Nature-based carbon credits and debt-for-nature swaps as part of a climate agenda for the global south

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Summary: About one-third of all human greenhouse gas (GHG) emissions come from food and agriculture. Rising temperatures, combined with drought and floods, have exacerbated soil degradation and erosion, thereby threatening food security. This particularly affects vulnerable groups in the Global South. How can we improve revenue models of farmers so that they can make the transition to sustainable farming practices while making soil healthier and fighting climate change? Carbon sequestration in trees, planting, pasture and soils are a potential income source for farmers through the use of verifiable and creditable carbon markets. By making the voluntary carbon market accessible to farmers, new business models can be developed. Potentially this entails a large trade between the Global North and the Global South that improves the living conditions of vulnerable groups in the Global South. This way, nature-based carbon solutions also contribute to a more inclusive food system. Combining debt-for-nature swaps and nature-based carbon solutions allow even greater impact. The G20 can spearhead international collaboration necessary to scale both regenerative agriculture projects including a carbon credit mechanism as well as the use of debt-for-nature swaps. When it comes to boosting the supply of nature-based carbon solutions, the G20 could lead a coalition of national governments, non-governmental organizations (NGOs) and business that helps to establish developing standards and organize the shift from the existing individual or 'bundled' projects to more jurisdictional/regional or commodity-wide solutions. Also, the G20 should encourage private markets to undertake climate and nature actions and also fund projects in low-income countries. To encourage greater consideration and use of debt-for-nature swaps, the G20 could work with the IMF and World Bank to work on a standard framework based on best practices. By fostering equitable resource allocation, supporting vulnerable nations with technology and financial aid, and promoting sustainable practices, the G20 can lead efforts to mitigate environmental and income disparities.

1. Economic growth beyond planetary boundaries

In recent decades our world has experienced unprecedented economic growth, driven by entrepreneurship, innovation and globalization. But we now know that unchecked growth has a downside. The global pursuit of economic growth has undeniably breached planetary boundaries, exerting unprecedented pressure on the earth's ecosystems. Natural resources — soil, water and biodiversity— are being depleted, and greenhouse gas emissions are on the rise. The loss of natural capital and the climate crisis are among the most urgent problems of our times.

Moreover, the unequal distribution of welfare and ecological risks, particularly between the Global North and South, adds a layer of urgency to finding sustainable solutions. While the Global North has historically been responsible for the lion's share of environmental degradation, it is the Global South that bears a disproportionate burden of the consequences. Low-income countries, with minimal contributions to GHG emissions and ecological strain, find themselves grappling with the impacts of climate change and biodiversity loss. The impacts of climate change, such as extreme weather events, disproportionately affect vulnerable communities with limited resources for adaptation and recovery. Moreover, shortages of clean water and depletion of natural resources further compound existing inequalities, depriving communities of vital resources for sustenance and development. Many nations in the Global South often lack the resources to adapt or mitigate effectively, and thus face compounded challenges in their quest for economic development.

Addressing these interconnected challenges requires a multifaceted approach. Wealthier nations must recognize their role in perpetuating global imbalances and take responsibility for mitigating environmental harm. Moreover, global cooperation is crucial to creating inclusive solutions that address both income inequality and environmental challenges. Collaborative efforts, such as international agreements on climate change and resource conservation, can pave the way for a more just and sustainable future. This includes supporting sustainable development initiatives, capacity building to enhance resilience and adaptation efforts, technology transfer, financial assistance, and fostering equitable trade practices. The G20, as a forum for major economies, holds a pivotal role in setting such a transformative agenda.

The imperative to combat poverty and transition towards a sustainable, green economy necessitates a balance between progress and planetary stewardship. Rather than viewing economic growth and environmental sustainability as mutually exclusive, strategic approaches that integrate both imperatives are essential. Investments in green technologies, renewable energy, and sustainable practices can drive economic growth while minimizing ecological impact. Combatting poverty requires targeted initiatives that promote inclusive growth, focusing on sectors that uplift marginalized communities.

One of the sectors in which many of the problems outlined above converge is food and agriculture. Therefore, in this paper we explore solutions that make this sector more sustainable while making the position of often vulnerable farmers in low-income countries more resilient.

Outline of this paper
We look at the opportunities for broadening the revenue model for farmers by rewarding them with carbon credits for ecosystem services they provide, thereby providing them with the means to make their farming practices more sustainable. We will conclude that the G20, national governments and business have a role to play when it comes to setting up the market for carbon credits, scaling it up and making it accessible to smallholders. Next, debt-for-nature swaps can play an important role in strengthening the macroeconomic situation of vulnerable low-income nations, which also benefits smallholders in those countries. A combination of nature-based carbon solutions and debt-for-nature swaps can have an even greater impact.

The rest of this paper is organised as follows. Section 2 briefly analyses the ecological footprint of food production, after which in section 3 we show how food production can be part of the sustainable solution. This can be done by enabling the transition to regenerative agriculture with nature-based carbon credits (section 4). The potential for carbon sequestration is huge, especially in the Global South. Both the financial position and the ecological sustainability of low-income countries can be improved by using debt-for-nature swaps. In section 5 we explain this instrument, and in section 6 we combine nature-based credits and debt-for-nature swaps to allow even greater impact. Finally, section 7 describes the G20's role in making these solutions work.

Voluntary carbon markets and carbon credits have regularly been in the news negatively in recent years. This was related, for instance, to poor transparency, double counting, and non-additionality. Double counting refers to a situation where a single GHG emission reduction or removal is counted more than once for the purpose of meeting climate mitigation targets. Additionality means that carbon credits should represent emission reductions or removals that would not have occurred without the incentive provided by the carbon credit market. This undermines the integrity of carbon markets and climate action. The premise of this paper is that carbon credits traded on voluntary markets can only contribute meaningfully to mitigating climate change and biodiversity loss if the credits fulfil high-integrity criteria (these will be discussed later). It means that, for instance, carbon credits should be used to address residual emissions (i.e. after a company addresses its own emissions) and should represent real ('additional') change. Another important premise is that carbon projects set up to generate credits should be designed in consultation and agreement with local and indigenous communities.

2. Food and agriculture sector is a large GHG emitter

In 2022, globally almost 54 billion tons of CO_2 equivalents (CO_2e, GHG or carbon) was emitted into the atmosphere as a consequence of human activities.[1] About one-third of all GHG emissions come from food and agriculture.[2] Just as human activity has contributed to climate change, feeding a growing population and producing enough food has impacted the planet's soils, reducing the natural carbon content of cultivated soils by up to 70%.[3] Soil is responsible for 95% of the food that we eat[4], just one teaspoon of soil holds more microbes than there are people on this planet.[5] It is a precious, essential asset that sequesters carbon and improves crop yields, nutritional values and livelihoods. Without healthy soil there is no food.

Rising temperatures, combined with drought and floods, exacerbate soil degradation and erosion. Each year, the world loses 24-36 billion tons of topsoil.[6] Severe adverse effects include soils that are depleted of the carbon content necessary for agricultural productivity, loss of plant nutrients and diminished water quality. This negatively impacts food security for around 3.2 billion people, most of whom live in Africa and South Asia.[7] Also, higher temperatures increase food and headline inflation globally.[8] Higher food prices are a major risk for low-income groups who already spend a large part of their income on food.

The ecological footprint of agriculture also includes usage of large amounts of freshwater and polluting rivers, lakes and oceans by releasing nutrients and chemicals.[9] According to FAO, 70% of global freshwater withdrawals are used for agriculture.[10] Poore and Nemecek (2018) state that 78% of global ocean and freshwater eutrophication is caused by agriculture.[11] Moreover, half of the world's habitable land is used for agriculture. That required massive land use changes leading to loss of forests, wildland, and natural habitat driving reduction of biodiversity.

There are around 570 million farmers worldwide, 84% of whom are smallholders.[12] These farmers typically operate on relatively small plots of land and engage in diverse agricultural activities, contributing substantially to the overall food supply. Ricciardi et al. (2018) concluded that smallholders produce 30–34% of global food supply on 24% of global cropland area.[13] Samberg et al. (2016) look at calorie production and indicate that smallholder farming is responsible for 41% of total

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[1] In this paper we use the terms carbon and GHG interchangeably to refer to carbon dioxide equivalents. CO_2e is a metric measure used to compare the emissions from various GHGs, such as methane, nitrous oxide and CO_2, on the basis of their global-warming potential. The 54 billion tons of CO_2e is based on: https://edgar.jrc.ec.europa.eu/report_2023#:~:text=Nevertheless%2C%20global%20GHG%20emissions%20restarted,and%201.4%25%20higher%20than%202021.

[2] FAO (2022), Greenhouse gas emissions from agrifood systems. Global, regional and country trends, 2000-2020. FAOSTAT Analytical Brief Series No. 50. Rome, FAO.

[3] https://www.nytimes.com/2016/05/18/business/energy-environment/a-boon-for-soil-and-for-the-environment.html (quoting Dr. Rattan Lal)

[4] http://www.fao.org/soils-2015/news/news-detail/en/c/277682/

[5] https://capitalscoalition.org/one-teaspoon-of-soil-contains-more-living-organisms-than-there-are-people-in-the-world/

[6] https://news.un.org/en/story/2019/06/1040561

[7] https://en.unesco.org/news/worsening-land-degradation-impacts-32-billion-people-worldwide

[8] Kotz, M., Kuik, F., Lis, E. et al. (2024), Global warming and heat extremes to enhance inflationary pressures, Communication Earth Environment, 5(116).

[9] https://ourworldindata.org/environmental-impacts-of-food

[10] FAO (2011), The state of the world's land and water resources for food and agriculture (SOLAW) – Managing systems at risk. Food and Agriculture Organization of the United Nations, Rome and Earthscan, London.

[11] Poore, J., and T. Nemecek (2018), Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987-992.

[12] Lowder, S.K., J. Skoet and T. Raney (2016), The number, size, and distribution of farms, smallholder farms, and family farms worldwide, World Development, 87, 16-29.

[13] Ricciardi, V., N. Ramankutty, Z. Mehrabi, L. Jarvis and B. Chookolingo (2018), How much of the world's food do smallholders produce?, Global Food Security, 17, 64–72.

global calorie production, and 53% of the global production of food calories for human consumption.[14] Their importance is particularly pronounced in developing countries, where smallholder agriculture is a primary source of livelihood for millions of people. Specifically for this group of smallholders it is important to foster innovation in regenerative, eco-friendly agriculture, so that we can create jobs and alleviate poverty without exacerbating environmental degradation. The next section explains how carbon sinks like soils, planting, pasture and trees which absorb carbon from the atmosphere, can be used to do that.

3. Food and agriculture can be part of the solution

In order to understand how nature-based carbon credits can be part of bringing back carbon balance in the global food system, we start with the global carbon cycle. As mentioned earlier, globally we emitted almost 54 billion tons of CO_2e into the atmosphere in 2022. About 60% of global greenhouse gas emissions remain in the atmosphere. The rest, about 40%, can be absorbed back by the soil. Removal is enabled by the earth's natural carbon sinks: soils, trees and oceans. Take soils: there are around 2,400 billion tons of carbon in the first two metres below ground, which is three times as much as in the atmosphere.[15] Absorption of carbon in the soil is the result of photosynthesis. Plants play a crucial role in the sequestration of carbon through the process of photosynthesis. During photosynthesis, plants extract CO_2 from the atmosphere and store it underground as soil organic matter.

As the saying goes: prevention is better than cure. It is therefore important, first and foremost, to avoid and reduce carbon or GHG emissions at the farm level. At the same time, removing these GHG from our atmosphere is also important. As long as there are high levels of GHG in the atmosphere, the earth will continue to warm, no matter how much we reduce emissions. So, we need to work both on the reduction and removal of carbon emissions.

Agricultural soils, plants and trees have substantial potential to act as a global carbon sink. So, on the one hand agriculture emits a lot. But on the other hand, farmers' land and trees have the unique capacity to take them out of the atmosphere again. However arable soils, especially in monocropping regions, have lost much of their soil carbon. Literature reviews estimate that agricultural soils have lost 30%-75% of their original soil organic carbon due to conventional farming practices.[16] Almost all cultivated soil can be improved.

That's why a growing number of specialists argue that by protecting and valuing our planet's soil, we can help mitigate climate change, restore soil health, boost agricultural productivity and feed our growing human population. If done correctly, the earth's diminished soils could reabsorb 80 billion to 100 billion metric tons of carbon between 2020 and 2100.[17] The potential for nature-based carbon solutions is huge.[18] The 2019 IPCC Special Report on Climate Change and Land (SRCCL) estimates that the 30-year economic sequestration potential of grassland and cropland soils ranges between 0.38 to 2.5 gigatons CO_2e/year. Other studies estimate even higher potential for world soils up to 4.4

[14] Samberg, L.H., J.S. Gerber, N. Ramankutty, M. Herrero and P.C. West (2016), Subnational distribution of average farm size and smallholder contributions to global food production, Environmental Research Letters, 11(12), 1–11,

[15] https://theconversation.com/how-agriculture-can-make-the-most-of-one-of-the-worlds-biggest-carbon-stocks-soil-219175#:~:text=There%20are%20around%202%2C400%20billion,impressive%20capacity%20for%20carbon%20storage.

[16] Global Carbon Project (2020), Carbon Budget and Trends 2019; & Zomer, R.J., D.A. Bossio, R. Sommer and L.V. Verchot (2017), Global sequestration potential of increased organic carbon in cropland soils, Scientific Reports, 7(1), 1-8.

[17] https://www.nytimes.com/2016/05/18/business/energy-environment/a-boon-for-soil-and-for-the-environment.html (quoting Dr. Rattan Lal)

[18] RaboResearch & FMO (2021), How to Unlock the Green Potential of the Agricultural Sector, Rabobank.

gigatons CO_2e/year.[19] Based on the midpoint of the more recent and conservative IPCC estimate (1.44 gigatons CO_2e/year), soil can potentially achieve more than 60% of the CO_2 sequestration targets outlined in the 2018 IPCC scenario.

This potential can be unlocked by switching from conventional to regenerative agriculture. This restores biodiversity and increases soil health. Healthy soil can absorb more carbon. The influx in the soil can be converted into validated removal units and ultimately into certified soil sequestered carbon credits that a farmer can sell. The potential for global soil carbon sequestration varies widely depending on factors such as soil type, climate, vegetation, and land management practices. Practices that can enhance soil carbon sequestration include conservation tillage, cover cropping, crop rotation, organic farming, and the restoration of degraded soils and grasslands.

The potential for soil carbon sequestration in the Global South is particularly significant due to the extensive agricultural lands and the prevalence of practices that can be optimized for better carbon storage. Many regions in the Global South face challenges such as deforestation, soil degradation, and desertification, which not only release carbon into the atmosphere but also reduce the land's productivity. Improving soil carbon sequestration in the Global South involves adopting sustainable land management practices that enhance soil health and restore degraded lands. These include:

- Agroforestry: Integrating trees into farming systems can increase carbon sequestration both above and below ground.
- Improved grazing practices: Managed grazing can help restore grassland ecosystems, leading to increased carbon storage in soil.
- Organic soil amendments: The use of compost, manure, and biochar can improve soil fertility and increase soil organic carbon content.

Implementing regenerative practices will also help in facing the other challenge: the food transition. The world's population is estimated to grow to almost 10 billion people in 2050.[20] And they will need more and better food. So food and agriculture has a double challenge. By 2050, the sector will have to cut emissions by three quarters[21] and at the same time at least double our food production to feed this growing world population.[22] One way we can make our food production much more ecologically efficient is by completely transforming the way we produce our food.[23] We have to make the transition from conventional farming, which emits GHGs, to regenerative farming, which can reduce and remove GHGs and restore biodiversity, improve water resilience and decrease chemical pollution.

4. Carbon credits as a means to pay for the transition

Exploiting this potential is especially relevant for smallholder farmers who often earn too little to live on. One of the fundamental problems in the food system is that the cost of greenhouse gas emissions and loss of biodiversity is not adequately priced. Globally, we do not pay the true cost of food. Consequently, farmers that do invest in more sustainable practices are not rewarded for the ecosystem services they deliver. They cannot pass on the costs of sustainable practices in their prices as players down the supply chain, including consumers, are unaware of true cost and insufficiently willing to pay more for sustainably produced food. Yet, policymakers and off-takers are increasingly focused on implementing sustainable practices on farms, either by introducing regulation or by setting sourcing requirements.

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[19] Lal R. (2004), Soil carbon sequestration impacts on global climate change and food security, Science, June 11, 304(5677), 1623-7.

[20] World Bank https://blogs.worldbank.org/opendata/worlds-population-will-continue-grow-and-will-reach-nearly-10-billion-2050

[21] According to IPCC calculations.

[22] World Resources Institute, 2018, How to sustainably feed 10 billion people by 2059, in 21 charts, https://www.wri.org/insights/how-sustainably-feed-10-billion-people-2050-21-charts#

[23] Another way is to make the diet in rich countries in the Global North more plant-based. Pyett, S., W. Jenkins, B. van Mierlo, L.M. Trindade, D. Welch and H van Zanten (2023), Our future in proteins, VU University Press.

The benefits that come from these ecosystem services — such as biodiversity and pest control — benefit all of us, and we cannot expect farmers to pay for them on their own. We must offer new business models for farmers and landowners that include compensation and reward schemes for ecosystem services. If we don't, we will see a loss of farmers either because smallholder farmers are unable to deal with the cost of implementing sustainable practices or because of consolidation among farmers as often only larger farmers will be able to cover the increased cost. This loss of smallholders will particularly affect smallholders in the Global South.

Carbon sequestration in trees, plants, pasture and soils are a potential income source for farmers through the use of verifiable and creditable carbon markets that allow farmers to benefit from sustainable practices. The influx in the soil can be converted into validated removal units and ultimately into certified soil sequestered carbon credits that a farmer can sell. An extra tonne stored per hectare of agricultural land can be converted into a tradable carbon credit. It is important that the intermediary between the farmer and the off-taker receives only a limited fee per credit, so that most of the revenue is going to the farmer.

Generating carbon credits is not an end in itself but a means of putting a price tag on ecosystem services provided by farmers. The voluntary carbon market is used to do just that. This market is currently the best developed market to price ecosystem services. At the moment, few markets exist in which these services, like soil health, pollination, pest control, flood control, water management and air purification, can be priced, and those that do are restricted to specific, largely developed world locations.[24] However, pending the wider emergence of such markets, ecosystem services can be priced as co-benefits that are part of nature-based carbon credits. That is why these credits have a higher price than other lower quality credits based on, for instance, avoided emissions due to the installation of solar panels.[25]

Carbon credit mechanisms can help to facilitate the inflow of money from downstream supply chain partners and actors in non-food supply chains to farmers to enable them to produce sustainably. Companies in the Global North are willing to buy these nature-based credits because they need them to help deliver on their net-zero emission pledges. These often take the form of net-zero commitments using Science Based Targets to reach the Paris aligned goals by 2050 or sooner. Once corporates have set targets they typically need to invest significantly in emissions reductions to meet their interim reduction targets. They may also choose to invest in carbon abatement or removals beyond their value chain - via the voluntary carbon markets - to compensate for residual emissions. For the latter, they can use nature-based carbon credits. Potentially this entails a large transfer from the Global North to the South that improves the living conditions of vulnerable groups. This way, nature-based carbon solutions also can contribute to a more inclusive food system.

Currently, there are already several successful agroforestry initiatives. One is the Acorn project, which is part of the Carbon Bank of Rabobank (Box 1).[26] However, soil sequestration is still hardly used to generate carbon credits. When it is used, it is usually in the United States, where large-scale farmers can achieve economies of scale that make up for the investment costs. For instance, IndigoAg is a company that carries out soil sequestration projects in 22 US states.[27] However smallholders currently have virtually no access to these soil sequestration projects, as these are very tech- and data intensive.

[24] See for example, UK biodiversity net gain markets, Australian water rights trading, USA nutrient credit markets.
[25] https://carboncredits.com/voluntary-carbon-credit-buyers-willing-to-pay-more-for-quality/
[26] The author is the former CEO of the Rabo Carbon Bank.
[27] https://www.indigoag.com/carbon

Box 1: The Acorn project uses agroforestry to help strengthen rural communities

Acorn focuses on working with local farmers in developing and emerging regions. Together with partners they strive to improve smallholder farmers' access to finance, knowledge and markets. By accelerating rural development, the project aims to contribute to empowering the ecosystem and the smallholders to fight environmental and financial challenges by doing agroforestry projects. Planting trees supports soil quality and crop yield as trees grow deep roots that retain soil, produce nutrients for other plants, and attract friendly pollinators. They provide shade, protection, and other environmental benefits. Also trees provide new produce (such as mangos, cashews, or avocados).

The Acorn team partners with local project coordinators, NGOs and cooperatives or companies working directly with smallholders around the world, to reach those smallholder farmers most impacted by climate change. By measuring and certifying the sequestered carbon in a low-cost manner, Acorn enables smallholders to access the voluntary market and empower them to generate an additional income stream by compensating them for sequestering additional carbon on their plots of land. Through support and financial incentives, we point them towards agroforestry. The trees they plant on their farmland capture excess carbon in the atmosphere.

Acorn turns the CO_2 that is sequestered through agroforestry into carbon credits to be sold on the voluntary carbon market. The team developed an innovative and scalable method for measuring, certifying, and monetizing the biomass growth of planted trees and turning that growth into Carbon Removal Units (CRUs). A certification process was set up in conjunction with Plan Vivo. This protocol keeps the certification process accessible and transparent and reduces the costs and lead times of certification significantly.

The CRUs (or carbon credits) are sold to organizations with strong emission reduction commitments. 80% of the income of every sold CRU flows back to the original smallholder. By the end of June 2024, over 330,000 smallholders were supported, covering more than 350,000 hectares and nearly 315,500 CRUs were issued.

For more information see: https://acorn.rabobank.com/en/

At present, nature-based carbon credits remain in short supply. The Taskforce on Scaling Voluntary Carbon Markets, a private initiative, indicated that future demand for carbon credits could increase by a factor of 15 by 2030 ($50 billion market size, 1.5-2 gigatons CO_2 per year), and by a factor of 100 by 2050 (7-13 gigatons CO_2 per year).

The rapid rise in expected future demand for nature-based carbon credits means supply will need to be ramped-up, providing scope for the inclusion of more nature-based credits and a shift from the existing individual or 'bundled' projects to more jurisdictional/regional or commodity-wide solutions. Setting up a carbon project among farmers does not happen by itself. So the fact that there is a demand for nature-based credits is not enough. For example, adapting farming practices requires knowledge and investments. Generating credits requires that carbon storage be measured and monitored. These processes must be standardized, verified and certified by independent parties. Intermediaries will also be needed who can sell farmers' generated credits to parties in need of credits. Parties will have to step up to lead the way here, and make this accessible to smallholders. Project developers are needed that set up and manage soil sequestration projects and take over the financial risks. After all, the upfront costs of soil sampling and project registration, the opportunity cost of changing practices, potential near-term reduction in yields and the market price of nature-based carbon credits imply financial risks for smallholders that they cannot bear individually.[28] These project developers should also bundle the projects. The smallholders' land is far too small to generate the desired economies of scale. By aggregating agricultural land among hundreds of smallholders, economies of scale can be created that are necessary to make the transition to carbon farming economically viable. Consideration will also have to be given to how to ensure that the carbon remains stored in the ground when the land is transferred from the smallholder to a new owner. After all, changes in land ownership could result in a reversal in carbon storage.

[28] These risks were mentioned in Hope, R. (2023), Soil carbon credits: Opportunities and challenges ahead, February 23, S&P Global Commodity Insights. https://www.spglobal.com/commodityinsights/en/market-insights/blogs/agriculture/022323-soil-carbon-credits-opportunities-and-challenges-ahead

Despite being criticized for the prevalence of low quality (non-additional) projects, high integrity voluntary carbon markets have a fundamental and vital role to play in addressing climate change. Firstly, liquid and transparent voluntary carbon markets could accelerate climate action and minimise transition costs by funding the most efficient sources of carbon abatement or removal. For instance, farmers that offer their nature-based carbon credits can then find financial support from several potentially interested off-taker, instead of being dependent on just a few corporates or even governments. Secondly, carbon credits also enable investments in agriculture from non-food companies and individuals, which is desperately needed as agriculture is typically a low-margin business with limited capital available to incorporate costs or transfer costs to off-takers and consumers. Thirdly, voluntary carbon markets allow climate-action-takers, such as farmers to monetise the value of their ecosystems services themselves. In current supply chains, it is typically the corporate who accumulates the value of the produce with the farmers increasingly squeezed out, as farmers have less market power than the often large multinational off-takers. We should design new market mechanisms to guard against this happening again for new (ecosystem) services that are delivered by the farmer.

Box 2: The Core Carbon Principles of the ICVCM

These ten Core Carbon Principles are a global benchmark for high-integrity carbon credits that set rigorous thresholds on disclosure and sustainable development.

A. Governance

1. Effective governance: The carbon-crediting program shall have effective program governance to ensure transparency, accountability, continuous improvement and the overall quality of carbon credits.
2. Tracking: The carbon-crediting program shall operate or make use of a registry to uniquely identify, record and track mitigation activities and carbon credits issued to ensure credits can be identified securely and unambiguously.
3. Transparency: The carbon-crediting program shall provide comprehensive and transparent information on all credited mitigation activities. The information shall be publicly available in electronic format and shall be accessible to non-specialised audiences, to enable scrutiny of mitigation activities.
4. Robust independent third-party validation and verification: The carbon-crediting program shall have program-level requirements for robust independent third-party validation and verification of mitigation activities.

B. Emissions Impact

5. Additionality: The greenhouse gas (GHG) emission reductions or removals from the mitigation activity shall be additional, i.e., they would not have occurred in the absence of the incentive created by carbon credit revenues.
6. Permanence: The GHG emission reductions or removals from the mitigation activity shall be permanent or, where there is a risk of reversal, there shall be measures in place to address those risks and compensate reversals.
7. Robust quantification of emission reductions and removals: The GHG emission reductions or removals from the mitigation activity shall be robustly quantified, based on conservative approaches, completeness and scientific methods.
8. No double counting: The GHG emission reductions or removals from the mitigation activity shall not be double counted, i.e., they shall only be counted once towards achieving mitigation targets or goals. Double counting covers double issuance, double claiming, and double use.

C. Sustainable Development

9. Sustainable development benefits and safeguards: The carbon-crediting program shall have clear guidance, tools and compliance procedures to ensure mitigation activities conform with or go beyond widely established industry best practices on social and environmental safeguards while delivering positive sustainable development impacts.
10. Contribution toward net zero transition: The mitigation activity shall avoid locking-in levels of GHG emissions, technologies or carbon-intensive practices that are incompatible with the objective of achieving net zero GHG emissions by mid-century.

Source: https://icvcm.org/the-core-carbon-principles/

For carbon credits to indeed become an important instrument in combatting climate change and improving farmers' livelihoods, it is essential that credits' quality is beyond question. To increase

trust, the Integrity Council for Voluntary Carbon Markets (the successor to the TSVCM) has developed a set of quality conditions to safeguard the integrity and effectiveness of carbon credits within the voluntary carbon market. These principles are designed to guide the development, verification, and sale of carbon credits, ensuring they represent real, additional, and verifiable emissions reductions or removals. These are called the ten core carbon principles (Box 2).

To sum up, companies in the Global North that have made net-zero emission commitments need high integrity nature-based carbon credits to compensate for the residual emissions that they cannot feasibly abate. Indeed, net zero is not gross zero, and typically they cannot reduce all emissions to zero and will need to off-set the remaining emissions in some way. Since the potential for nature-based carbon solutions is greatest in the Global South, this can trigger a large-scale benefit transfer from the Global North if companies based there buy carbon credits generated in low and middle income countries in the Global South on the voluntary carbon market. Governments can also potentially meet some of their climate goals in this way. However, there is another way governments in the Global North can contribute to sustainability in low-income countries, namely by using debt-for-nature swaps.

5. Debt-for-nature swaps could also be part of the solution

Typically, countries that are rich in nature and biodiversity experience excessive levels of debt. Yet, these are also the countries that are the most vulnerable to climate change and the loss of biodiversity. The IMF shows that 34 of the 59 low- and middle-income countries that have climate threats at or above the median are also at a high risk of fiscal crisis in the next two years, and that only five countries are at low risk and 20 at medium risk.[29]

One way to address both debt sustainability and ecological issues are debt-for-nature swaps. In this form of financing, part of the national debt is written off if certain environmental targets are met. Debt-for-nature swaps offer relief to countries burdened by repayment and interest obligations from high government debt that are having problems refinancing that debt. Restructuring the loans reduces government debt and also lowers interest costs. Another benefit of lower debt is an upgrade to a country's sovereign credit rating, which makes government borrowing cheaper. In return for the reduction in debt obligations the country commits to finance domestic climate or nature related projects with the freed-up financial resources. The concept of debt-for-nature swaps has its roots in the 1980s debt crisis.

The idea of partial debt relief operations conditional upon debtor commitments to undertake climate-related investments resulted in 1987 in the first debt-for-nature swaps in Bolivia and Costa Rica. The basis of these transactions, set up by the World Wildlife Fund and Conservation International respectively, were modest in size.[30] In the case of Costa Rica, it involved restructuring loans, waiving loans and reducing public debt. As a result, the country had to pay $5.4 million less in interest and repayments. Costa Rica promised to use these savings for the benefit of a Natural Resources Conservation Fund. This fund was used to support various conservation projects, including the purchase of land to establish protected areas, restoration of degraded forests and development of sustainable agricultural practices. A year later, in 1988, Costa Rica entered into a similar swap, but the value was much higher, at US$33 million.

This construct has since been used in several countries in the Global South. According to an African Development Bank inventory, around 145 debt-for-nature swaps had been applied by 2021.[31] The last one in the survey took place in Belize and had a size of over $550 million. After 2021, the number of

[29] Chamon, M. E. Klok, V.V. Thakoor and J. Zettelmeyer (2022), Debt-for-Climate Swaps: Analysis, Design, and Implementation, August 12, IMF Working Paper 2022/162, International Monetary Fund, Washington, DC.
[30] Rosebrock, J. & H. Sondhof (1991), Debt-for-nature swaps: A review of the first experiences, Intereconomics, 26(2), pp. 82-87.
[31] African Natural Resources Management and Investment Centre (2022), Debt for Nature Swaps – Feasibility and Policy Significance in Africa's Natural Resources Sector, African Development Bank, Abidjan, Côte d'Ivoire.

debt-for-nature swaps grew steadily. In 2023, Ecuador concluded the largest debt-for-nature swap to date, worth $1.6 billion. Box 3 presents more details on the Belize and Ecuador swaps, respectively.

Debt-for-nature swaps are an appropriate instrument when necessary climate and nature investments give rise to the unsustainable nature of sovereign debt.[32] Yet swaps are not substitutes for debt restructuring, because in the case of debt problems typically, a swap cannot sufficiently restore solvency. To have a meaningful impact, a swap must have a significant effect on overall debt burdens and thus result in additional resources to the debtor country, including for conservation and climate purposes.[33] For this reason, some think debt-for-nature swaps are mainly a solution when debt is high but still sustainable.[34] But even then, debt-for-nature swaps can involve high transaction costs because they are complex to structure. For instance, multiple parties are involved in the sometimes lengthy negotiations of the transaction. There is an NGO that raises capital from investors for clearly defined sustainable projects in developing countries facing sovereign debt issues. Then a service provider is needed to set up a special purpose vehicle (SPV) from which approved projects can be funded. From the SPV, a loan is also provided to the country concerned to buy back the downgraded debt from commercial and private creditors. So, the creditors swap the old debt with a haircut for a new loan. With the proceeds, the investors are eventually repaid.

Box 3: Recent debt-for-nature swaps in Belize and Ecuador

The Belize debt-for-nature swap in 2021 enabled the refinancing of this Central American country's sovereign debt on more favourable terms. The interest savings realised through the restructuring were used by the Belizean government for nature conservation. The swap was set up by US-based environmental group, The Nature Conservancy. It is lending funds at a low-interest rate to Belize to buy back $553 million in commercial debt at a deep discount of 45%. The Nature Conservancy raised funds from a Swiss investment bank via the issuance of 'blue bonds' backed by the US government, which gave the bonds a strong investment-grade credit rating.

Due to the ongoing political crisis in Ecuador in 2023, government bonds had fallen sharply in price. This made it attractive for banks to buy these bonds. In May, a Swiss bank paid $644 million for Ecuadorian bonds with a face value of $1.6 billion, that is almost a 60% discount. The advantage for Ecuador is that it will have to pay roughly a billion dollars less in repayments over 17 years. The old debt will be replaced with a cheaper-to-service $656 million 'Galapagos Bond' maturing in 2041 and insured by the US International Development Finance Corporation. Because of this additional security for investors, the new debt was given a provisional investment-grade Aa2 credit rating by a credit agency, which is considerably higher than Ecuador's Caa3 'junk' rating. In return for the bond loan, the Ecuadorian government committed to spend about $18 million annually for 20 years on conservation in the Galapagos, a volcanic Pacific archipelago home to many unique animals and plants.

Source: Oh (2022)[35], Campos and Jones (2023a, 2023b)[36].

When the debt position is unsustainable and the country concerned no longer has access to the capital market, it is necessary to give priority to debt restructuring, and climate and nature take second place.

[32] Volz, U., S. Akhtar, K. P. Gallagher, S. Griffith-Jones, J. Haas, and M. Kraemer (2021), Debt Relief for a Green and Inclusive Recovery: Securing Private Sector Participation and Creating Policy Space for Sustainable Development. Berlin, London, and Boston: Heinrich-Böll-Stiftung, SOAS University of London, and Boston University.

[33] Cassimon, D., M. Prowse, and D. Essers (2011), The Pitfalls and Potential of Debt-for-Nature Swaps: A US Indonesian Case Study, Global Environmental Change 21, pp. 93-102.

[34] Essers, D., D. Cassimon and M. Prowse (2021), Debt-for-Climate Swaps: Killing two Birds With One Stone?, Global Environmental Change 71(9).

[35] Oh, S. (2022), How debt-for-climate swaps can help solve low-income countries' fiscal and environmental challenges at the same time, PhysOrg, November 1. https://phys.org/news/2022-11-debt-for-climate-swaps-low-income-countries-fiscal.html

[36] Campos, R. and M. Jones (2023a), Ecuador frees cash for Galapagos conservation with $1.6 billion bond buyback, Reuters, May 5. https://www.reuters.com/world/americas/ecuador-frees-cash-galapagos-conservation-with-16-bln-bond-repurchase-2023-05-05/

Campos, R. and M. Jones (2023b), Ecuador seals record debt-for-nature swap with Galapagos bond, Reuters, May 9. https://www.reuters.com/world/americas/ecuador-seals-record-debt-for-nature-swap-with-galapagos-bond-2023-05-09/

In that case, debt and sustainability should be addressed separately, and it is more efficient to provide a loan, the proceeds of which should be used by the developing country to make ecological investments.

For debt-for-nature swaps to make a significant contribution to conservation and climate mitigation and adaptation, the number and size of transactions will need to scale up significantly. The debt-for-nature swaps market will exceed $800 billion, according to Bloomberg.[37] The G20 could play a leading role in the upscaling.

There have been several efforts at international coordination on debt reduction for low-income countries in recent years. For instance, temporary significant relief measures were taken in the COVID-19 pandemic. However, this has not prevented the aforementioned debt crisis from emerging in the Global South, which has been exacerbated by rising interest rates and increasing geopolitical tensions. In response, the G20 created the Common Framework, a coordinated plan for debt relief. By now, there is general agreement that the Common Framework fell short in its inability to include all creditor classes in the negotiations and to link debt relief to development and climate goals. According to the Debt Relief for Green and Inclusive Recovery Project, the Common Framework needs immediate reform to provide debt relief for a green and inclusive recovery.[38] One way to do this is by making high-integrity nature-based carbon credits part of debt-for-nature swaps.

6. Inclusion of nature-based credits in debt-for-nature swaps

Nature-based carbon credits can be used to cover interest or redemption payments in debt-for-nature swaps by providing an alternative form of payment that aligns with the goals of environmental protection and sustainability. By using credits for interest payments, debt sustainability can improve. After all, less capital is then needed to service a given debt. Moreover, this will provide incentives for countries to protect and restore their natural ecosystems, as credits can be generated by doing so. In this way, carbon credits could increase the fiscal space gained by the country undertaking ecological investments.

Debt-for-nature swaps involve projects that increase the climate and nature resilience. On top of these projects, the country whose debt is cancelled may also set up other projects that are thus separate from the agreements in the swap. These projects can be used to create carbon credits. That can be done with projects such as reforestation, habitat restoration, biodiversity conservation, and sustainable land management. After having assessed the carbon sequestration potential of these projects, a carbon credit mechanism needs to be established. This involves setting up a standardized methodology for measuring carbon credits and establishing a registry to track and trade these credits. The next step is to calculate the financial value of the carbon credits generated by the protected or restored natural ecosystems. This can be done by considering the market price of carbon credits or through negotiations between the participating countries and relevant stakeholders. Then allocate a certain number of carbon credits for interest payment and convert these credits into a cash equivalent value by selling the credits in the voluntary carbon market. To make double counting impossible, it should obviously not be possible to resell the carbon credits. So the country or the organization that receives the credits as interest or redemption payments will have to retire them. The carbon credits can be used to fit into the Paris aligned path to net zero of this country or organization.

A robust monitoring and verification system needs to be implemented to ensure that the protected or restored natural ecosystems continue to sequester carbon as expected. This can involve regular

[37] White, N. (2023), Barclays Sees Real Greenwashing Risk in ESG Debt-Swap Market, Bloomberg, January 23. https://www.bloomberg.com/news/articles/2023-01-23/barclays-sees-real-risk-of-greenwashing-in-esg-debt-swap-market?utm_source=website&utm_medium=share&utm_campaign=copy

[38] Ramos, L., Ray, R., Bhandary, R.R., Gallagher, K.P., and W.N. Kring (2023), Debt Relief for a Green and Inclusive Recovery: Guaranteeing Sustainable Development. Boston, London, Berlin: Boston University Global Development Policy Center; Centre for Sustainable Finance, SOAS, University of London; Heinrich-Böll-Stiftung.

assessments, satellite monitoring, and on-the-ground verification. By using nature-based carbon credits to pay interest in debt-for-nature swaps, countries can demonstrate their commitment to environmental sustainability while fulfilling their financial obligations. This approach provides a unique opportunity to align economic incentives with conservation efforts and promote the protection and restoration of natural ecosystems.

Nature-based carbon credits can also be used as collateral in debt-for-nature swaps to provide assurance to creditors that the participating countries will fulfil their commitments to protect or restore natural ecosystems. This will involve setting up a trust or escrow account where the carbon credits are deposited and held as collateral. Also a legal agreement needs to be established between the participating countries, creditors, and relevant stakeholders involved in the swap. These agreements should specify the use of carbon credits as collateral and the conditions under which the credits can be utilized or released. By using nature-based carbon credits as collateral in debt-for-nature swaps, countries can provide a tangible and measurable asset that assures creditors of their commitment to environmental protection. This can help unlock financial resources for nature conservation and promote sustainable development.

Next to nature-based credits, credits might also come from renewable energy or energy efficiency interventions in the developing country doing the swap. These interventions could also bring other co-benefits, such as reducing countries' oil imports. Chamon et al. (2022) rightly point out that the carbon credits generated through climate mitigation interventions should only be eligible for inclusion in a debt-for-nature swap if they meet the additionality condition:[39] "To the extent that the credits are generated through climate mitigation that would have not been feasible absent the debt-for-climate swap, the gains are additional—the debtor country has a lower debt and the creditor benefits from carbon credits in support of their mitigation objectives.". Cassimon et al. (2014) name a successful example, namely a 2005-2007 debt-for-wind-power swap between Spain and Uruguay through the now defunct Clean Development Mechanism (CDM, which is not part of the voluntary carbon market).[40] This earned Spain certified emission reduction credits (CERs).

7. G20's role in making these solutions work

Because of the broad representation of states in the G20[41], it can play an important role in driving the scale-up of instruments that can help improve both the financial position and environmental resilience of low-income nations. In this paper, we discussed two possible instruments, nature-based carbon solutions and debt-for-nature swaps. Each of these can be used separately or in combination. While carbon credits can be a solution for individual farmers who want to become more sustainable, debt-for-nature swaps improve the macroeconomic situation. Obviously, that does determine the context in which farmers in low-income nations operate. Therefore, both instruments are relevant when it comes to empowering smallholders in the Global South.

The world's poorest countries are struggling to pay for a climate crisis they did not cause. More public debt is not the answer since low-income countries have limited ability to borrow. The use of nature-based carbon solutions can help make agriculture more sustainable and broaden farmers' revenue model by generating carbon credits. Currently, there are already successful examples of agroforestry projects generating nature-based credits for farmers in the Global South. However, these are stand-alone projects, each creating its own marketplace. Furthermore, there are still very few initiatives that make carbon credits based on soil sequestration accessible to smallholders. The knowledge and

[39] Chamon, M. E. Klok, V.V. Thakoor and J. Zettelmeyer (2022), Debt-for-Climate Swaps: Analysis, Design, and Implementation, August 12, IMF Working Paper 2022/162, International Monetary Fund, Washington, DC.
[40] Cassimon, D., M. Prowse, and D. Essers (2014), Financing the Clean Development Mechanism through debt-for-efficiency swaps? Case study evidence from an Uruguayan wind farm project, European Journal of Development Research 26 (1), 142–159.
[41] The G20 is made up of 19 countries (Argentina, Australia, Brasil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Saudi Arabia, South Africa, Russia, Turkey, UK and USA) and two regional bodies: the African Union and the European Union. The members of the G20 represent around 85% of the world's GDP, more than 75% of world trade and around two-thirds of the world's population.

technology needed for this will only become affordable if large-scale soil sequestration projects are done worldwide.

When it comes to boosting the supply of nature-based carbon solutions, the G20 could lead a coalition of national governments, NGOs and business that coordinates standard development and organizes the shift from the existing individual or 'bundled' projects to more jurisdictional/regional or commodity-wide solutions. The voluntary carbon market is now based on carbon reduction or removal projects that follow different standards with different sets of requirements depending on focus and scope. There are few unified rules or regulations across jurisdictions or regions. Correspondingly, a fragmented landscape has emerged that consists of a multitude of carbon credit registries, reporting protocols, standard bodies, third-party verifiers, certification bodies (for project design and impact assessment) and service providers. Based on the work of the Integrity Council for Voluntary Carbon Markets, the G20 could promote more global cooperation and standardisation. However, this starts with scale, i.e. more and larger projects with smallholders, and collaboration. For that, NGOs could team up with large food processing companies that need the nature-based credits.

So, collaboration between the G20, national governments, NGOs, researchers, and the farming community is essential to realize this potential. Investments in research, education, and extension services are crucial to support the adoption of these practices among smallholder farmers in the Global South. Additionally, policies and incentives that encourage sustainable land management can significantly enhance the region's contribution to global soil carbon sequestration efforts.

The investment needs in the Global South are beyond the capacity of the world's multilateral lending and development institutions. Olabisi et al. (2022) point to the fact that the stakes in South-Asia (excluding China) and Africa are heightened because the continents will contribute the most to human population growth in the coming decades.[42] This will increase the need for funds to mitigate climate-warming emissions and to adapt to climate change. Xie et al. (2023) map the aggregate climate finance provided by the multilateral development banks for 143 emerging and developing countries between 2015 and 2020 and find that climate finance is aimed towards mitigation and not so much to adaptation.[43] Only 8% of the development banks' climate finance goes to developing countries with high vulnerability and low emissions. The G20 should therefore encourage private markets to undertake climate and nature actions and also fund adaptation projects in low-income countries, especially the most vulnerable ones. This is often more effective than funding projects in a developed country in the Global North, because the climate or nature return on every dollar there is usually lower than in the Global South. Governments of developed nations can use regulation, taxes, cap and trade schemes and subsidies to stimulate the private sector to invest also in emerging and developing nations, ss was the case when the EU allowed companies to use certified emission reduction credits (CERs) generated under the UN's Clean Development Mechanism (CDM) to meet a share of emissions reductions required under its flagship Emissions Trading Scheme. Investments could involve food production, but also the energy transition which may have more direct relevance to many companies than food production.

Let's take the energy transition as an example to further clarify this. The energy transition must be accelerated by investing not only domestically but also in African countries, for example, where there is plenty of sunshine and more space to make cheap green hydrogen. Olabisi (2024) rightly argues that governments in the Global North should not only support the in-country installation of solar panels in

[42] Olabisi, M., R. Richardson and A. Adelaja (2022), The Next Global Crisis: Africa's Renewable Energy Financing Gap, Climate and Development, 15 (6), 501–08.

[43] Xie, L., B. Scholtens and S. Homroy (2023), Rebalancing climate finance: Analysing multilateral development banks' allocation practices, Energy Research & Social Science, 101, 103-127. They study the climate finance allocation practices of eight multilateral development banks: Asian Development Bank, African Development Bank, Asian Infrastructure Investment Bank, European Bank for Reconstruction and Development, European Investment Bank, Inter-American Development Bank Group, Islamic Development Bank and the World Bank Group.

high-income countries, as installation in a tropical setting could produce 40% more energy.[44] There is a parallel with greening food production. Instead of just investing in afforestation projects in rich countries, it is often more effective to strengthen natural carbon sinks in the Global South. In many low-income nations, it is now cheaper for farmers to cut down trees to obtain fuel or land for cattle ranching. Yet at reasonable carbon prices, the forest can capture carbon that is more valuable per hectare than fuel or beef. It is therefore important to develop the voluntary carbon market and give high-integrity nature-based credits a place in regulated carbon markets, like emission trading mechanisms. The G20 can play a stimulating role in linking the voluntary to the regulated carbon market for these credits, by setting out a set of specific requirements the voluntary market would have to meet before a link to the regulated market is possible.

To enable governments in developing and emerging economies to invest in sustainability, it is essential to keep the cost of capital for these countries as low as possible. Only then can they raise funds on the capital markets at reasonable rates to invest in sustainability. A sustainable debt position is necessary to maintain access to capital markets and keep the cost of capital low. If debt levels threaten to get too high, debt-for-nature swaps can be used. The potential impact of this is huge, but to unlock that potential, the instrument needs to be used much more often. To enable such scaling up, it is important for the world's rich economies to join forces.

The G20 can provide impetus by making arrangements to drive upscaling with parties such as the World Bank, the IMF, academics[45] and NGOs on climate and nature. Together, they could, for instance, establish a knowledge centre on debt-for-nature swaps. That centre could develop a framework based on best practices for structuring a successful debt-for-nature swap. In doing so, there are a number of concerns. Firstly, it is important that as little money as possible flows away to intermediaries (often banks) that coordinate and settle the swap, leaving as much capital as possible to spend on nature and climate investments. This would require the transactions to be significantly simplified, standardised and otherwise de-risked. The framework should also steer towards repurchase of the unsustainable debt at the lowest possible price, so as to maximise debt reduction for the developing country concerned. These include, for example, those parts of debt that are difficult to refinance because of their maturity or the currency in which they were incurred, or debt on which interest rates are very high. A third component of the framework should see effective ways of monitoring the climate and nature outcomes to be delivered in return for debt relief. This can also tie in with standards already developed by, for example, VCS or Goldstandard.

As part of debt-for-nature swaps, nature-based credits can play a role to pay interest and principal payments. The G20 could set up a mechanism with others to include high-integrity nature-based carbon credits in debt-for-nature swaps. This could make use of the earlier Clean Development Mechanism from the Kyoto Protocol. The (CDM) under the Kyoto Protocol was a pioneering framework that allowed developed countries to invest in emission reduction projects in developing countries, earning certified emission reduction credits in return. These credits could then be used to meet a portion of their emission reduction targets. With the advent of the Paris Agreement, the CDM has been phased out, but its principles can be adapted to create a new mechanism to incentivize debt-for-nature swaps. A new mechanism would need to be in line with the goals of the Paris Agreement, emphasizing transparency, environmental integrity, and global emission reductions. It would also need to support the nationally determined contributions (NDCs) of participating countries. Nature-based solutions would be at the heart of the new mechanism, focusing on projects that protect, restore, and manage ecosystems. Local and indigenous communities would play a central role in the design and

[44] A quote clarifies this: “Spending billions on additional wind farms in California that yield less energy per dollar than a comparable investment in Kenya suffers from the same flaw. If the vast renewable energy potential of areas near the equator can be hooked into global value chains through trade—yielding climate gains, as well as profits that feed back to the German, British, or Californian sources of the investments—it may be the policy win of the century.” Olabisi, M. (2024), Paying Africa’s Climate Bill, F&D Features, IMF, March, pp. 44-47.
[45] Such as the scientists working together in the Debt Relief for Green and Inclusive Recovery Project.

implementation of projects. Their knowledge and consent would be essential to ensure that projects are appropriate, respectful of local rights, and provide equitable benefits.

In summary, the G20 could play a leading and facilitating role in several ways in scaling up the voluntary carbon market, increasing the use of debt-for-nature swaps to give developing countries space to invest in their climate and nature resilience, and could shape mechanisms to enable the use of nature-based carbon credits in debt-for-nature swaps.