Nature-based Solutions in Carbon Markets

Stiftung ZUKUNFT DES KOHLENSTOFFMARKTES

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TREES*

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- The *Foundation Future of the Carbon Market* (*Stiftung Zukunft des Kohlenstoffmarktes*) was established in 2011 to promote environmental and climate protection in developing and emerging countries. The Foundation aims to support innovative carbon market mechanisms and access emission reduction potentials that so far have barely been tapped by the carbon market. A particular focus has been set on programmatic activities.

  While some types of Nature-based Solutions have been used under the Clean Development Mechanism (CDM) only to a certain exent, the magnitude of the required emission reductions to achieve the aims of the Paris Agreement make it necessary to widen and substantially scale the use of ecosystems as natural solutions for combating climate change including through carbon markets. With this publication, the Foundation aims to contribute to spur further market developments and regulative requirements in line with its mission. For more information on the Foundation, please visit http://www.carbonmarket-foundation.org/home

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- TREES - as solution architects and developers for traditional and new innovative NbS at quantification, program, and governance levels - is highly engaged to accelerate and expand the solid and long-term implementation of NbS based activities. Building on more than decade of NbS experience in compliance and voluntary carbon markets developing projects and programs, quantification methodologies, MRV systems, governance components, and corporate scope 3 value chain programs, TREES aspires to drive innovation in carbon markets and activities. For more information please visit: https://trees-consulting.com/

- Gold Standard - seeks to catalyze high-integrity NbS and land use activities that result in credible emission reductions and measurable sustainability co-benefits, and to do so by leveraging carbon market and non-market mechanisms, climate finance, and corporate investment. GS further seeks to anchor NbS mechanisms in the Greenhouse Gas Protocol, Science Based Targets, and aligned with the Articles of the Paris Agreement. For more information please visit: https://www.goldstandard.org/

Note that as much of the current discourse impacts the usefulness of historic literature, the following study on Nature based Solutions (NbS) is not a meta-study compiling existing literature and opinions (though is written with extensive knowledge of them). All figures and tables not listing a specific source have been developed and compiled by TREES for this study.

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Executive Summary

With the end of the Kyoto system in 2020 and the national programs not yet fully operational after the Paris Agreement, the voluntary carbon market has become the main driver for climate mitigation projects and the forefront for testing and developing Nature based Solutions (NbS) project types in land use, forestry, and the blue carbon sector.

The following study thus assesses NbS in carbon markets including programmatic approaches emphasizing climate change mitigation to inform carbon market stakeholders and climate negotiators on their potential, barriers, and risks as well as the opportunities and innovation potential going forward.

The study concludes that there is long-term experience on successfully implementing NbS for climate change mitigation in carbon markets on project scale. Barriers have been identified and a wide variety of approaches, solutions, tools and guidelines are available. To allow the urgently needed upscaling from project-based credit mechanism to landscape or country level and allow successful implementation in the newly blended and evolving carbon markets, critical barriers first need to be resolved - the most prominent being regulatory systems impeding NbS implementation and market-based climate finance. Hybrid approaches combing jurisdictional and credit-based mechanisms represent an opportunity to overcome these barriers. Nevertheless activity-based risks including trade-offs and interactions between different NbS activities and respective stakeholders need to be managed in the program setup, from the very beginning.

The most important findings are summarized below:

There is long-term experience on successfully implementing Nature-based Solutions in carbon markets

NbS have been successfully implemented in carbon markets and environmental programs for a long time. What is different about NbS today, however, is the way they are framed: NbS are now regarded as a solution to achieving ambitious social and environmental goals on a mass scale. Besides climate impact, the focus is on food and water security, on disaster risk reduction, human health and socioeconomic development, as well as combating environmental degradation and biodiversity loss.

Different definitions for NbS are being used today which can be summarized as an umbrella concept for many approaches addressing climate-related challenges using nature to emphasis different aspects on either the problem to be solved or the nature to be used. WWF recommends including in the NbS definition the use of nature for both climate change mitigation and adaptation, to set ambitious, measurable and time bound numeric targets, to maximize benefits from biodiversity, and to include all ecosystem types that can provide climate benefits such as wetlands, forests, mangroves, coral reefs, grasslands, working lands, and urban landscapes.

Though there is no common practice definition of NbS in carbon markets, scopes and implemented project activities are streamlined across the voluntary carbon standards and thoroughly reviewed science-based quantification methodologies are available for NbS activities in the forestry, land use and blue carbon[1] scope. Application of NbS in carbon markets proved to provide a range of mitigation benefits (emission reductions, removals, avoided emissions) urgently needed to limit global warming to 1.5°C, respectively 2°C by 2030[2].

[1] Blue carbon is the carbon stored in coastal and marine ecosystems

[2] IPCC special report: Global Warming of 1.5.° (IPCC 2018) SR15_SPM_version_report_LR.pdf (ipcc.ch)

Besides mitigation, NbS projects also provide multiple co-benefits/Sustainable Development Goals (SDG) contributions, though robust quantification and selection of mandatory key SDGs per NbS scope is needed.

Considerable potential remains for countries to strengthen the role of NbS in future Nationally Determined Contribution (NDC) updates

While many current NDCs include NbS, most contain mainly references to efforts in the forestry sector though many other ecosystems can also provide substantial NbS contributions. In addition, many of the NbS targets are not set per sector, non-specific, not measurable, do not define the baseline stock/emissions, and do not describe how the quantification per NbS activity will be performed. Also, there is vast potential to improve quantification precision and accuracy.

Carbon market approaches offer solutions to many barriers inherent to NbS projects

Key barriers and challenges identified for NbS range from access to upfront capital and lagged returns, ensuring permanence of stored carbon, to issues in social and regulatory environments. For many of these barriers, safeguards and solutions have been implemented in carbon markets on project-scale already, with stakeholder consultation and alignment at the core of many solutions. However, if NbS activities are to be upscaled to country/landscape level, critical barriers still need to be resolved. Newly emerging barriers – not specific to NbS but to mitigation projects in general – like avoiding double counting between different markets (e.g. carbon markets, NDCs, corporate supply chain, emerging systems like CORSIA), are recommended to be addressed by applying corresponding adjustments (aligned with Paris Agreement Art. 6) to ensure that a mitigation unit is only counted once across all market and systems.

Growing demand in NbS due to blending and evolvement of carbon markets

In the transition from the Kyoto protocol to the Paris Agreement, and thus to global emission reduction targets and contributions across all countries and sectors, the formerly clear separation of compliance and voluntary markets is softened. Further applications and schemes are emerging, including sectoral programs (e.g. CORSIA) and corporate initiatives, and compliance and voluntary market components are aligning. Many of them are requiring NbS credits such as removals specifically (e.g. Net Zero approach). This provides a huge opportunity for usage of NbS mitigation units in different markets.

Substantial potential for innovation exists for large-scale NbS application and for blue carbon and urban scope

There is substantial potential and opportunity for innovation especially for NbS activities not yet tapped by carbon markets (mainly in the blue carbon and urban sector) and for the urgently needed upscaling from project to landscape/country level by combining jurisdictional with credit-based mechanism. For this, the development of a system-wide framework is needed to address interactions and potential trade-offs between different NbS activities also from the perspectives of different stakeholders. Especially for NbS in diverse productive environments, harmonized overall policies and regulatory requirements and incentives need to be managed already during the program setup. Also, innovative finance approaches such as ex-ante credits or early credit issuance to close the gap between upfront investments and lagged financial returns need to be explored.

Contents

Glossary of Terms and Abbreviations

ACR	American Carbon Registry
A/R	Afforestation / Reforestation
Baseline	Pre-project GHG emissions or carbon stock
BAU	Business as usual
Blue Carbon	Carbon stored in coastal and marine ecosystems
CA	Corresponding Adjustments
CAR	Climate Action Reserve
CH_4	Methane
CO_2	Carbon Dioxide
COP	Conference of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
Crediting period	time span in which SDG impacts can be accounted for and are subject to monitoring
EbA	Ecosystem-based Adaptation
EbM	Ecosystem-based Mitigation
Eco-DRR	Ecosystem -Disaster Risk Reduction
EU	European Union
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse Gas
GS	Gold Standard for the Global Goals
IFM	Improved Forest Management
ITMO	Internationally Transferred Mitigation Outcome)
JI	Joint Implementation
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
LDC	Least Developed Countries
MRV	Monitoring Reporting and Verification
NbS	Nature-based Solutions
NCS	Natural Climate Solutions
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organization
Plan Vivo	Plan Vivo Foundation – For Nature, Climate and Communities
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SDG	Sustainable Development Goals
SOC	Soil Organic Carbon
UNDP	United Nations Development Program
UNEP	UN Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard (Verra)
WWF	World Wide Fund For Nature

1 Nature-based Solutions in Carbon Markets

1.1 What are Nature-based Solutions?

Nature based solutions (NbS) is the established concept of working with nature to address societal challenges especially climate change. NbS have been successfully implemented in carbon markets and environmental programs for decades mainly in the forestry and land use sector including coastal systems and wetlands, i.e. as measures that conserve, restore, or enhance forests, wetlands, grasslands and agricultural lands (see Table 1 for NbS activities overview). Also, communities around the world have longstanding traditions of using nature to benefit their lives and lands, such as planting trees to control water supply.

What is different about NbS today, however, is the way they are framed: NbS are now regarded as a solution to achieving ambitious social and environmental goals on a mass scale. Besides climate impact, the focus is on food and water security, on disaster risk reduction, human health, and socioeconomic development, as well as environmental degradation and biodiversity loss.

Different definitions for NbS are being used today (for an overview compare Box 1). WWF[3] summarizes that NBS can be considered an umbrella concept for many approaches addressing climate-related challenges using nature to emphasizing different aspects on either the problem to be solved or the nature to be used. In its own definition of NbS, WWF recommends including the use of nature for both climate change mitigation and adaptation, to set ambitious, measurable and time bound numeric targets, to maximize benefits from biodiversity, and to include all ecosystem types that can provide climate benefits such as wetlands, forests, mangroves, coral reefs, grasslands, working lands, and urban landscapes[3]. The latter is also in line with the European Commission's framing for NbS, focusing on urban ecosystems and innovating with nature: "[NbS are] solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions[4]."

[3] WWF, 2020: Enhancing NDCs through Nature-Based Solutions https://c402277.ssl.cf1.rackcdn.com/publications/1318/files/original/enhancing_ndcs_through_nature_based_solutions.pdf?1585149353
[4] European Commission: https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en

Box 1: Different NbS Definitions *(based on WWF 2020[3])*

IUCN it its Global Standard for NbS[21] defines nature-based solutions as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits." While this definition does not mention climate change explicitly, it includes climate change as one of six broad societal challenges that nature can help address (the others are disaster risk, food security, water security, socio-economic development, and human health). Nature can be utilized to address climate change directly (ecosystem based or nature-based mitigation) or to reduce vulnerability to the climate change impacts that affect the other societal challenges (ecosystem-based or nature-based adaptation). All these approaches would be considered nature-based solutions for climate, either mitigation or adaptation.

Other definitions of nature-based solutions aimed at addressing climate-related challenges emphasize different aspects on either the problem to be solved or the nature to be used. The Nature Conservancy (TNC) and Rainforest Alliance use the term Natural Climate Solutions (TCS) that makes reduced or avoided emissions the primary objective, while the Rainforest Alliance definition also includes resilience to extreme weather but limits actions to forest biomes. The World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR) uses nature-based solutions in the context of disaster risk reduction. Some definitions include both natural and artificial (such as green roofs) or modified ecosystems (such as forest plantations) while others do not. All of these are valid depending on context. In fact, the Oxford University nature-based solutions Initiative describes NbS as an "umbrella concept for other established nature-based approaches such as ecosystem-based adaptation (EbA) and mitigation (EbM), eco-disaster risk reduction (eco-DRR), Green Infrastructure (GI) and natural climate solutions (NCS)."

1.2 Nature-based Solutions Activities in Carbon Markets

The carbon market does not have a common practice definition for NbS, each carbon standard does interpret the definition differently. While VCS[5] relies on Natural Climate Solutions (NCS)[6] focusing on climate mitigation, Gold Standard[7] is aligning their GHG mitigation projects requiring Sustainable Development Goal (SDG) contributions with the IUCN NbS Standard[21]. Nevertheless, NbS project scopes (forestry, land use and blue carbon[8]) and activities have been aligned across the voluntary carbon standards (Table 1 and Box 3).

[5] https://verra.org/project/vcs-program/
[6] https://www.nature.org/en-us/what-we-do/our-insights/perspectives/natural-climate-solutions/
[7] https://www.goldstandard.org/
[8] Carbon stored in coastal and marine ecosystems

Table 1: Scope, NbS activities and their GHG mitigation impacts in carbon markets

Scope	Activity	Carbon Credit Units		
		Emission reduction	Avoided emissions	Removals
Forestry	▪ Afforestation/reforestation (A/R)			X
	▪ Improved forest management (IFM)			X
	▪ Avoided deforestation or forest degradation (REDD)		X	
Agriculture	▪ Agroforestry			X
	▪ Nutrient management (fertilizer/inputs)	X		X
	▪ Improved practices (tillage)	X		X
	▪ Irrigation / water management	X		
	▪ Organic inputs (compost, green manure / mulch, biochar)			X
	▪ Livestock (CH4 reduction in enteric fermentation)	X		
Blue Carbon	▪ Peatland and wetland conservation and restoration	X	(X)	X
	▪ Coastal mangrove restoration	X	(X)	X
	▪ Tidal wetland restoration	X		X

For all of the above listed project activities, robust and thoroughly reviewed scientific-backed quantification methodologies are available under the voluntary carbon standards to calculate GHG emission reductions or sequestration potential for small to large-scale mitigation projects and produce tradable carbon credits. Carbon credits are measurable, verifiable GHG emission reductions, removals, or avoided emission units from certified climate mitigation projects (compare Box 2). Projects must adhere to a rigorous set of criteria and safeguards to pass verification by third-party auditors and review by the voluntary carbon standards. Carbon credits are issued after verification of impact (result-based approach).

Box 2: Carbon Credit Units

There are three basic types of emission reductions, all of which are common in NbS:

Reduced emissions are the quantity of anthropogenic CO_2 emissions reduced as a result of specific interventions. An example for an NbS reduced emission activity is the reduction in methane emissions from enteric fermentation in cows through application of feed supplements.

Avoided emissions are the quantity of anthropogenic CO_2 emissions that have not been emitted to the atmosphere as a result of interventions with lower or no greenhouse gas emission. An example for an NbS avoided emission activity is avoided deforestation and forest degradation (REDD) whereby protection of the standing forest is the aim of the project, thus preventing emissions from its loss.

Removed emissions (removals) are the quantity of anthropogenic CO_2 removed from the atmosphere and durably stored in geological, terrestrial, or ocean reservoirs as a result of interventions. Examples for NbS removal activities are afforestation, reforestation and improving forest management, as well as agricultural practices (e.g. enhancing the uptake and storage of carbon in soils).

NbS activities face different mitigation potentials and risks: While removal activities with their required long crediting period (~ 10-50 years depending on activity, methodology applied and carbon standard) incentivize a long-term practice change and provide many SDG contributions/co-benefits including adaption and disaster risk reduction they face a permanence risk/reversal risk[9] (see section 3.3). Emissions reduction activities do not face a permanence risks but may provide less SDG contributions/co-benefits and a higher risk to revert to old practices after the end of the project (crediting periods of 5-10 years). Generally, the performance of all NbS projects is highly site-specific and heavily depends on the baseline (pre-project) emissions/carbon stock which can vary on a small scale.

Box 3: Nature-based Solutions in Voluntary Carbon Markets

The application of credits in voluntary offset markets involves an entity (without a legally binding target), typically a company, which makes a promise to its stakeholders that although it has emitted, the atmosphere is not net worse off than if it had not. This process is facilitated by the application of certified carbon units as credits, purchased and retired by the company seeking to make compensatory claims.

Voluntary carbon markets allow global application and trade of these project-based mitigation benefits (carbon credits/offsets) with the Gold Standard and Verra VCS (Verified Carbon Standard) as the major international voluntary carbon standards, American Carbon Registry (ACR) and Climate Action Reserve (CAR) standards having strong impacts in the US, and Plan Vivo focused on smallholders and community projects.

Gold Standard, VCS, CAR, and ACR, and Plan Vivo all have methodologies and programs in place to implement NbS for GHG emission reductions, avoidance and removals in the land use and forestry scopes. Recent developments expand this scope to blue carbon, i.e. coastal and aquatic systems.

Nature-based Solutions – in fact if not in name – have been at the core of successfully implemented activities with strong co-benefits, i.e. contributions to socioeconomic and environmental factors related to the SDGs. Certification approaches like Gold Standard or co-certification of Verra's VCS and CCB (Climate, Community and Biodiversity) standards have set high quality requirements and safeguards to ensure the broad impacts (beyond climate action) expected from NbS.

Programmatic approaches, called grouped projects under Gold Standard and VCS and similar to Programs of Activities (PoA) under the Clean Development Mechanism, which would allow scalable approaches for activity implementation have not been realized at significant scale (as compared to the success e.g. of PoAs for improved cookstoves).

[9] Re-emittance of bound carbon into the atmosphere

1.3 Nature-based Solutions provide multiple Sustainable Development Goal Contributions

NbS carbon market projects not only reduce emissions and remove large quantities of carbon from the atmosphere they can simultaneously deliver a broad range of Sustainable Development Goals (SDG)[10] contributions (formerly called co-benefits; Figure 1) while improving resilience to future extreme events and natural disasters. They are thus fully compliant with the IUCN global standard for NbS[21]. Typical SDG contribution areas as delivered by NbS carbon projects cover:

- Climate change adaptation
- Food security
- Water security
- Biodiversity
- Disaster reduction
- Socio-economic development
- Human health

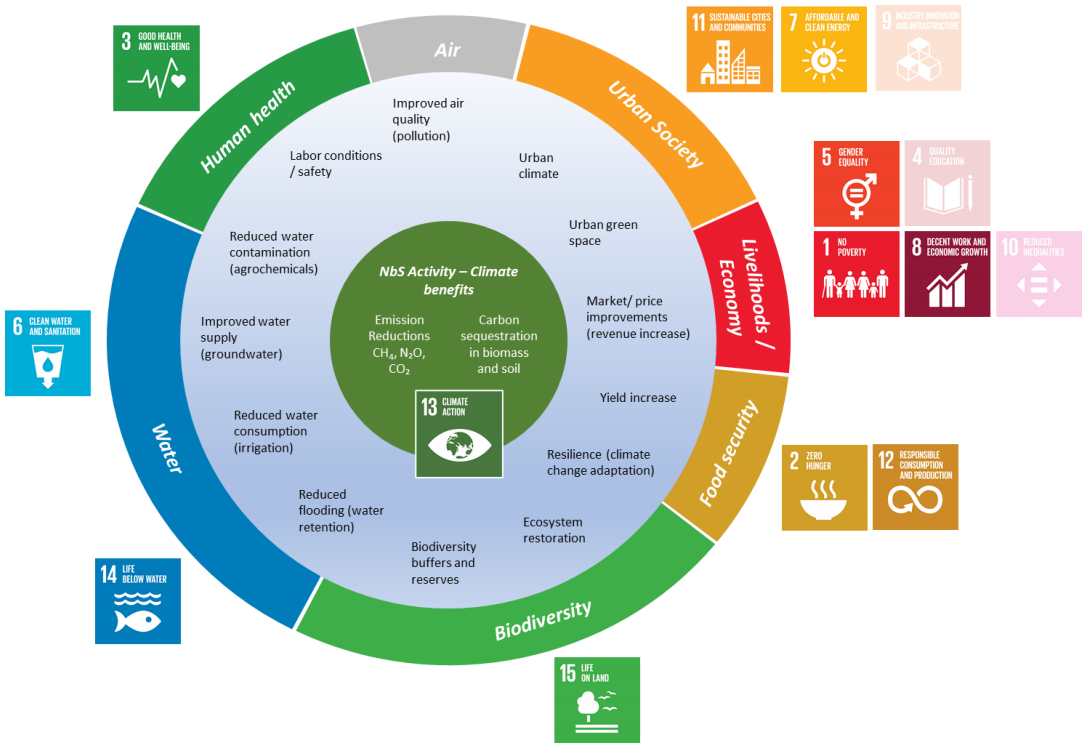

Figure 1: Overview of potential co-benefits for a generic NbS activity (climate centric)

These SDG contributions/co-benefits are a key selling point for NbS carbon projects[11] and clearly identify the quality of a good carbon project. Since the adoption of the UN Sustainable Development Goals, voluntary carbon standards have aspired even stronger integration of non-climate impacts. Gold Standard for example requires that each carbon mitigation project provides impact on two additional SDGs besides SDG 13 (climate action).

[10] https://sdgs.un.org/goals
[11] Ecosystem Market Place State of the Voluntary Carbon Markets 2020: https://share.hsforms.com/1ICNqRm4gSRGccSuyRZF-dg1yp8f

Quantification of co-benefits respectively SDG impacts of NbS projects is done under the voluntary carbon standards trough dedicated methodologies (e.g. gender equality impact, water benefits, improved health outcomes under GS[12]) or by applying a separate specific co-benefit standard (e.g. Climate, Community & Biodiversity Standard[13] or the Sustainable Development Verified Impact Standard under VCS/Verra[14,]). The most efficient approach is to calculate co-benefits using measurable SDG indicators. However, as these were developed for national accounting, standardized project-level SDG indicators first need to be established. Such SDG criteria and monitoring requirements through measurable SDG indicators establish a transparent and tangible contribution to human development, biodiversity, and environment. Going further, the voluntary carbon standards are now discussing requirements which SDGs (co-benefits) need to be addressed by a specific NbS project scope to avoid cherry picking and to incentivize a long-term practice change.

However, many NbS projects have the potential for trade-offs (negative or unintended impacts) in relation to other environmental objectives or social and economic priorities. Examples are biodiversity loss in a monoculture afforestation/reforestation approach or negative food security impact by switching fertilizers in crop production. All voluntary carbon standards have thus built rigorous safeguards (e.g. requiring native species in A/R[15], requiring buffer zones around water bodies and rivers and setting aside min 10% of the project area to protect or enhance biodiversity following the high conservation value approach[16]), binding requirements, and monitoring requirements to foster positive social, economic and environmental impacts. Stakeholder inclusion during the design of the project is one of the most important aspects to address potential negative trade-offs from the very beginning.

1.4 Growing Demand in Nature-based Solutions due to Blending and Evolvement of Carbon Markets

The NbS concept gained new momentum and a growing interest in both public and private investment and brought great political attention when the 2019 IPCC Climate Change and Land Report[17] stated that all scenarios that limit climate change to 1.5°C rely heavily on land-use change mitigation methods and research showed that NbS can provide more than a third of the emissions reductions needed to limit global warming to 2°C by 2030[18]. NbS were a major focus of the United Nations Secretary- General's Climate Action Summit in 2019, where participants launched the Nature-Based Solutions for Climate Manifesto[19]. In the same year, paragraph 15 of the overarching decision stemming from UNFCCC COP 25 "underlines the essential contribution of nature to addressing climate change and its impacts and the need to address biodiversity loss and climate change in an integrated manner"[20]. In 2020, the International Union for Conservation of Nature (IUCN) launched the first-ever Global Standard for NbS[21] to boost impact of NbS to global challenges. It guides users through NbS applications and sets benchmarks for their progress. In 2021, NbS continued to be high on the agendas at both the World Economic Forum and the Climate Adaptation Summit in January and will play a key role at the upcoming global summits on climate, biodiversity, desertification and food CBD CoP15 as well as at the Glasgow

[12] Gold Standard for the Global Goals
[13] https://www.climate-standards.org/
[14] VCS: Sustainable Development Verified Impact Standard SD VISta
[15] Plan Vivo carbon Standard: https://www.planvivo.org/Handlers/Download.ashx?IDMF=a677d7d1-ce55-4925-aeea-71b8c95caf1c
[16] Gold Standard for the Global Goals, Land Use and Forestry Requirements: https://globalgoals.goldstandard.org/203-ar-luf-activity-requirements/
[17] IPCC. 2019 Climate and land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. See https://www.ipcc.ch/report/srccl/.
[18] Griscom, B.W. et al. Natural climate solutions| PNAS | 2017 : https://www.pnas.org/content/114/44/11645
[19] https://wedocs.unep.org/bitstream/handle/20.500.11822/29705/190825NBSManifesto.pdf
[20] United Nations Framework Convention on Climate Change [UNFCCC] 2020
[21] https://www.iucn.org/theme/nature-based-solutions/resources/iucn-global-standard-nbs

UNFCCC CoP26. In addition, the Net-Zero[22] pledges of countries and corporates to balance emissions with sinks triggered a rush for removals.

In the transition from the Kyoto protocol to the Paris Agreement and thus to global emission reduction targets and contributions across all countries and sectors, the formerly clear separation of markets into compliance systems and the voluntary offset markets (Figure 2 left side) is softened, and markets are blending (Figure 2 right side). Further applications and schemes are emerging, including sector programs and corporate initiatives, and compliance and voluntary market components are aligning.

With the provisional end of the Clean Development Mechanism CDM in 2020 and pending the conclusion of negotiations on Article 6 of the Paris Agreement, the biggest compliance market for project-based mitigation benefits ceased to operate. Following the Paris Agreement, the voluntary carbon market has become the main driver for NbS mitigation projects also feeding credits into post-Paris compliance markets and initiatives such as CORSIA[23] (see Box 4), the corporates taking actions under the Science based Target Initiative[24] (see Box 5) and national approaches (e.g. South African and Colombian carbon tax systems allowing heavy emitters to purchase offset credits from voluntary standards). Alignment with national accounting to avoid double claiming of benefits has thus become a key challenge (compare chapter 2).

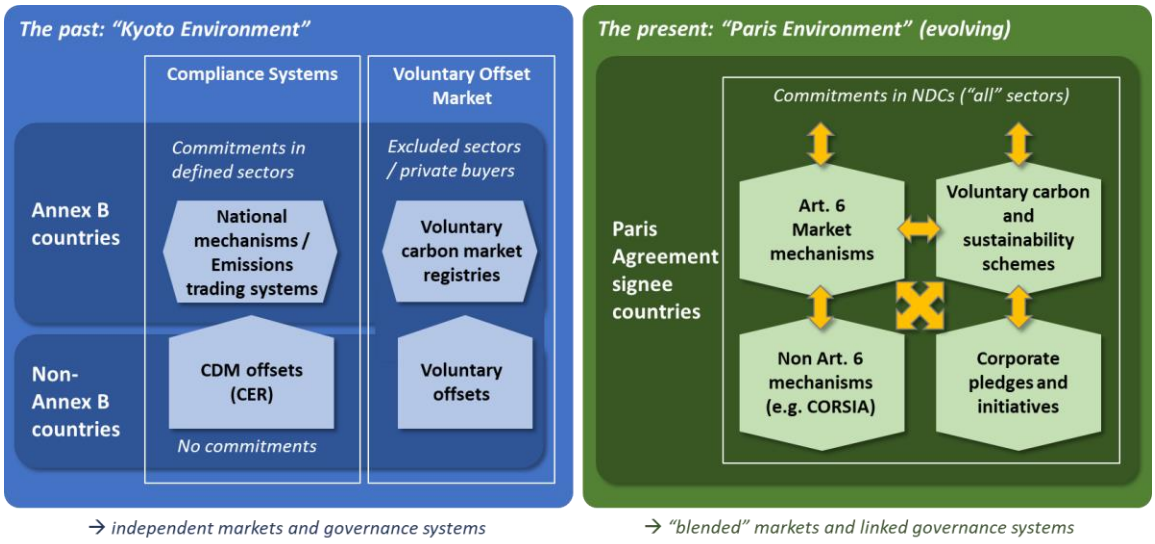

Figure 2: Simplified schematic view of Kyoto and Post-Paris carbon market environments

[22] https://sciencebasedtargets.org/net-zero
[23] https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx
[24] https://sciencebasedtargets.org/

Box 4: CORSIA – Carbon Offset and Reduction Scheme for International Aviation

CORSIA[23] is a market-based mechanism adopted in 2016 to achieve ICAO's (UN International Civil Aviation Organization) goals of increasing fuel efficiency by 2% per year and carbon-neutral growth of civil aviation from 2020 onwards. The mechanism aims to cap aviation's future emissions growth by obliging airlines to buy offsets, rather than reducing their aircraft emissions. CORSIA addresses the increase in total carbon dioxide (CO_2) emissions from international aviation above 2020 levels though a 'market-based measure' that enables aircraft operators to offset relevant emissions. CORSIA is expected to generate a significant additional source of demand for offsets: around 2.6 billion tons of CO_2 by 2035 which constitute as a separate voluntary carbon market itself.

Eligible carbon standards/programs for CORSIA's 2021-2023 pilot phase include the American Carbon Registry, the China Greenhouse Gas Voluntary Emission Reduction Program, Clean Development Mechanism, Climate Action Reserve, the Gold Standard, and the Verified Carbon Standard. However, CORISA does not allow all project activities by those standards/programs but has specific restriction on project activity. For example, CORSIA will not accept CDM credits from A/R projects – highlighting the problems with permanence, as CDM projects have no compliance buffer, insurance, or other provisions to address permanence. Project-level REDD+ credits are also not eligible due to important concerns about leakage. Gold Standard credits from A/R projects are accepted because of the Gold Standard management of both permanence and leakage.

Box 5: Science Based Targets (SBT)

Corporate GHG emission reduction targets as pledged under the Science-Based Targets Initiative[22] ensure that companies reduce their emissions at a rate that is consistent with the level of decarbonization required to limit warming to 1.5°C or well-below 2°C. The focus of SBT is on abatement of emissions within the value-chain of the company. Offsets cannot be used to count as emissions reduction toward the progress of companies' science-based targets. NbS carbon removals, however, can be used to account for net-zero, subject to the company having achieved internal science-based conformity (for most companies this is likely to be between 2035 and 2050). As of the date of this report, 1215 companies are taking science-based climate action and 603 companies have approved science-based targets.

2 Nature-based Solutions in NDCs

The importance of NbS for climate change mitigation and adaptation is evident by its inclusion in the majority of the Nationally Determined Contributions (NDCs). However, most contain mainly references to efforts in the forestry sector covering the management, restoration and/ or protection of terrestrial forests and/or afforestation. Meanwhile, other ecosystem types that can provide NbS benefits such as grasslands, drylands, coastal and/or marine ecosystems (e.g. mangroves), other wetlands (e.g. peatlands), working lands, and even urban landscapes are relatively poorly represented.

Many of the NbS targets are nonspecific, not defined per sector but stating a general emission reduction target covering all sectors (e.g. EU NDC). In addition, most NDCs do not include robust NbS targets, i.e. ones that are linked to a clear established baseline and are measurable, time-bound and based on science and/or local knowledge and consultation; only few are expressed in tons of carbon dioxide equivalent or are even stating the specific quantification/measurement approach[25]. Under the voluntary carbon standards all carbon projects are required to apply an activity specific, thoroughly reviewed and registered science-backed quantification methodology to calculate the emission reduction or sequestration potential in tons of carbon dioxide equivalent. In addition, the quality and accuracy (uncertainty) of the data/models used needs to be assessed for any carbon projects with penalties installed to incentive a more improved approach than simply using IPCC tier 1 defaults[26] with high associated errors.

Challenges inherent to NbS such as the management of climate risks that threaten the long-term viability or potential reversal are currently not addressed in the NDCs but are vital to the success of NbS for climate mitigation and adaptation. In contrast to CDM, the voluntary carbon standards such as the Gold Standard and VCS have established risk mitigation tools[27] and safeguards on standard level to address these topics and ensure successful implementation and delivery of NbS climate benefits for their long-term carbon projects. These tools and safeguards could also be considered with NbS in NDCs.

Another issue is the uncertainty around how carbon units will be embedded within the accounting and governance structure of a country's NDC. At the core of this is a lack of clarity as to whether countries will allow voluntary carbon market projects contributing to the NDC goals respectively export carbon units to private buyers without simultaneously making corresponding adjustments to their own NDC NbS goals – which could lead to "double counting" or overestimating the amount of carbon (compare section 3.4).

This clearly shows that considerable potential remains for countries to strengthen the role of NbS in future NDCs. Unfortunately, while general targets have been improved in some updated NDCs as submitted by end of 2020 only few improvements were made on including NbS specific measurable targets (see chapter 7.1 in Annex for country examples of strong NbS consideration in their NDCs).

[25] United Nations Development Programme. 2019. Pathway for Increasing Nature-based Solutions in NDCs: A Seven-Step Approach for Enhancing Nationally Determined Contributions through Nature-based Solutions. New York, USA: UNDP.
WWF, 2020: Enhancing NDCs through Nature-Based Solutions. https://c402277.ssl.cf1.rackcdn.com/publications/1318/files/original/enhancing_ndcs_through_nature_based_solutions.pdf?1585149353
Seddon, N., Sengupta, S., García-Espinosa, M., Hauler, I., Herr, D. and Rizvi, A.R. (2019). Nature-based Solutions in Nationally Determined Contributions: Synthesis and recommendations for enhancing climate ambition and action by 2020. Gland, Switzerland and Oxford, UK: IUCN and University of Oxford.

[26] 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: chapter 3 Key Concepts unchanged from the 2006 IPCC Guidelines.

[27] GS: Land use and forests risks and capacity guideline: https://globalgoals.goldstandard.org/203g-ar-luf-risks-capacities-guideline/; VCS: AFOLU Non-Permanence Risk Tool, v4.0: https://verra.org/wp-content/uploads/2019/09/AFOLU_Non-Permanence_Risk-Tool_v4.0.pdf

3 Barriers for Nature-based Solutions and Ways to Overcome them

Since their inception, NbS were successfully implemented on project level but have been facing a range of challenges that impeded large-scale implementation, ranging from regulatory and social environments, cultural barriers and traditions, funding difficulties, and technical and operational challenges.

Not all barriers discussed for NbS, however, are NbS specific. It is important to distinguish between general barriers to the implementation of carbon market activities and barriers inherent to NbS activities. Table 2 provides an overview of barriers inherent to NbS activity implementation and available solutions under the voluntary carbon standards, while Table 3 lists common and new barriers and solution approaches for general carbon market activities implementation on project level. The key challenges and barriers for large-scale application of NbS are then discussed in sections 3.1-3.5.

Also, not all barriers have the same relevance or impact for all types of carbon market systems and application (compare section 3.3). Permanence of sequestration, a barrier specific to NbS for example, may not be a big concern for a long-term approach where fluctuations are acceptable, and the goal is an overall long-term impact and practice change. However, for credits used in an offsetting system, ensuring permanence is crucial to prevent that losses of sequestered carbon cancel out the offset and thus nullify the credits' value. Another example for different impacts of a barrier is access to finance. In a third-party funded program, initial investment may not be an issue but lack of continued investments for long-term operations can lead a program to failure. Contrary, performance-based carbon credit projects often lack the capital for initial investments, despite a long-term profitable business case, e.g. due to time-lagged revenue generation.

Table 2: Barriers specific to the implementation of NbS activities on project level, and available solutions in carbon markets

Type of barrier	**Examples of barriers and challenges**	**Solution approaches available in voluntary carbon markets**
Social and cultural barriers	▪ Dominating traditional practices (e.g. land use) ▪ Lack of knowledge/skills[28]	▪ Multi-year (10-50) crediting period ensures long-term practice change. ▪ Projects require public stakeholder interactions to raise awareness, and to provide support and training.
	▪ Food security ▪ Water security	▪ Voluntary carbon standard's principles and safeguards ensure that yields are not reduced, and water quality and quantity are not adversely impacted.
Land tenure and social conflicts	▪ Long-term land tenure / conflicts ▪ Multi-stakeholder environments, land use conflicts ▪ Gender equality and child labor (in agriculture systems), illegal land use activities /land use change	▪ Voluntary carbon standards require uncontested land right proof or long-term lease to ensure carbon rights. ▪ Mandatory public stakeholder consultation creates transparency, identifies common goals, and reduces risk of conflicts. ▪ Grievance processes are required for any carbon project to deal with potential conflicts during the entire project duration. ▪ Standard level safeguards forbid child labor and require gender equality.
Quantifi-cation of GHG benefits	▪ Complexity of natural processes	▪ Models and data are rigorously verified and calibrated by third party auditors to ensure project and activity applicability.

[28] While lack of knowledge/skills is not per se specific to NbS activities, it represents a significant upfront risk for NbS activity change if not addressed properly at project setup.

	▪ Interaction of benefits if several NbS activities are applied in one project. ▪ Variability and uncertainty in quantification models, data and measurements	▪ On site field measurements directly quantify net multi-activity impact. ▪ Voluntary carbon standards such as GS require credit deductions for high uncertainties in models or data (i.e. reducing credits issued).
Climate Risks	▪ Climate change impacts (drought, water shortage) ▪ Natural disasters (fires, floods)	▪ Risk assessments for projects include climate change effects and require risk management and mitigation at project setup. ▪ Deductions of credits are applied for non-mitigated risks. ▪ Recovery of losses through retirement of credits in carbon standard's risk buffer pool.
Environ-mental integrity & quality assurance	▪ Permanence of stored carbon	▪ Carbon standard such as GS and VCS require risk buffer credit contribution for NbS projects, CAR allows insurance solutions or a ton-year accounting (see section 3.3). All voluntary carbon standards have implemented strict reversal rules resulting in project non-compliance or required credit compensation.

Table 3: General barriers to the implementation of carbon market activities on project level, and available solutions

Type of barrier	**Examples of barriers and challenges**	**Solution approaches available in voluntary carbon markets**
National governance and regulatory frameworks	▪ Lack of supportive and aligned policy and legal frameworks (e.g. NDCs) ▪ Lack of sector specificity and quantification of targets in NDCs ▪ Lack of long-term market governance (e.g. government/policy change)	▪ Voluntary carbon standards require projects to comply, align with and exceed regulatory requirements. ▪ NDC alignments and/or corresponding adjustments required to avoid overlaps with national reduction claims (see also double counting below). ▪ The voluntary carbon standards recommend regular interaction with governance systems to allow early adaptation in case of policy changes.
Financial issues	▪ Lack of financial incentives to change practices. ▪ Lack of upfront investment capital, long time-lag to carbon revenues	▪ Carbon credit revenues contribute to returns on capital. ▪ Voluntary carbon standards require project business case to transparently document cost and investment needs. ▪ Ex-ante[29] credits or early partial issuance of carbon credits allow early monetization of GHG benefits.
Environ-mental integrity & quality assurance	▪ Double counting of GHG benefits due to country NDCs ▪ Leakage[30] ▪ "Common practice" and additionality	▪ Some voluntary carbon standards such as GS require corresponding adjustments or as interim solution credit retirement ("overlay of NbS credits with energy credits"), carbon standard registry controls credit ownership, transfer, and retirement. ▪ Leakage analysis and accounting (credit deduction for leakage) as required by the activity specific quantification methodology under all voluntary carbon standards. ▪ Clear rules on additionality, available additionality tools. ▪ Positive list to facilitate prioritized activities, structures and regions (e.g. for LDC).

[29] Partial credits issuance at project registration (before GHG reductions have been verified) based on forecasted modelled GHG benefits. Such credits can be sold but not be used for offsetting; they represent future options.
[30] Increase in GHG emissions outside the project area as a result of project activities.

		▪ Next generation, robust additionality approaches (performance benchmarks coupled with positive lists, above)
Quantifi-cation of GHG benefits	▪ Emerging new science	▪ Thoroughly reviewed, science-backed activity-specific accounting methodologies are applied for quantification of GHG emission reduction or sequestration under the voluntary carbon standards.
Social and cultural barriers	▪ Risk aversion and resistance to change ▪ Lack of knowledge/skills	▪ Carbon credit revenues create incentive to change. ▪ Projects require stakeholder interactions to raise awareness, and to provide support and training.

3.1 National Governance and Regulatory Frameworks

Barriers and challenges:

A critical success factor for the scale up of NbS in carbon markets is the establishment of national and international governance systems suitable for market-oriented carbon projects and initiatives. With the changes taking place under the Paris Agreement, specifically Article 6, this will be key for any carbon market activity across compliance and voluntary markets, as well as sector-specific solutions and corporate programs.

The recent wave of policy updates and governmental climate legislation is increasing the need for alignment with non-governmental programs as well as between different activities and parties. Especially in large-scale NbS programs, the multitude of stakeholders involved, often with different priorities and interests, also raises risk of overlaps and potential conflicts between multiple regulatory systems. Moreover, as the setup and revision of international and national GHG governance is still ongoing and expected to continue with the refinement of Paris Agreement Article 6, such interactions between policy, stakeholders and activities will play a key role in the development of market based GHG reduction activities.

Large-scale NbS programs are often governed by multiple government units applying different sector policies, e.g. forestry, agriculture, conservation and environment, economic development, fishery (for coastal and aquatic systems). Regulatory environments are dynamic, and conflicts with large-scale GHG programs and projects are common. Impacts on carbon projects range from unsupportive incentives (e.g. subsidy programs), double claiming issues (e.g. NDC accounting overlaps, see also chapter 2), to fully preventive regulations (e.g. overarching development schemes, land use intensification programs). Harmonized overall policies, regulatory requirements and incentives are thus crucial for large-scale NbS implementation, especially for NbS in productive environments.

Political and functional “silo” thinking (i.e. lack of cross-sectoral and cross-functional planning and governance), lack of long-term commitment and sense of urgency among policy makers are often cited as preventive for large-scale NbS implementation, especially in urban and commercial environments. Indeed, few market solutions have been developed in such settings, though corporate initiatives as well as governmental approaches have been implemented, e.g. in agricultural supply chains or “green cities”. Private sector engagement has been important to incentivize supply chain stakeholders and link to product markets, corporate rules and regulations (e.g. requirements for brand or quality labels) further impact activities.

Therefore, a key requirement for NbS large-scale/landscape approaches – and one of the strongest operational barriers – is collaboration and alignment between a multitude of government and private stakeholders and processes. Programs need to build a common understanding of what needs to be achieved and ensure that

incentives and rewards are set fairly and comprehensively target-driven, while conflicts and counterincentives, e.g. through competing land use regulations or subsidies, are eliminated. As much as NbS should be focused on the natural systems involved, these governance components are key to their large-scale application success.

Suggested solutions:

Early and frequent interaction between the relevant parties, both governmental and non-governmental, is the core of any solution to conflicts between regulatory environment and climate programs. Such talks have been started in various groups around Art.6 discussions, NDC development, corporate programs and emission reduction pledges, and voluntary carbon standards. Early arrangements are already contributing solutions to some of the challenges listed above (e.g. double counting), while other important regulatory aspects remain still to be developed:

- Country NDCs need detailing on quantitative and sectors-specific goals including quantification approach and precision level, policy and operative means to be used for GHG reduction (compare chapters 2 and 4).
- Alignment of goals and targeted activities for all relevant NbS scopes (forestry, agriculture, blue carbon, urban) in the ongoing evolution of NDCs to prevent unintended impacts for different NbS (e.g. incentivize deforestation due to food security goals).
- Framework policies facilitating operational implementation, ensuring consistent governance and benefits accounting, e.g. corresponding adjustments (compare section 3.4 below).
- Transparency must be created in the relevant national and international policy landscapes and incentive systems to avoid inefficiencies and losses in carbon program setup and operations. The regulatory systems must also be flexible enough to allow new, innovative approaches to be implemented.

However, currently no “ready-made” and generally applicable solutions are available to align multiple NbS activities in large-scale programs with the regulatory requirements and incentive systems on country-level. Voluntary carbon standards have made it a certification requirement to comply with and exceed the legal requirements and assess social structures specifically for each carbon project. Public stakeholder consultations and grievance processes are mandatory to ensure acceptance and long-term performance of activities. NbS implementations of all structures and scales should also follow these examples.

3.2 Access to Risk Capital, Lagged Returns

Barriers and challenges:

Access to investment capital has become easier in recent years due to increased attention towards NbS, often linking revenues from emission reductions to production of tradable goods (forest and agricultural products) and tangible SDG contributions/co-benefits. Financial market products like dedicated impact capital and micro-credits can provide funds against the commitments to produce carbon credits, though most of these are targeted to smaller scale projects and focus has been primarily outside of NbS (e.g. energy, cookstoves). In many regions, financial issues remain one of the most common barriers for large-scale NbS carbon programs. Especially for sequestration approaches, risk and long-time gap between investment and returns from carbon credits lead to reluctance by investors or high capital cost:

- NbS require up-front investments for setup and implementation, e.g. for stakeholder interaction and organization, training, technical equipment and baseline data collection. Access to capital is often difficult both for small scale endeavors (performance risks) and large-scale approaches (large capital volume needed).
- This is further aggravated by the contrast between the short-term nature of public and private sector decision-making and long-term planning and maintenance required for the emergence and sustained delivery of NbS benefits.

- Especially for CO_2 sequestration projects in biomass or soil organic carbon (SOC), revenues from sale of carbon credits can only be realized significantly later, when adequate growth/increase can be verified, and volumes of benefits are sufficient to warrant cost for verification audit.

Suggested solutions:

Various solutions have been introduced by the voluntary carbon standards to overcome investment barriers and reduce risks or revenue loss:

- Risk-based buffer deductions to "insure" against reversals, thus reducing risk of revenue losses (see Table 2 and section3.3 for buffer description).
- "Ex-ante" credits have been introduced by some voluntary carbon standards to allow sale of future credits, governed by the standards' registries (similar to futures in stock markets). Such approaches can attract earlier capital and provide a performance-based obligation between the buyer and project owner (as the risk to deliver on the committed benefits remains with the project). Despite ex-ante credits not being eligible for offsetting, voluntary market buyers (e.g. corporates planning to offset emissions) have used the opportunity to purchase ex-ante credits early at attractive prices, and bank them until they are verified and transformed into full credits.
- To improve on ex-ante credits, voluntary carbon standards are moving towards risk-based issuance, i.e. allowing early (partial) issuance of credits, or are looking into simplified and more frequent credit verification to allow earlier access to full credits which could directly be sold for offsetting. To avoid preventive increase in transaction cost, especially verification audits, interim verification process could be simplified, with the standards carrying some of the risk of underperformance.
- Another related finance opportunity may focus on facilitating forward option purchases, in support of future Net Zero claims (compare section 4.1). In addition to such future options, long-term carbon removal activities are currently being implemented in supply chain programs (e.g. to increase soil carbon stocks in agriculture) and introducing forward option purchases would open such activities to parties outside the supply chains.

3.3 Permanence of Stored Carbon

Barriers and challenges:

Carbon sequestration and storage in biomass or soil organic carbon (SOC) carries the inherent risk of reversal, i.e. re-emittance of bound carbon into the atmosphere. For credible (and creditable) long-term storage of carbon and thus climate impacts, reversal risks need to be managed:

- Operational reversals are caused by project-internal factors such as project governance failure, mismanagement, or stakeholder deviation from agreed practices.
- Externally caused reversals are re-emissions caused by effects uncontrolled by the project, e.g. natural catastrophes (e.g. flooding, fires, drought).
- A special case of externally caused reversals are overarching government changes and decisions or policy changes impacting project activities and leading to re-emission of sequestered carbon.

Suggested solutions:

The voluntary carbon standards have implemented several approaches to mitigate risks of non-permanence. These mechanisms aim at avoiding or compensating losses from reversals to ensure validity of credits issued.

- The voluntary carbon standards require projects to manage and mitigate likely high-risk events and project risks which could result in an externally caused reversal (e.g. through the development of a fire management

plan, implementation of resilient practices). For operationally caused reversals, liability to replace lost credits is contractually attached to the project owner.

- The voluntary carbon standards also recommend regular interaction with governance systems to allow early adaptation in case of policy changes.
- The most common approach implemented in voluntary carbon standards for externally caused reversals are risk buffer pools. In this approach, transparent risk assessments for project activities and corresponding risk buffer contributions (carbon credits retained in a buffer account by the standard) build the basis for the prevention of reversals and accountability for damages. For externally caused carbon losses, credits are recovered/retired from the buffer.
- Some voluntary carbon standards allow partial release of buffer contributions after a project has operated without losses, evidenced in an updated risk assessment[31].
- An alternative approach originally proposed by IPCC and implemented in carbon markets by the Climate Action Reserve voluntary carbon standard CAR (for example in their soil enrichment protocol[32]) is the ton-year accounting. Under this system, credits are issued for the number of tons of carbon held out of the atmosphere for a given number of years. This approach considers effect of "delayed emission" of carbon through sequestration or storage; the mitigation benefit from a given patch of land is greater the longer the carbon remains sequestered which would be reflected in the credits earned.
- How impermanence is dealt with depends on the application of the credit. Offsetting requires permanence, as otherwise the compensatory promise is not met. Other market applications, such as financial contribution claims may allow for other options, e.g. allowing a certain amount of non-permanence as long as the projects achieve the long-term goals (e.g. through renewal of the activity and thus achieving a long-term carbon storage – comparable to sustainably managed afforestation were carbon is periodically released through timber harvest but regrown, leading to a long-term average carbon stock, stabilized by financial returns from sale of timber). Options could also include temporary storage solutions, such as 'ton-year' logic.

3.4 Double Counting

Barriers and challenges:

"Double counting" or "double claiming" issues arise when multiple GHG accounting systems include an activity's impacts, creating a conflict for proper allocation of benefits (and offsets). Its threat to integrity depends on the nature of the mechanisms involved, for example a company inventory can be double claimed in the host country NDC and both would remain true and accurate. When applied to offsetting, as will be seen, this is not the case. While this barrier is not inherent to NbS but applies to all carbon market activities (e.g. also energy approaches), it represents a substantial challenge for NbS credit implementation and is thus further discussed here.

- Double counting of emission reductions or removals is a situation in which the same emission reduction or removal is claimed by two different entities towards achieving climate change mitigation, e.g. once by the country in which the emission reduction or removal occurs, and once by the country or entity using an emissions unit (i.e. a carbon credit).
- Double issuance or double use of a carbon credit are two other important forms of double counting but not considered here, as they are issues that are dealt with at the level of the carbon credit organization, for example through registry transparency and methodologies. While these are important issues, they are not considered to be especially material to the wider discussion in this paper (and are relevant to all carbon credits, not specifically NbS).

[31] VCS: https://verra.org/wp-content/uploads/2019/09/AFOLU_Non-Permanence_Risk-Tool_v4.0.pdf
[32] CAR: https://www.climateactionreserve.org/wp-content/uploads/2020/10/Soil-Enrichment-Protocol-V1.0.pdf

In the context of offsetting, double claiming undermines the integrity of the offset claim, i.e. that the "atmosphere is no worse off" overall because an emission is offset. If a second (or third, fourth etc.) claimant uses that benefit, then they may, for example defer an action or policy they had planned elsewhere as their achievement is met by the offset project. This renders the offset claim to be untrue. Hence offsetting must not be double claimed with either the host country or other company inventory reports, or the integrity of the claim is damaged.

Suggested solutions:

With NDC updates underway and carbon markets in flux, double counting risk is one of the most important discussion topics in carbon governance. Voluntary carbon standards as well as policy makers and other stakeholders (e.g. corporate programs, Science-based Targets Initiative, Greenhouse Gas Protocol (GHG Protocol) are working on solution approaches to avoid double counting and maintain accountability of GHG reductions:

- Corresponding Adjustments (CA): originally termed for the implementation of ITMO (Internationally Transferred Mitigation Outcomes) between countries under PA Art. 6.4., CA are a means to avoid double counting, whereby one of the claimants, usually the non-paying party (e.g. host country, other company) adjusts their accounting to not capture the impact of the credit. This eliminates double counting while still allowing operational or geographical overlaps of programs. It should be noted that the CA mechanism in Article 6 of the Paris Agreement was not developed to support voluntary offsetting, but rather for ITMOs transferred between countries. Coincidentally however, it also represents a solution that can protect the future of voluntary offset markets.
- Company inventory adjustments: double claiming with company inventory reporting is difficult to track, because of the complex nature of supply chains and the lack of tracking infrastructure. It is expected that the Greenhouse Gas Protocol[33], the pre-eminent company inventory accounting standard, will confirm that a company that sells a carbon credit from within its operations should not also count that same result in its inventory. The adjustment approach would need to work similarly to CAs above.
- Alternative claims: the market creates a new application of "contribution claims", wherein the "credit" represents an impact caused by the purchaser that benefits the host country. Such claims are verified but not used to offset by the paying/contributing party, thus avoiding double counting. This is becoming increasingly attractive as a simple but effective way to take responsibility for company residual emissions, without the risks associated with offset claims. WWF recently published its Corporate Blueprint for Climate and Nature[34] to explain how this can be achieved with credibility and integrity.[35]
- Credit backup: A work-around for potentially double-claimed credits is to back each (NbS) credit with a not double-counted, second credit (e.g. from an independent energy project) to assure the emission reduction. However, as this is costly and potentially misleading if not credibly and transparently administered, it is usually not the preferred solution and should only be applied as an interim solution.

It is important to re-state that not all double claiming situations are problematic, as the third solution above indicates. If carbon impacts are used as claims, e.g. for "low emission" products by a brand company, but not used in GHG accounting by that company, it does not lead to overestimation of GHG emissions.

Also, some countries have indicated that they do not consider carbon credits traded among (non-governmental) market participants as double counting with their NDCs. For example, the South African carbon tax system regulates heavy emitters and allows them to purchase offset credits from voluntary standards, such as Gold Standard, provided the project is within South Africa. This is an innovative use of voluntary carbon markets,

[33] https://ghgprotocol.org/corporate-standard
[34] https://wwf.panda.org/discover/our_focus/climate_and_energy_practice/blog/?1172766/Blueprint-Corporate-Action-Climate-Nature
[35] A first mover, Klarna ("Give One") has demonstrated the feasibility of this approach.

though it should be noted that as the scheme refers to offsetting, the impact of the credits should not also be counted towards the NDC. While this is not unique to NbS activities, discussions on such approaches are ongoing and depending heavily on how national systems quantify GHG reductions for their NDCs. Notably, allowing voluntary market approaches or private programmatic interventions within an NDC can significantly contribute to a country's GHG reduction targets.

3.5 GHG Impact Accounting and Uncertainty

Barriers and challenges:

Quantification of GHG emission reductions and removals by NbS activities relies on data, models and field-based measurements, e.g. project area, carbon stock, biomass growth, or emission factors. Project-level data (historic data and measurements) and published research can provide much information, yet gaps in data or information often remain, e.g. due to lack of measurement technology or cost restrictions on project-wide sampling, especially in large scale programs. Statistical models or process-based calculations can support quantification in such cases, though this may face limitations if multiple activities are combined in a program, which is typical for NbS in landscapes. Interactions between activities can be complex and net impacts difficult to quantify accurately if not field-based measurement are performed. Various factors such as natural variation in conditions and ecosystem dynamics, measurement uncertainty, model structure and parameter variance influence accuracy and precision of calculated results using models ore IPCC default parameter approaches.

Some level of uncertainty in the activity benefit quantification is unavoidable when working with natural systems. With the increased use of models and large datasets for large-scale, multi-activity NbS implementation, understanding and limiting uncertainty is thus important to ensure conservative results and prevent over-estimation of benefits, especially when "hard" quantities such as carbon credits for offsetting or GHG impacts for emission accounting are concerned.

Solution approaches:

- Recent quantification methodologies developed and registered under the voluntary carbon standards often include multiple quantification approaches (e.g. on-site measurements, applying scientific backed default values, applying models), allowing project developers to balance efforts and uncertainty, accepting reduction in carbon credits (see "uncertainty deductions" below) at the benefit of less complex calculation. This also allows projects to evolve in quality as data becomes available.
- Innovative future measurement approaches such as field spectrometers for soil carbon or remote sensing approaches for biomass sequestration would reduce cost, cover large-scale project setups, and allow net benefit estimates if several different NbS activities are applied in one project/program (prevent benefit overlap). However, these approaches are currently not yet ready to be applied in carbon markets as evidence to meet carbon standard uncertainty requirements (see point below) has not yet been provided.[36]
- Voluntary carbon standards have defined specific thresholds for uncertainty based on statistic calculations (e.g. precision of 20% of the mean net GHG reductions at a 90% confidence level for GS). Carbon credit projects are required to quantify carbon benefits within this range of uncertainty.
- If uncertainty thresholds are exceeded despite reasonable efforts by the projects, some voluntary carbon standards (e.g. Gold Standard) allows "uncertainty deductions" from net benefits (i.e. reduction of credit

[36] Voluntary carbon standards usually require evidence trough peer-reviewed scientific publication. Ideally evidence of such new measurement approaches should show NbS activity applicability, scope and limiting factors.

issuance, depending on uncertainty), thus allowing higher uncertainty in calculated results while ensuring conservativeness and integrity of certified emission reductions.

Various guidelines, calculation procedures, and tools are available under the voluntary carbon standards on how to consider uncertainty in the project planning, assess variance and provide approaches on how to reduce the level of uncertainty in the quantification of GHG impacts (e.g. through smart area and activity stratification, and allocation of sufficient measurement plots). As expert support is commonly needed to accurately assess and reduce uncertainty, such capacity needs to be created through expert inputs and capacity building early in NbS programs to identify need for improvement in activity data collection (monitoring) and analysis. For large programs, suitable frameworks could supply such expertise (see "hybrid approaches" as opportunities for NbS, below).

4 Opportunities for Nature-based Solutions in Carbon Markets

NbS projects and programs with climate change mitigation targets have been implemented and documented across a broad diversity of geographies, structures, and mechanisms. Credit-based carbon market mechanisms have been used for many small to medium scale projects, while large programs tend to be part of jurisdictional or fund-based approaches (Box 6).

NbS (and the related Natural Climate Solutions with an exclusive focus on GHG reduction) have contributed substantially to emission reductions in voluntary carbon markets (Box 3). Experiences gained and solid solutions developed under the voluntary carbon market can be applied broadly in future carbon markets being designed now, including innovative program structures and approaches outlined below to upscale GHG benefits from NbS.

4.1 Opportunities under Evolving Carbon Markets

With the blending and evolvement of carbon markets (compare section 1.4) it is likely that all the key attributes associated with carbon credits, including baselines, additionality, double counting, and sustainable development will evolve to be fit for the current market-era. This is influenced by the overlaps in market policy regimes and the expected blending and scale up of markets.

For national and international compliance markets, the Paris Agreement envisages 'Internationally Transferred Mitigation Outcomes' (ITMOs) for the transfer of mitigation outcomes between parties, either bilaterally under Art 6.2. or via a centralized market mechanism under Art 6.4 (compare Box 7).

In addition to fully market-based mechanisms as outlined above, additional emerging applications of same or similar quantification approaches further widen the scope of (certified) GHG emission units, for example mechanisms to support corporate GHG inventory reporting including Scope 3 emission reductions (compare Box 6) or results-based climate finance approaches for which impacts are quantified and reported with the same rigor as for a carbon credit but not used in a compensatory mechanism.

Box 6: Nature-based Solutions in Non-Market Mechanisms

Funds and results-based payments

Currently, there are USD 2 billion committed in non-market "pay-for performance" NbS funds. This inter alia includes the Forest Carbon Partnership Facility, the Green Climate Fund, and the BioCarbon Fund, all of which operate under the United Nations or World Bank, as well as bilateral funding for REDD+. Fund-based mechanisms are used to incentivize and enable implementation of climate programs, including NbS solutions. While the primary focus of such schemes has been on large-scale implementation and readiness partnerships, solutions are also being set up to facilitate access for smaller, sub-national projects.

Such payments are considered "results-based finance" and not offsets because they do not generate an offset that can be used to reduce a carbon footprint elsewhere.

Government programs / Jurisdictional approaches

The jurisdictional project approach within a national or subnational GHG accounting systems have proven to be highly effective for the REDD+ NbS activity. Jurisdictional programs, linking carbon benefits with national or subnational governance have stopped deforestation and degradation in the targeted areas, and along with direct community engagement and the establishment of clear carbon rights helped to maximize a country's climate and sustainable development outcomes in a robust and credible way.

"Halting and reversing deforestation and forest degradation on a large scale usually requires actions that only governments can perform. Where forest loss is due to illegal activity, only governments can enforce the law. Where deforestation results from unclear land tenure, only governments can recognize rights to resources. Where forest conversion or degradation is due to licensing of concessions on state-owned land, only governments can suspend or better regulate such licenses. Where deforestation is happening on private land, governments can regulate land use and provide incentives and disincentives through fiscal policies such as access to credit and tax relief." (Frances Seymour, WRI, May 5, 2020[1])

Jurisdictional approaches also have the ability to access and integrate a range of financial streams, not just carbon finance, ostensibly achieving more sustainable outcomes.

Corporate programs / Value chain initiatives

Recently, large-scale mitigation driven NbS approaches have emerged through the corporate supply chain reduction programs (compare Box 5; especially in the agriculture sector). Experiences and mechanisms from the voluntary carbon markets (tools, processes, quantification methodologies, safeguards, SDG contributions) are successfully applied in these corporate programs, expected to deliver emission reductions and removals to be incorporated into corporate "scope 3" (value chain) emission reductions.

In such applications within a supply chain, no market mechanism is used for compensatory claims, though voluntary carbon standards' methodologies and tools are often applied to drive change in supply chains and to properly quantify and allocate the benefits.

[1] https://www.wri.org/insights/insider-4-reasons-why-jurisdictional-approach-redd-crediting-superior-project-based

It can be seen from the above applications that a single "carbon credit" (or better: a certified GHG emission reduction) may have the potential to be eligible for a number of (market) applications. For the project owner "producing" that credit, it will likely be desirable to keep as many options open as possible, which in turn points to a core carbon asset that is consistent regardless of where it is used, coupled with variable attributes such as location, vintage, project type, etc. that may determine its eligibility for specific markets, as mentioned above:

- CORSIA allows for a wide range of project type eligibility but has restrictions on vintage[37]. It also requires a corresponding adjustment (see section 3.4) to be in place.
- The South Africa carbon tax requires credits issued for projects in South Africa but does not explicitly require corresponding adjustments to be in place.

These examples of CORSIA and South Africa point to a situation where a South African project is likely to be eligible for the South African carbon tax system, but only eligible for CORSIA if it meets vintage requirements and can obtain a corresponding adjustment. A project in a different African state may find it easier to be eligible in the CORSIA scheme (provided their host country makes the adjustment) but are ineligible for the South African carbon tax scheme.

It can be said therefore that markets will diversify along different lines of application for a carbon credit or other emission reduction, such as domestic versus international, compliance versus voluntary, Party to the Paris Agreement versus corporate etc. The use of the carbon credit thereby determines applicability and requirements for GHG reduction activities and accounting. To manage associated risks appropriately, it will be essential for the carbon credit or other emission reduction to be consistent with these overarching requirements.

For NbS, this increases opportunities to generate finance, including under the Paris Agreement and national markets, voluntary carbon standards, and systems for corporate accounting such as the Science-Based Targets Initiative and the Greenhouse Gas Protocol.

NbS can be expected to play an important role is such blended markets. Not only are they contributing to multiple SDGs (which adds value to the carbon credit) and climate adaptation, but they provide different types of GHG impacts (emission reductions, avoided emissions, and removals as described in Box 2).

All three GHG impact types will find potential in many applications, but in the case of removals especially there are likely to be specific market applications that target them. For example, in the Science Based Targets pending Net Zero standard[38], there is the possibility that removal units can be purchased/retired by a company to make a credible "Net Zero claim", provided other preconditions are met (no deforestation, emissions inventory conforms to a 1.5 degree warming scenario).

[37] No credit issued before 2016 are accepted under CORSIA.
[38] https://sciencebasedtargets.org/net-zero

Box 7: Discussions related to NbS under Paris Agreement Article 6

Parties to the UNFCCC have not yet agreed guidance underpinning Article 6 of the Paris Agreement, which will provide the framework and establish a mechanism for international transfers of mitigation outcomes. Parties tried unsuccessfully to conclude this guidance at COPs 24 and 25 and are now working towards its adoption at COP26 in November 2021.

The treatment of the land use sector under Article 6 has been one of the issues under negotiation between Parties within the UNFCCC. Going into COP25 in 2019, draft versions of the Article 6.2 and 6.4 decisions included several proposed provisions, supported by certain Parties, which would restrict the ability to transfer and use mitigation outcomes from the land sector. These included a proposed requirement for internationally transferred mitigation outcomes to be "permanent" (rather than having a system in place to address the risk of reversals)[1] and a proposal to exclude from the new Article 6.4 crediting mechanism any activities under Article 5 of the Paris Agreement, which relates to the conservation and enhancement of sinks and reservoirs of greenhouse gases, including forests[2].

These proposed restrictions did not appear in draft decisions proposed by the Chilean presidency in the second week of COP25. This suggests that Parties may be moving towards agreement that Articles 6.2 and 6.4 should be open to credits from all sectors, including the land sector, provided all requirements – for instance Article 6.4 activities having safeguards to address any reversals in full[3] - are met. However, it is important to note that Parties have not yet reached agreement to Article 6 guidance, and so the final outcome on this issue is still to be determined.

[1] Paragraph 1(a)(i) of the 26 June 2019 draft decision on Article 6.2
[2] Paragraph 39(a) of the 26 June 2019 draft decision on Article 6.4
[3] Paragraph 31(d)(ii) of the 15 December 2019 draft decision on Article 6.4

4.2 Integration of Jurisdictional with Credit-based Mechanisms

Some jurisdictional programs for NbS have been implemented over the past years which include considerations on climate benefits. However, while such programs have been successful in implementing improved practices and restoration of forest ecosystems, they have also shown a focus on "business-as-usual" (BAU) activities and (domestic) funding commonly corresponding to subsidies for land use activities, often with a focus on forest management.

To make use of full NbS scope and opportunities, future approaches will need to involve additional activities, driving change beyond BAU and expanding beyond the "traditional" afforestation, forest landscape restoration and REDD programs.

NbS to improve agricultural land management or restore cultivated land with strong contributions to social and environmental development are well-suited for jurisdictional approaches, requiring intensive change management (communication and training, implementation support, monitoring) and long-term governance.

The current situation on the market side, with mechanisms undergoing structural change and re-alignment spanning from national and international compliance systems to voluntary carbon markets, presents a unique

opportunity to align (or de-couple) the various mechanisms and schemes, to identify overlaps and synergies and to prevent double counting issues (see section 3.4).

Lessons learned from international trade (e.g. CDM and JI) as well as voluntary carbon schemes and non-market mechanisms (e.g. jurisdictional programs and corporate interventions) can be applied in the design of new markets and new, integrated "hybrid" models combining market mechanisms with jurisdictional programs to maximize climate benefits, scale up NbS activities and accelerate implementation. Hybrids also facilitate separation of tasks and funding for project setup and governance (ideally at program level, best through public or grant funding) from operations (at project level, suitable for commercial business case).

4.2.1 National Hybrid Programs

Building on the strengths of programmatic and market approaches, innovative hybrid setups could accelerate and support NbS implementation on a country level. Programmatic approaches can efficiently provide overall governance, targets, and activity prioritization, facilitate access to base funding and build operational and monitoring capacity. Based on such a program layer, performance-oriented activities (interventions, projects) participating in carbon markets would gain efficiency in implementation and operation and could potentially link into monitoring systems to further reduce transaction and operational cost. Linking these components also improves data transparency and consistency between national accounting and carbon credit schemes by applying aligned sources and quantification approaches.

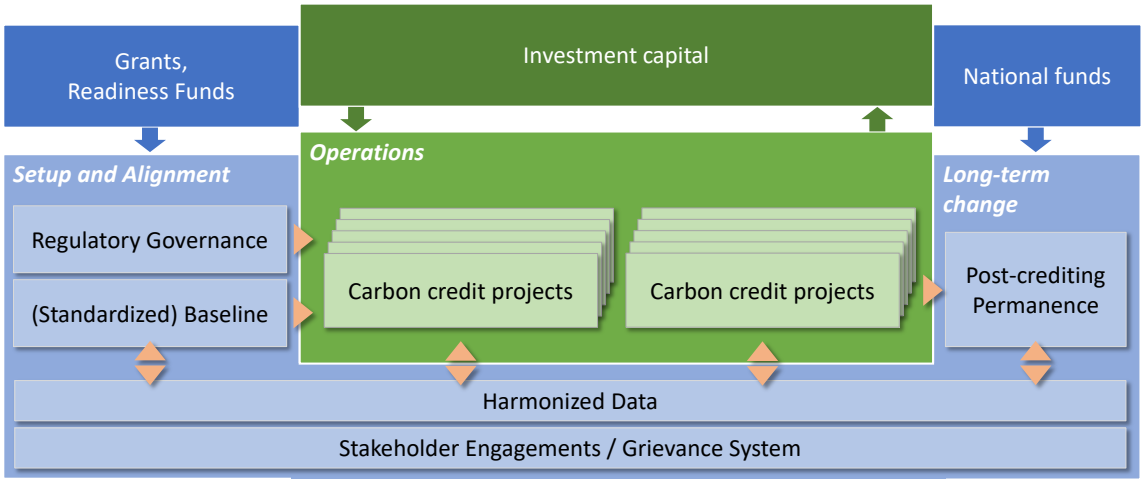

Figure 3: Conceptual setup of a hybrid program framework and integrated carbon credit projects

Integrating market-based incentives within a programmatic structure can thus resolve several issues and barriers:

- Policy alignment: Integrating carbon credit activities into overall programs promotes early alignment of policies and governance, reducing risks of conflicts at time of activity implementation. A programmatic framework facilitates and supports political decisions on strategic targets and priority of activities. However, requirements at Policy level to implement specific GHG initiatives would likely also lead to lack of additionality and thus limit access to carbon markets.

- Financial barriers and funding: Compared to a stand-alone program, integration of crediting activities reduces operational efforts at program level, while reducing implementation cost, facilitating access to funding and increasing overall efficiency (e.g. monitoring) for the carbon project. On the other hand, revenues from carbon credits can deliver returns back into the program (if not absorbed into the project activities themselves).
- Technology and skills: With the program establishing the necessary skills and providing training, NbS carbon credit projects can be implemented on a solid knowledge basis and support structure, following standardized procedures laid out in the program.
- Permanence: Programmatic monitoring can track long-term change, extending beyond carbon crediting periods. Areas can thus be monitored even after final issuance of carbon credits, ensuring permanence of impacts, ideally linking to long-term incentives at program level.
- Double counting risk: Programs should be set up to closely align with national accounting, considering NDC commitments. Integrating carbon credit projects with a jurisdictional framework allows transparent and consistent allocation of benefits, e.g. differentiating between standard emission factors on program level and additional, activity-based reductions for carbon credit issuance.
- Baseline, additionality and common practice: With data collected and capacity built in the program, standardized quantification of baseline emissions and assessment of additionality and common practice is possible, facilitating project setup and monitoring. Also, once a "common practice" benchmark is reached, the program could "absorb" the activity, which at this point is no longer certifiable for carbon credits, efficiently scale the implementation further and claim non-tradable GHG reductions for the program.

Notably, hybrid programs can allow various levels of integration and synergies. From basic alignment to prevent double counting and facilitate national and project accounting, hybrid programs could go as far as establishing a full framework for simplified carbon credit project implementation and certification, the program providing a "full service" environment for fast upscaling of activities.

4.2.2 Multi-Country Programs

Similar to national hybrids, multi-country programs could support efficient setup and accounting for market-based schemes. Such programs could have different objectives, as needed:

- Facilitate international trade, including ITMOs, through harmonization at program level (to be aligned with Paris Agreement Art. 6 requirements)
- Facilitate and incentivize multinational corporate programs (see section 4.4 below).
- Allocate, delineate or split benefits to various accounting systems (e.g. between different national and/or other compliance schemes, e.g. CORSIA)

In all of the above, the basis for such integration is an agreed regulatory platform, defining quality requirements and quantification guidelines at sufficient granularity and transparency for international programs to align.

4.3 Upscale from Individual Projects to Landscape Programs

As with NbS themselves, landscape management approaches are nothing new. Forest landscape restoration programs have been implemented using programmatic approaches and carbon funding. However, applying NbS principles to a landscape in multi-use productive systems or urban areas would contribute to scale up NbS and allow implementation in situations where a single smaller project cannot achieve the desired NbS objectives.

NbS at their core are recovery activities, restoring, re-introducing, improving, or adapting natural processes to benefit climate, environment and human society. However, in many situations, counteractive objectives require trade-offs, with an increase in one contribution leading to a decrease in another (e.g. increase in socioeconomic productivity leads to decrease in biodiversity). While in the best case this can be overcome, it remains a reality in many NbS applications. One solution to is to expand the NbS space from a single site to a larger landscape as an incentive to address conflicts and integrated all relevant stakeholders.

Figure 4: NbS landscape approach with multiple benefits

Diversifying natural structures and human land use allows the harnessing of different benefits from different activities in a landscape. Each type of activity (i.e. stratum) has one or more clear and transparent objectives and is managed accordingly. Beyond this, integrating all strata as an NbS attaches great weight to understanding and improving interactions between different strata, eliminating negative effects, and improving overall performance towards all NbS goals. In such approaches, the whole is indeed greater than the sum of its parts.

Tapping carbon markets with landscape program activities serves multiple purposes in a landscape program, including provision of additional income from carbon credits, providing transparent and consistent mechanisms to quantify impacts (and thus performance indicators for the program), and increasing commitment for long-term governance and stakeholder contributions.

5 Innovation and Actions for Nature-based Solutions

There is substantial potential for innovation especially for NbS sector and activities not yet (fully) tapped by carbon markets (compare 5.1 below). Also, research gaps need to be closed to provide the scientific evidence and basis for rigorous risk management for the urgently needed upscaling from NbS project to landscape/country level. To accelerate the upscaling, new innovative financing options need to be explored.

5.1 Expand Scope of Nature-based Solutions Activities

In the past, NbS activities in carbon markets heavily focused on the forestry scope (afforestation, restoration, conservation, REDD). More recently, NbS in carbon markets have expanded into other land uses, such as agriculture[39], coastal ecosystems (e.g. mangroves, seagrass activities[40]), and the urban scope[41]. Especially for the last two substantial potential remains:

- Expansion of blue carbon NbS, e.g. macroalgae in marine carbon sequestration; algae as animal feed, power source, replacement for fossil products, for carbon sequestration in coatings)
- Expansion of urban NbS, both in and around cities, linking urban processes to climate mitigation and adaptation objectives (e.g. green roofs, urban gardens, green spaces, city trees, community gardens, green indoor areas, green infrastructure and urban forests)
- Use of natural solutions in artificial systems such as controlled aquatic systems or integration of carbon sequestering organisms into production processes. Note: Such approaches may technically not be categorized as NbS if deeply imbedded into industrial or manufacturing processes. However, connecting or integrating with NbS programs can be beneficial, e.g. to link resource supply chains.

To enable the application of these new NbS activities in carbon markets, respective research on GHG impacts quantification and influencing factors as well as development of respective quantification methodologies is highly needed. Ideally, such activity-based quantification follows a standardized applicable approach as applied under the voluntary carbon standards but applies program-specific/locally applicable parametrization and/or models (IPCC Tier 2 or Tier 3[42]) instead of using globally applicable Tier 1 defaults with high associated errors.

5.2 Dedicate Research to address scaling up of Nature-based Solutions Activities

To close knowledge gaps and resolve barriers for upscaling NbS to landscape/country level trough carbon markets the following research is needed:

- Research interactions between multiple NbS activities implemented jointly in a large-scale program setup to better understand potential negative or positive interactions (double counting) and to verify "real" net GHG impact. Develop respective standard level guidelines/safeguards to prevent benefit overlap.
- Research effect and impact of activity reversals as NbS implementation as large scale setups cannot always avoid variation in practices applied (e.g. impact of periodic tillage in "no till" systems on SOC and possibilities to improve long-term stabilization of SOC).

[39] Land use NbS activities are covered under all major voluntary carbon standards (e.g. VCS, GS, CAR, ACR) and registered quantification methodologies available.
[40] https://verra.org/first-blue-carbon-conservation-methodology-expected-to-scale-up-finance-for-coastal-restoration-conservation-activities/
[41] https://www.goldstandard.org/articles/cities-programme
[42] 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: chapter 3 Key Concepts unchanged from the 2006 IPCC Guidelines.

- Research new mechanisms to manage permanence risks and impacts for sequestration (and avoided emissions) activities. E.g. assess impact potential and calculation approach for activities "balancing" sequestration and re-emission to achieve long-term net positive benefits (note: this is already done in afforestation with sustainable harvesting where credits are only provided for the oly the long term average stock)
- Provide free access to quantification tools and global datasets (example: FAO GSOC database for soil carbon) to allow cost-efficient implementation of large-scale NbS activities.

6 Conclusions

Long-term experience from Nature-based Solutions (NbS) in voluntary carbon markets can be leveraged to ensure that large-scale NbS programs provide the required contribution to climate change mitigation, adaptation and the Sustainable Development Goals. Voluntary carbon standard's safeguards, guidelines, impact quantification methodologies, and risk tools for all NbS activity scopes (forestry, land use, blue carbon, urban) can be used and expanded for broad application across different market systems and purposes.

To enable the application of new NbS activities not yet fully tapped by carbon markets such as blue carbon and urban scopes, respective research on GHG impacts quantification and influencing factors as well as development of respective quantification methodologies is highly needed.

National policies and regulatory systems currently impeding NbS implementation need to be improved and aligned to allow the urgently needed upscaling from a project-scale single NBS activity approach to a program covering multiple NbS activities on landscape or country level. NbS frameworks with consistent policy and incentives across all involved NbS scopes, stakeholders, and governance levels need to be established.

Barriers inherent to NbS activities such as permanence of stored carbon can be overcome, with available solutions to be targeted to the mechanism applied (e.g. NDC, CORSIA, corporate supply chain, compliance/voluntary markets). The same is true for new challenges faced by all market-based approaches (e.g. specification of Art. 6 implementation, avoidance of double counting).

Lessons learned from international trade as well as voluntary carbon schemes and non-market mechanisms (e.g. jurisdictional programs and corporate interventions) can be applied in the design of new markets and new, integrated "hybrid" models combining market mechanisms with jurisdictional programs to maximize climate benefits, scale up NbS activities and accelerate implementation.

7 Annex: Country Examples with strong Nature-based Solutions NDCs

The following country examples show strong NbS NDCs which can serve as an example for other countries (see also WWF 2020 NDC enhancement approach):

1. Include the use of nature for both mitigation and adaptation

2. Nepal (2020, p 4-5): The national mitigation strategy is reinforced by a bold commitment to maintain 45 percent of forest coverage, sustainably manage a half of the Tarai and Inner Tarai forests, and a quarter of middle hills and mountain forests by 2030 with the implementation of adaptation plans.

- Belize (2016, p4-5): Protecting and restoring mangrove forests. This activity can be an effective mitigation action while also helping the protection of low-lying coastal areas against the impact of storms and soil erosion.
- Lao PDR (2016, p3): An ambitious target is set out in the National Forestry Strategy to the Year 2020 for increasing forest cover to a total of 70% of land area by 2020 and maintaining it at that level going forward. This will reduce the risk of floods and prevent land degradation, yet at the same time the greenhouse gas mitigation potential of such a target is substantial and long lasting.

3. Set ambitious, measurables and time bound numeric targets

- Nepal (2020, p 4-5): Clear quantifiable targets in agriculture (e.g. by 2030, soil organic matter content of agriculture land will reach to 3.95%, and mulberry and fruit orchard areas will be expanded to 6,000 ha).
- Namibia (2016, p2): Measures evaluated in the AFOLU sector are: Reforesting 20,000 ha annually as from 2018; Implementing agroforestry systems over 5,000 ha annually during the commitment period as from 2018; Converting 5,000 ha of grassland annually as from 2018 to arboriculture up to 2030.
- Democratic People's Republic of the Congo (2017, p9): It is planned to support projects allowing to plant around 3 million hectares of forest by 2025 as part of afforestation programs and reforestation, which would sequester about 3 million tonnes of CO_2.

4. Maximize benefits to biodiversity, include climate benefits from protected areas

- Belarus (2016, p7): Pursuant to the National Strategy for the Development of the System of Strictly Protected Areas until 2030, efforts will be made to ensure further conservation of natural ecosystems, biological and landscape diversity, ensuring ecological balance of natural systems and sustainable use of protected areas covering at least 8.8% of the territory of the country.

5. Cover other ecosystems beyond forests

- Vietnam (2020, p38): Increase of forest coverage to 42%-42.5%; increase of the area of coastal protection forests, including the extension of mangroves plantation; preservation and sustenance of the ecosystems.
- Canada (2017, p3): Protecting and enhancing carbon sinks including in forests, wetlands and agricultural lands.
- Uruguay (2017, p12): Adoption of good practices of natural grassland management in livestock production in 1,000,000 ha (10% of grasslands), thus avoiding the loss of soil organic carbon, and favoring carbon sequestration towards 2025. Implementation of no-till farming, with grain crop rotations, cover crops, and inclusion of C4 grasses, under Plans for Soil Use and Management, in 95% of the agricultural area by 2025.

6. Manage climate risks that threaten the long-term viability of NbS

- Uruguay (2017, p19): The management plans of at least six protected areas will include climate change and variability considerations by 2025. To have formulated, adopted and implemented by 2025 three integrated basin management plans that consider climate change and variability.
- Jordan (2016, p15): Conducting a comprehensive review of the National Network of Protected Areas. The sought revision will aim at identifying/validating climate-vulnerable ecosystems, extending conservation efforts in PA-surroundings and designing buffer zones as deemed necessarily for strengthening the adaptive capacities of key ecological hotspots.