 289-308). Routledge.
[33] CBD COP 10 Decision X/2. Strategic Plan for Biodiversity 2011-2020
[34] Watson, J. E., Dudley, N., Segan, D. B., & Hockings, M. (2014). The performance and potential of protected areas. *Nature*, *515*(7525), 67-73.
[35] Cohen-Shacham et al. (2019).
[36] Sowińska-Świerkosz and García, (2022).
[37] 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
[38] Norad (2021). Bistandens bidrag til å redusere klimagassutslipp: Løsninger for mennesker klima og natur. (The contribution of development aid to reducing greenhouse gas emissions: Solutions for people, climate and nature.
[39] Griscom, B. W. et al. (2017). Natural climate solutions.solutions. *Proceedings of the National Academy of Sciences*, *114*(44).
[40] Pörtner, et al. (2021).

ecosystem integrity can provide cost-effective measures that, if complemented by other policies, can enhance community preparedness and resilience.[41] For example, increased vegetation in coastal ecosystems can create a physical buffer from hazards such as storm, flooding and erosion events and secure soils and sediments. Restoring healthy coastal ecosystems has the added benefit of reinstating crucial and extremely effective carbon sinks, thus contributing to greenhouse gas mitigation goals alongside improvements in adaptation and resilience.[42]

Specifically on climate change adaptation, ecosystems with high biological diversity are generally more resilient to climate change and variability than impoverished ecosystems.[43] Improving biodiversity integration can also enhance the climate resilience of industries such as agriculture, where ecosystem-based practices contribute to adaptation by increasing the diversity of mixed crop-livestock production.[44] UNEP has assessed that a majority of countries' nationally determined contributions (NDCs) and national adaptation plans (NAPs) acknowledge the vulnerability of ecosystems to climate change, as well as their ability to effectively reduce climate impacts. However, the potential of NbS for reducing specific climate risks has rarely been translated into goals and targets for implementation of NbS. In addition, only a small proportion of climate finance is targeted towards NbS for adaptation.[45]

In summing up, maintaining and restoring ecosystems represents an opportunity for benefits for carbon sequestration and storage, adaptation and disaster risk reduction. Reducing deforestation and degradation of tropical forests is often highlighted as an example of these co-benefits since tropical forests are estimated to house more than 50 per cent of all plants and animals found on land, while tropical deforestation is viewed as representing 20 to 25per cent of global CO_2 emissions.[46]

However, the climate change-nature linkages may also include the possibility of adverse side-effects and thus of difficult tradeoffs between the two concerns. [47] Examples of quick gains for climate change mitigation and adaptation that could be labelled NbS, but are harmful to biodiversity, are deployment of bioenergy plantations with carbon capture. It could also be replacing natural forests with monoculture plantations to maximise the efficiency of forest-based carbon sequestration, and it could be fertilization of oceans to stimulate rapid and large-scale phytoplankton growth, sequestering atmospheric carbon through increased marine productivity.[48]

In 2020, 50 of the world's leading biodiversity and climate experts were assembled by the two main science-policy bodies for climate change and biodiversity, the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Platform on Biodiversity and Ecosystem Service IPBES to examine synergies and trade-offs.[49] Remarkably, this was the first joint arrangement of the two bodies on the climate change-nature interface. Not surprisingly, NbS was a key topic for this workshop which among other thing concluded that "NbS can play an important role in climate mitigation, but the extent is debated, and they can only be effective with ambitious reductions in all human-caused greenhouse gas emissions" and that NbS "can be

[41] UNDP (2020). Human Development Report 2020. The next frontier Human development and the Anthropocene.
[42] Mcleod, E., Chmura, G. L., Bouillon, S., Salm, R., Björk, M., Duarte, C. M., Lovelock, C.E., Schlesinger, W.H., Silliman, B. R. (2011). A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO2. *Frontiers in Ecology and the Environment*, *9*(10), 552-560.
[43] van Asselt, H. (2011). Managing the Fragmentation of International Environmental Law: Forests at the Intersection of the Climate and Biodiversity Regimes, p. 18.
[44] CBD (2019).
[45] United Nations Environment Programme (2021). Adaptation Gap Report 2020. Nairobi.
[46] Pörtner et al. (2021).
[47] Joly, C.A. (2009). Synergies between the Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC). Biota Neotrop., vol. 9, no. 1, Jan./Mar. 2009
[48] V Masson-Delmotte et al (eds), 'Summary for Policymakers' in *Global Warming of 1.5°C: An IPCC Special Report...* (WMO, Geneva, 2018).
JCM Pires, 'Negative emissions technologies: A complementary solution for climate change mitigation' (2019) 672 *Science of the Total Environment* 501-14.
[49] Pörtner et al. (2021).

most effective when planned for longevity and not narrowly focused on rapid carbon sequestration." It was also concluded that NbS creates co-benefits for adaptation to climate change, for nature and its contributions to people.[50] On adaption, it was further concluded that "technical and technological measures that are narrowly focused on climate adaptation can have large negative impacts on nature and nature's contributions to people but can also be complementary to NbS."[51]

The latest report issued by the IPCC also focuses on the key role that nature can play in in mitigating and adapting to the climate crisis. According to the report, except for solar and wind energy and nuclear energy, the most effective strategies for mitigating CO2 emissions are all natural solutions: ecosystem protection, restoration, and better management of farmlands.[52]

5. NbS and people

NbS to combat and mitigate the effects of biodiversity loss and climate change are necessary for the well-being of all people. Healthy ecosystems underpin diverse livelihoods and economies, cultures, and the enjoyment of a wide range of human rights, including the right to life. The critical role of nature for people includes providing food and feed, energy, medicines and genetic resources and a variety of other goods and services fundamental for people's physical well-being and for maintaining culture.

The fundamental role of nature and biodiversity for human well-being is well established and has most lately been thoroughly demonstrated in publications such as the IPBES Global Assessment Report on Biodiversity and Ecosystem Services (2019),[53] and the Economics of Biodiversity: The Dasgupta Review.[54] Besides, the human-nature relation was the main theme of the 2020 UNDP Human Development Report.[55]

Below are some examples of human interconnections with nature and their threats, among many, taken from the IPBES report:

- 2 billion people rely on wood fuel to meet their primary energy needs;
- 4 billion people are estimated to rely primarily on natural medicines for their health care;
- 70 per cent of drugs used for cancer are natural or are synthetic products inspired by nature;
- 75 per cent of global food crop types, including fruits and vegetables and some of the most important cash crops, such as coffee, cocoa and almonds, rely on animal pollination;
- Land degradation has reduced agricultural productivity in 23 per cent of the global terrestrial area, and between $235 billion and $577 billion in annual global crop output is at risk as a result of pollinator loss;
- By 2016, 559 of the 6,190 domesticated breeds of mammals used for food and agriculture (over 9 per cent) had become extinct and at least 1,000 more are threatened;
- Loss of coastal habitats and coral reefs reduces coastal protection, which increases the risk from floods and hurricanes to life and property for the 100 million to 300 million people living within coastal 100-year flood zones;
- Disasters linked to natural hazards has increased by 75 percent over the past 20 years affecting more than 4 billion people, displacing appr. 23 million per year, claiming 1.23 million lives and causing close to $3 trillion in economic losses;

[50] Ibid.
[51] Ibid.
[52] IPCC Working group III (2022). Working Group III contribution to the Intergovernmental Panel on Climate Change
[53] IPBES (2019)
[54] Dasgupta, P. (2021), The Economics of Biodiversity The Dasgupta Review: Abridged Version.
[55] UNDP (2020). Human Development Report 2020. The next frontier Human development and the Anthropocene.

- Zoonotic diseases account for approximately 17 per cent of all infectious diseases and causing an estimated 700,000 deaths globally per annum (estimated before the Covid 19-pandemic and therefore with higher figures today).

Moreover, these threats to people in the Anthropocene are fundamentally unequal. Those that have contributed less to planetary pressures and benefited less from the changes that drive the pressures are disproportionately hard-hit by the negative changes. This includes indigenous peoples and many of the world's poorest communities.[56] Supporting the practices of indigenous peoples that sustain biodiversity is key, especially since lands managed by indigenous peoples— around 25 percent of global land area—host an estimated 80 percent of global biodiversity and because nature managed by indigenous peoples and local communities is under increasing pressure.[57]

In recent years it has been increasingly recognized that more use of green infrastructure and other NbS can help to advance sustainable development in cities and other urban areas while reinforcing climate mitigation and adaptation. NbS include combining grey and green infrastructure (such as wetland and watershed restoration and green roofs), enhancing green spaces through restoration and expansion, promoting urban gardens, maintaining and designing for ecological connectivity, and promoting accessibility for all (with benefits for human health).[58]

The COVID-19 pandemic had brought higher levels of attention to the interaction between health and biodiversity and the need for NbS to combat zoonotic diseases. This topic, including the NbS related concept "One Health" is further discussed in two reports by the Fridtjof Nansen Institute.[59]

So far, no country in the world has succeeded in ensuring major progress in the living conditions of its people without at the same time causing great damage to nature and the climate. Poorer countries therefore do not have the option of the same development route as the richer countries have followed.[60]

6. NbS in international intergovernmental forums.

As discussed above, NbS have been embraced by science-policy frameworks like IPCC and IPBES as well by the UNDP for harnessing nature's role in addressing biodiversity, climate change and human well-being in an integrative manner. However, the concept also needs more official approval from relevant intergovernmental forums to bring NbS from theory to concrete pathways for delivery. This could also be a pathway for closer collaboration and synergies among these forums including not least the CBD and the UNFCCC with their history of working in silos.[61] The endorsement of NbS by UNEA in 2022 with a definition of the concept, which only came after hard negotiations, is an important achievement on the way.[62]

NbS was addressed by the Climate Change COP 27 in Glasgow, UK, in 2021. This has been described as a groundbreaking event since UNFCCC for the first time clearly recognized the interlinked relationship

[56]UNDP (2021) Human Development Report 2021/2022. Uncertain times, unsettled lives. unsettled lives

[57] Fa, J. E., Watson, J. E., Leiper, I., Potapov, P., Evans, T. D., Burgess, N. D., ... & Garnett, S. T. (2020). Importance of Indigenous Peoples' lands for the conservation of Intact Forest Landscapes. *Frontiers in Ecology and the Environment*, *18*(3), 135-140.

[58] IPBES (2019)

[59] Heggelund, G.M., Prip, C., Rosendal, G.K., and Sandberg, K.I. Global governance of health and nature in the wake of COVID-19. Attentive to the role of China and to poverty perspectives. Rosendal, G. K., Heggelund, G.M., Prip, C. (Unpublished). Global cooperation on health and nature issues in the (longer) wake of COVID-19. Effects on poverty alleviation and the role of China.

[60] UNDP (2020).

[61]Kok, M. et al. (2018), From Paris to Beijing. Insights gained from the UNFCCC Paris Agreement for the post-2020 global biodiversity framework.PBL Netherlands Environmental Assessment Agency, The Hague.

[62] Earth Negotiation Bulletin (2022). UNEA 5.2.Summary report 21 February – 4 March 2022.

between the global biodiversity and climate crises and the critical role that nature plays in both adaption and mitigation.[63] A number of NbS related commitments was made at COP26 to conserve, restore and sustainably manage forests, oceans and other ecosystems. These include efforts to combat deforestation and degradation by 2030, a significant increase of funding to directly support Indigenous peoples in the management of their lands and territories. However, even though the interlinkages with nature were acknowledged, the term NbS in the end was not included in the official outcome documents.

Despite the close connections between NbS and CBD concepts and approaches, NbS has neither been endorsed by the CBD. A draft Post-2020 Global Biodiversity Framework with currently 4 overall goals and 22 targets is on the agenda as the major contribution of the CBD Cop 15 in December 2022. The Framework has been pre-negotiated in 4 meetings of an open-ended working. Two months from COP 15, the draft Framework is very far from agreement with most of the text in square brackets. Therefore a 5th meeting of the working group is scheduled immediately before. COP 15. Also, NbS appear in brackets in targets on minimizing the impacts of climate change (8), restoring, maintaining and enhancing nature's contributions to people, including ecosystem functions and services (11), and increasing the level of financial resources for biodiversity. (19.1).[64] With the lack of consensus on explicit reference, NbS shares fate with its sister concept "One Health".

In conclusion, UNEA, the governing body of the UN Environment Program (UNEP) and UN host of the CBD, has taken an important step by providing green light and an official definition of the NbS concept. This could hopefully lead to a corresponding approval of the two most important multilateral environmental agreements in terms of NbS, UNFCCC and CBD when their governing bodies COP 27 and COP 15 meet by the end of 2022.

7. Discussion and conclusion

NbS embodies a simple logic of working with and enhancing nature to help address societal challenges. With its breath, this has facilitated understanding of and engagement in the concept among diverse sectors, researchers, policy-makers and practitioners across climate change, biodiversity and development.[65]

The simplicity and breath have also implied that the full understanding of the concept and its scope has been uncertain and maybe still is to some extent despite recent important work by the IUCN to improve the conceptualization of NbS. Lack of detailed and standardized monitoring methods, reporting protocols and guidance at the different stages of the NbS life cycle has been seen as a deficiency. Thus, there is a need for methods for robust evaluation of NbS performance and impact to fully understand their benefits and trade-offs.[66] Without these developments, there is a risk that NbS will remain a vague concept without operational rigor like the Ecosystem Approach and other related concepts.[67]

Some pitfalls in NbS application must be avoided: NbS should not distract from the need to decarbonize energy systems. Substantial and rapid greenhouse gas emission reduction in all sectors of the economy is essential, and NbS should not, as has been suggested by some big emitters, be a tool to offset greenhouse gas emissions by industries.[68] Another type of greenwashing to be avoided is NbS-

[63] IUCN (2021) IUCN welcomes recognition of nature's role at COP26 and calls for more ambition.
[64] CBD/WG2020/REC/4/1. Post-2020 global biodiversity framework
[65] Seddon et al. (2021).
[66] Dumitru, A., Frantzeskaki, N., & Collier, M. (2020). Identifying principles for the design of robust impact evaluation frameworks for nature-based solutions in cities. *Environmental Science & Policy*, *112*, 107-116.
[67] Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., ... & Wittmer, H. (2017). The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of the total environment*, *579*, 1215-1227.
[68] Seddon et al. (2021).

labelled projects of tree planting and other purposes that is not sustainable in term of ecosystem resilience and biodiversity.

Managed in the right way, NbS hold great promises. While there are no quick technical fixes to solve the climate and nature crises, nature itself has immense restorative power and provides some of the most cost-effective solutions. By working with NbS, we not only have a potential to reduce emissions and biodiversity loss and to improve human well-being, but we must also do so to achieve 1.5°C or net-zero emissions by 2050, the Post 2020 biodiversity targets and the Sustainable Development Goals. This requires a drastic change in the way we interact with and depend on nature to unlock the full potential of NbS.

On global NbS governance, the full commitment to NbS by UNEA is an important step. This must now lead to similar commitment to NbS by the key legal instruments, UNFCCC and CBD, to break down their silos and work on NbS in a collaborative and mutually supportive manner. The science-policy bodies IPCC and IPBES have paved the way in this respect.

FRIDTJOF NANSENS INSTITUTT
FRIDTJOF NANSEN INSTITUTE

Fridtjof Nansens vei 17 | P.O. Box 326 | NO-1326 Lysaker | Norway
Telephone (+47) 67 11 19 00 |E-mail post@fni.no | www.fni.no