

# China's nature-based solutions in the Global South: Evidence from Asia, Africa, and Latin America

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## ABSTRACT

China increasingly engages in environmental diplomacy through South-South cooperation across the developing world. Since 2019, the rise of the discourse of Nature-based Solutions (NbS) within this cooperation has been exponential. Coined just over ten years ago, NbS refers to the underexplored potential of leveraging the natural world to address socio-environmental challenges. The concept finds particular resonance in China, where it demonstrates strong parallels with the domestically-pioneered concept of Ecological Civilization – the ruling paradigm when it comes to all realms of Chinese environmental governance. Building on the global discourse, NbS has been adapted to the Chinese context, creating what some call “Chinese-style” NbS that prioritizes large-scale interventions and ecological engineering over grassroots preservation. China's NbS are not only being pursued domestically, but also increasingly abroad through the country's Belt and Road Initiative. From Southeast and Central Asia to Africa and Latin America, this article surveys Chinese-led or financed projects that fall under the broad umbrella of NbS. We provide a comparative analysis of these interventions – or the conspicuous lack of such interventions – to show the current status and future prospects for China's growing sphere of influence when it comes to advancing NbS in the Global South. We find that China's embrace of this concept in environmental diplomacy is directly related to the potential for NbS to serve as a tool for helping the country's vision of an Ecological Civilization “go global.” The consonance between the rhetoric of NbS and Ecological Civilization, combined with the global reach of NbS, provides a powerful platform for taking Chinese environmental discourse to the global level.

## 1. Introduction

China has sustained varying levels of global connection long before the concept of the “Global South” – i.e., the conglomeration of developing countries located in Latin America, Africa, and certain parts of Asia Pacific – was coined. Now, as part of the Global South, Chinese engagements with other Southern countries are referred to as South-South cooperation (*nán nán hézuò*, 南南合作), which has increased

exponentially in the current century. Since China's “going out” policy (*zǒu chūqù zhànlüè*, 走出去战略) in 1999, followed by the Belt and Road Initiative (BRI; *yīdài yīlù*, 一带一路) launched in 2013, China has increasingly turned to the Global South to meet its development goals and resource needs. The establishment of the BRI was particularly influential. With more than 150 countries across six continents having officially joined (Gong, 2023), this global initiative is the largest in the world. It has been referred to as “the new WTO,” “globalization 2.0,”

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“global commerce on China’s terms,” and a major departure from a US-centered world order.<sup>1</sup>

Along with infrastructure investments and development assistance, the BRI has triggered increased environmental diplomacy across member countries (Harlan & Lu, 2022; Sun & Yu, 2023; Wang-Kaeding, 2021). At the first Belt and Road Forum in 2017, President Xi Jinping proposed the BRI International Green Development Coalition (BRIGC) to monitor and shape BRI projects in a more sustainable direction. Also in 2017, Chinese ministries jointly released “Guidance on Promoting a Green Belt and Road” with similar intentions and including provisions for mobilizing funding for green projects through existing multilateral and bilateral funds (MEE, 2017). At the second Belt and Road Forum in 2019, BRIGC was officially launched, now with 134 partners including 26 national environmental ministries. The forum also witnessed the signing of the Green Investment Principles for the BRI, supporting guidelines for green projects, by 27 financial institutions. Just as the BRI initially sought overseas outlets for China’s excess construction and infrastructure capacity, the “green BRI” seeks overseas outlets for the country’s excess green capacity, including renewables and electric vehicles (Cheung & Hong, 2021).<sup>2</sup>

As part of the greening of the BRI and the globalization of China’s environmental efforts more broadly, the concept of Nature-based Solutions (NbS) has found its way into the Chinese lexicon. Coined just over ten years ago, NbS refers to the underexplored potential of leveraging the natural world to address socio-environmental challenges. IUCN defines NbS as “actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously benefiting people and nature” (IUCN, 2023). Quintessential examples of NbS are the protection, restoration, or alteration of ecosystems to sequester carbon, protect biodiversity, heighten water quality, reduce desertification, or guard against inland flooding and coastal erosion (Cohen-Shacham et al., 2016; Guo et al., 2021). Encompassing an enormous range of potential activities, IUCN’s definition leaves ample room for interpretation, leading to the apt critique that NbS can be anything to anyone, from an important tool for “leveraging the power of nature” to a “dangerous distraction” that succumbs to the very neoliberal logic that contributes to environmental degradation in the first place (Melanidis & Hagerman, 2022).

The critique holds true for NbS in China as well. NbS – or *jīyú zìrán de jiějué fāngàn*, 基于自然的解决方案 in Mandarin – became popular in Chinese policy documents following the 2019 New York Climate Action Summit, in which China and New Zealand co-lead the workstream on NbS, culminating in a jointly published “NbS for Climate manifesto” (UNEP, 2019). Spanning from reforestation to wetland restoration and urban renewal, China’s NbS – like all NbS – are intended to be “green” solutions offered in contrast to (or in combination with) the more conventional engineered or “grey” solutions (Seddon, 2022). Chinese NbS initiatives reflect the global norm (for example the country’s Ministry of Natural Resources has largely adopted the IUCN definition), but are also in certain ways distinctly Chinese projects – or, as some practitioners have called it, “Chinese-style” (*zhōngguó shì de*, 中国式的) NbS (Liu, 2021). What exactly Chinese-style NbS implies is still in the making, yet one can decipher potential trends. As with the country’s approach to environmental governance more broadly, China’s NbS can be profoundly vast in their spatiotemporal dimensions, as exemplified by the

Great Green Wall and Grain for Green projects, both revegetation initiatives covering large swathes of the country and spanning decades if not centuries.<sup>3</sup> NbS in China also often involve a remarkable degree of social, political, and material engineering, alongside the ecological. They push the boundaries of the founding conceptions of NbS formulated more than a decade ago, both in terms of their vast spatiotemporal scale and their tendency to blur the distinction between “green” and “grey” by following the type of “infrastructural thinking” so typical of Chinese development (Oakes, 2019). In Chinese environmental discourse, the language of “building” or “construction” (*jiànshè*, 建设) – exclusively associated with the built environment in Western discourse – applies to forests and ecosystems just as much as to skyscrapers and cities (Ren, 2011; Weins et al., 2022). Both ecological and development initiatives are pursued in tandem as large-scale socioenvironmental engineering efforts that are the larger goal of the state (Rodenbiker, 2022, 2023; Yeh, 2022; Zee, 2022) and this is reflected in the country’s approach to NbS.

China is pursuing NbS not only domestically, but also globally. As with NbS in China, the country’s overseas assistance with NbS is not entirely new. Chinese environmental assistance to the Global South (mainly to like-minded countries in Africa and Asia) dates back to at least the 1960s but has developed rapidly since the early 2000s. Since 2019, some of these growing overseas interventions have begun to explicitly be referred to as NbS. Other initiatives have yet to explicitly adopt the term, but retain clear characteristics of the approach. These include an array of interventions associated with the BRIGC and the Green Silk Road Fund (Ascensão et al., 2018). Indeed, following the launch of these attempts to green the BRI, state support for NbS expanded along with the “framing of nature-based infrastructural interventions as key to green development” (Rodenbiker, 2022, p. 7). While many of these projects are not (yet) explicitly referred to in terms of NbS, they are likely to trend that way in the near future. Beyond this, a myriad of small-scale connections between Chinese ministries, universities, institutions, and partners across the Global South are emerging in the fields of sustainable agriculture, coastal management, and forestry that will likely be increasingly framed as NbS.

China’s involvement in the NbS playing field thus has global implications. With China as a rising proponent vis-a-vis Western nations, NbS initiatives in the Global South may increasingly reflect “Chinese-style” approaches that “focus on exporting industrial scale forestry” (Qi & Dauvergne, 2022, p. 4) and other “large-scale Chinese state-backed interventions in Earth systems” (Rodenbiker, 2022, p. 8), rather than a narrower approach to NbS that prioritizes nature conservation and grass roots social participation. This follows recent findings demonstrating that neither “nature” nor “ecology” are universal concepts but rather reflect the knowledge and power embedded in particular socio-cultural milieus (Pascual et al., 2021; Rodenbiker, 2021; Zhu, 2022) which, in turn, shapes how NbS play out on the ground (Woroniński et al., 2020). When it comes to NbS, for instance, what constitutes “nature” after all? Does using water to make hydrogen fuel – an example posed by the head of China’s C+NbS platform at a 2021 webinar – count as NbS? She preferred the expansive definition and Chinese institutes, such as Tsinghua University’s Institute of Climate Change and Sustainable Development (ICCS), urge that the definition be even more open and

<sup>1</sup> Respectively cited in Keith Bradsher, “At Davos, the Real Star May Have Been China, Not Trump,” *New York Times*, January 28, 2018; Jessica Meyers, “China’s Belt and Road Forum Lays Groundwork for a New Global Order,” *Los Angeles Times*, May 15, 2017; James A. Millward, “Is China a Colonial Power?,” *New York Times*, May 4, 2018; Jane Perlez and Yufan Huang, “Behind China’s \$1 Trillion Plan to Shake Up the Economic Order,” *New York Times*, May 13, 2017.

<sup>2</sup> Although the majority of BRI projects remain more “brown” than “green” (Liao, 2022).

<sup>3</sup> China’s Great Green Wall (also known as the Three North Shelterbelt, *sān běi fānghùlín*, referring to the north, northeast, and northwest portions of the country) is one of the largest tree planting and ecological restoration efforts in history, formally initiated in 1978 and planned to conclude in 2050, with a project implementation area extending across northern China (covering approximately one-third of the country) (Li et al., 2012; Mu et al., 2022; K. Qi et al., 2023). The nationwide Grain-for-Green program (also known as Returning Farmland to Forests, *tùgēng huán lín*) was initiated in 1999 and aims to restore degraded farmland across northern China but also covers parts of southern China (Delang & Yuan, 2015; Wu et al., 2019).

inclusive, leaving room for all countries to explore precisely what the concept means to each and how they will choose to deploy it. Others critique the broad scope of the term as being exceedingly amorphous and overly vague (Pauleit et al., 2017).

This article examines the rise of China's support for NbS across the Global South in order to better understand the country's growing influence in shaping the practice and discourse of environmental initiatives overseas. We examine Chinese rhetoric of NbS alongside practical examples from Asia, Africa, and Latin America through a systematic review of government and non-governmental documents from the agencies and organizations most involved in NbS implementation. Since the term NbS is quite new and deployed strategically, our overview examines long-standing cooperation at the forestry-climate-biodiversity nexus that generally falls under the rubric of NbS (but is not necessarily labeled as such yet) as well as newer initiatives explicitly referred to as NbS. We provide a comparative analysis of this cooperation across three continents to show the current status and future prospects for China's growing sphere of influence when it comes to advancing NbS in the Global South, as well as how this sphere of influence varies geographically and substantively. Our analysis sheds light on the much larger question of why China's approach to NbS is being advocated so resolutely at the international level and what implications this holds for the future of South-South cooperation in the twenty-first century.

## 2. China and the rise of NbS

Like many countries, China has been implementing some version of NbS for decades, if not centuries – only not under that name. This has, for the most part, taken the form of large-scale tree-planting projects unparalleled in the world. As early as the thirteenth century, already facing a largely deforested landscape from intensive agricultural development (Elvin, 2022; Miller, 2020), residents in southern China initiated large-scale reforestation projects to restore the ecosystem and invest in future growth (Miller, 2015; M. Zhang, 2021). After the founding of the People's Republic of China in 1949, similar environmental destruction ensued, this time to make way for aspired industrial development (Shapiro, 1999). In response, similar restoration projects were initiated at the national level (Richardson, 1990), including the country's Three North Shelterbelt (popularly known as the Great Green Wall) and, decades later, the Grain for Green program (Delang & Yuan,

2015). Other restoration activities related to China's ecological red lines (zoning plans excluding large tracts of land from development (Xu et al., 2018)), ecological compensations (fiscal transfers for environmental and resource management (Yu et al., 2020)), and other ecological measures to mitigate infrastructure impacts (Bai et al., 2017; X. Liu et al., 2015) have been on the rise as well. Many of these interventions may count as NbS in today's parlance, but only since 2019 have they actually been called such by Chinese officials.

The 2019 New York Climate Action Summit, in which China co-lead the workstream on NbS, triggered an exponential uptake of the term in academic and policy circles. In 2022, China became the largest publisher on the topic of all countries globally and by far the largest publisher from the Global South (Fig. 1). China's National Natural Science Foundation is also by far the number one funder of NbS scientific papers globally (more than double the next largest funder on the list, according to Scopus data). Cooperating with IUCN, China's Ministry of Natural Resources (MNR) translated and published a standard and user guide for NbS in China, showcasing ten representative cases already underway across the country (IUCN, 2020). These exemplary projects have extended the discourse of NbS into far-reaching fields, from water quality, to engineering, fisheries, urban planning, agriculture, and rural development. Officially codifying the term in January 2021, China's Ministry of Ecology and Environment (MEE, the country's other major resource and environmental ministry, alongside MNR) released a guiding opinion which highlighted NbS as a means to synergistically reach China's biodiversity and climate goals (MEE, 2021). The discourse of NbS has thus reached the highest levels of environmental governance in the country.

The rapid uptake of NbS in China is not coincidental but rather has to do with the term's clear synergies with the concept of Ecological Civilization (*shēngtài wénmíng* 生态文明) – the ruling paradigm when it comes to all realms of environmental governance in China, from national parks to carbon markets. Initially coined by the German philosopher Iring Fetscher in 1978 and later picked up in Soviet Union Marxist philosophy, Ecological Civilization has most recently been pioneered by the Chinese government as a distinctly Chinese approach to the environment (Goron, 2018; Lu, 2021). As deployed by Chinese leadership, the term has both domestic and global aspirations. It is best understood as a state-sponsored, socio-technical imaginary aimed at building a sustainable future, first domestically and now globally (Hansen et al.,

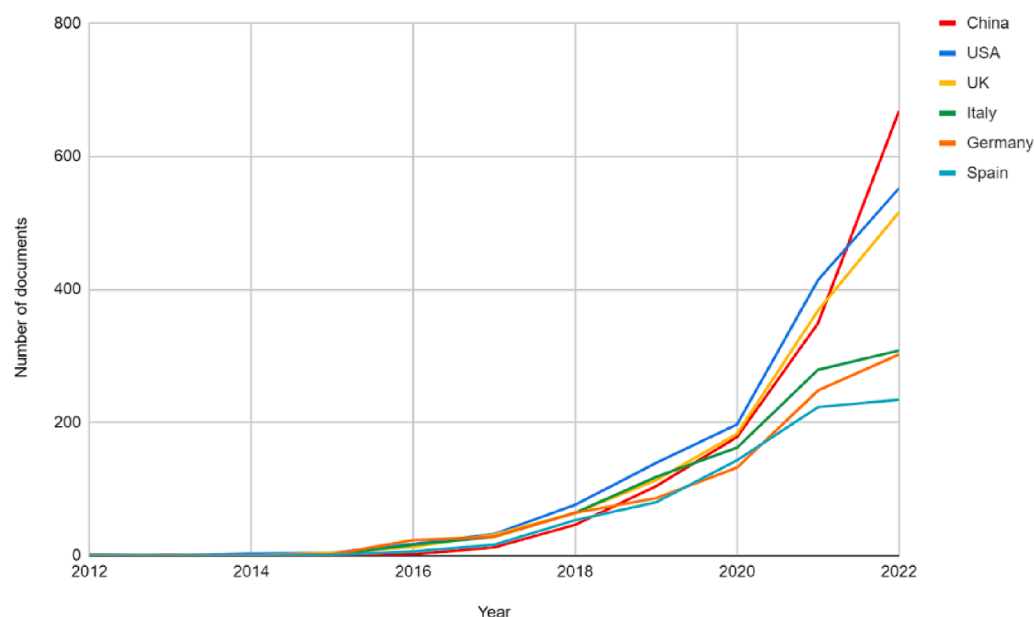


Fig. 1. Number of articles containing “Nature-based Solutions” (in English) published in Scopus for the top five source countries (i.e., authors have listed institutional affiliations from these countries) from 2012 to 2022.

2018). Ecological Civilization brings together the discourse of ecology and development in order to operationalize state power through large-scale socioenvironmental engineering (Rodenbiker, 2021, 2023). These efforts and the eco-developmental logic that underpins them recall the generic rhetoric of NbS – addressing societal challenges through ecosystem management – but with a strong role for the state at a potentially much larger scale. The result, as evidenced in certain regions of northern China, is a state-sponsored quest to leverage ecological rhythms in order to quite literally “mold new landscape formations” (Zee, 2022, p. 52; see also Zee, 2020).

NbS, as adopted in China, thus mimics the tone of Ecological Civilization. Both concepts are purposefully vague, lacking clear conceptual and practical limits. Both concepts also share the same underlying logic of leveraging natural rhythms to achieve human development in harmony with wider ecologies and realize a future in which humans do not dominate or conquer nature but rather adhere to its rules and rhythms to realize shared prosperity. Whether or not these concepts are *actually* facilitating such a shift or simply recasting industrial or engineering approaches in green veneer (see, for example, Y. Zhang (2021) on “green industrial civilization”) does not necessarily detract from their shared rhetorical aspirations. Wang Hong, the deputy minister of China’s MNR, is explicit on the connection: “NbS are highly compatible with China’s concept of Ecological Civilization and provide an effective way to promote construction of Ecological Civilization” (People’s Daily, 2021). Similarly, in a recent TEDx talk, vice president of Tsinghua University’s ICCSD, Li Zheng, also highlights the connection, noting that despite its global significance NbS “actually has deep historical roots in Chinese culture, philosophy, and even in daily life.”

While domestically China’s environmental turn is being framed in terms of Ecological Civilization, globally the concept has had limited uptake (Chen & Zhao, 2022). This poses a bit of a thorny issue given that the global deployment of Ecological Civilization is strategically important to the Chinese state, so much so in fact it has been codified as the sixth and final principle of President Xi Jinping thought on the topic (Xi, 2018). “Constructing a global Ecological Civilization,” a process through which China will become “deeply involved in global environmental governance,” comprises the last pillar of Xi’s doctrine on Ecological Civilization, which guides national implementation and, in turn, influences the research and policymaking of nearly all environmental institutions within the country.

This is where NbS plays an important role. Given its consonance with Ecological Civilization, NbS provides an ideal vehicle through which China can showcase its environmental engagements on the global stage. In contrast to Ecological Civilization, the discourse of NbS benefits from wide international circulation, while also simultaneously retaining strong parallels with Ecological Civilization. Adopting the concept of NbS has thus become a key part of the global dissemination of Ecological Civilization. Director of the Chinese Academy of Social Sciences, Xie Fuzhan, and Party Secretary and Director of the China Meteorological Administration, Liu Yaming, are clear on this point: “Leading the work in the field of ‘nature-based solutions’ is an important starting point for exporting Chinese ideas and Chinese solutions and to promote the construction of a global ecological civilization” (Xie & Liu, 2019, p. 274). Other major academics and policymakers echo this sentiment. Indeed, as noted by Qi and Dauvergne (2022), NbS provides “an alternative terminology to promote China’s existing ecosystem-based policies and strategies on the international stage” (7). China’s leadership in NbS, as well as environmental leadership more broadly (such as through launching the Erhai Forum on global environmental issues and hosting COP13 of the Convention to Combat Desertification in 2017 and COP15 of the Convention on Biological Diversity in 2021), is intended as a way to “promote Chinese concepts and Chinese solutions to ‘go global’” (Wei et al., 2021; Xie & Liu, 2019; Zou et al., 2017). The Chinese presidency of the Convention on Biological Diversity COP15, for example, was a first important step in setting Ecological Civilization on the global environmental agenda, including as the title of a UN Conference (Zou et al., 2017).

An array of China-based global platforms and initiatives are afoot, expounding upon the concept of NbS and its global dimensions, as summarized in Table 1. At the same time, Chinese institutions also participate in NbS-related global platforms not based exclusively in China, as summarized in Table 2. Given the hazy and emergent borders of what exactly constitutes NbS, these tables are not necessarily exhaustive, but rather provide an overview of the main Chinese actors engaging in the global promotion and funding of NbS and NbS-adjacent activities in order to guide future research on the topic. As noted in the final column of the tables, the listed organizations and initiatives have varying degrees of involvement in NbS-related activities. Among Chinese-based global platforms (Table 1), for example, some organizations (e.g., CCICED and ICCSD) have been pioneers in defining and developing the discourse around NbS in China. Other organizations (e.g., BRIGC and the China International Development Cooperation Agency) provide funding for a range of projects, including NbS-related projects. And others still (e.g., the Kunming Biodiversity Fund and Global Development Initiative) are only now in the making, but will likely fund such projects in the future. Global platforms with contributions from China (Table 2) reveal a similar range of involvement, including initiatives explicitly involved in NbS implementation (e.g., UNEP-IEMP and the Global Center on Adaptation), initiatives that work on NbS-related topics but do not explicitly mention the term (e.g., FAO-China South-South Cooperation Program and SCPI), and initiatives that explicitly mention NbS but are still in the works (like the NbS Asia Center and Great Green Walls for Cities (GGWC)). This table also shows varying levels of Chinese involvement, from China being the main national actor (UNEP-IEMP, FAO-China, NbS Asia Center, SCPI) to China playing a role alongside many other national actors (e.g., Global Center on Adaptation and GGWC).

These platforms and initiatives cover the main bodies through which China promotes the global dissemination of NbS discourse and practice. This type of “going global” is distinct from the political economic expansion conventionally associated with discussions of global China (Lee, 2018). In addition to large-scale infrastructural and financial investments in the built environment (Franceschini & Loubere, 2019), China’s “going global” as demonstrated in these tables and the sections that follow also consists of environmental interventions and the particular rationalities underpinning them – for example, technoscientific expertise and the varying cultural-historical understandings of “nature” and “ecology” infused within environmental projects (Rodenbiker, 2021; Zhu, 2017). This dissemination of ecological technologies and practices to the Global South, alongside finance and construction, is an emerging yet overlooked dimension of research on global China. NbS, as the following sections reveal, play a key role in this global dissemination.

### 3. Three modes of Global South engagement

Overall, our research reveals three types of on-the-ground initiatives related to China’s assistance with NbS in the Global South (Table 3). The first type of involvement is referred to as triangle cooperation, through which Chinese ministries or organizations cooperate with a multilateral organization not exclusively in the Global South, such as the UN, to jointly implement projects in a developing country context. This is a newer form of cooperation that did not characterize China’s overseas engagement throughout the twentieth century. Only since the launch of the BRI has this type of cooperation become characteristic of Chinese overseas environmental assistance. It is also much more common in Chinese assistance with African projects as compared to China’s collaborations with other Asian countries, likely because of the longer history and diversity of inter-Asian ties. Triangle cooperation is often employed when the primary purpose of the cooperation is environmental, such as UNEP-IEMP projects. These projects strive for community involvement but are geared toward the larger goals of ecological engineering and adaptation: combating desertification, reforesting large

**Table 1**  
China-based global platforms working on and/or providing funding for NbS.

China-based global platforms				
Platform	Partners	Status	Description	Primary relation to NbS
China Council for International Cooperation on Environment and Development (CCICED) 中国环境与发展国际合作委员会	China-led with many IGO and NGO partners (e.g., IISD, World Bank, WWF, EU, GIZ, UNDP, UNEP, TNC)	Founded in 1992; involved in NbS since 2019	High-level international advisory body with outward facing influence globally and inward facing direct channel to China's state council. Active in promoting NbS and Ecological Civilization in global environmental frameworks.	Policy development
BRI Green Coalition (BRIGC) 一带一路绿色发展国际联盟 (including BRI Green Development Institute (BRIGDI))	China-led (MEE) in partnership with dozens of ministries from BRI countries, IGOs, and enterprises	Launched in 2019; involved in NbS since 2020	Global platform to increase green development of the BRI. Works on NbS mainly through partnerships with other organizations listed in this table.	Funding
Institute of Climate Change and Sustainable Development (ICCS) 气候变化与可持续发展研究所	China-led (Tsinghua University) with many domestic and global partners (e.g., TNC, UNEP, UNFCCC, Chengzhi, WWF, BP, GCF)	Founded in 2017; involved in NbS since 2019	Research and policy exchange institution at Tsinghua University devoted to promoting Chinese domestic and international environmental policies. Established the NbS for climate change (C+NbS) platform to connect stakeholders in China and abroad to leverage NbS for improving global governance.	Research
Kunming Biodiversity Fund 昆明生物多样性基金	China-led (MEE) in partnership with UN Convention on Biological Diversity	Announced in 2021; launched 2023	US\$20 million to support biodiversity conservation in developing countries and promote the implementation of the Post-2020 Global Biodiversity Framework. NbS are likely to feature in funded projects, but still unclear what these projects will be.	Future funding
Global Development Initiative 全球发展倡议	China-led global initiative with nearly 100 partner countries.	Announced in 2021; launched 2022	Massive global initiative to meet the 2030 SDGs; rivals the BRI in geographic extent but with a focus on development and capacity building. Eight priority areas, including "climate change and green development," with some explicit NbS projects to be funded.	Future funding
China International Development Cooperation Agency 国家国际发展合作署	National governments from the Global South	Founded in 2018; ongoing	The overall coordinator and strategic planner of Chinese foreign aid since 2018 (before that, MOFCOM's Dept. of Foreign Aid). Provides general aid and South-South Cooperation funds to support climate and biodiversity-related projects.	Funding

tracts of land. While not entirely different from an infrastructure approach, these projects focus on manipulating ecologies specifically. Yet, as many are still in the piloting phase, their impacts on the ground remain minimal.

A second type of initiative when it comes to NbS is multi- and bilateral scientific cooperation and knowledge exchange. Although such exchanges are often also included as part of triangle cooperation, in this case, they are undertaken as direct South-South cooperation, with no third party (UN) mediator involved. Such direct multi- and bilateral cooperation connects Chinese scholars and policymakers with partners embedded in specific domestic contexts. The exchanges are very context specific and focused around specific regional ecological issues. They typically characterize China's assistance with NbS in Southeast Asia, given the diversity of environmental platforms that have arisen in the region. This cooperation is less common in Sino-African initiatives, and when it does exist, there may also be third party assistance, such as the Netherlands assisting with the China-Africa Bamboo Center, thus blurring the boundaries with triangle cooperation.

A third type of initiative consists of infrastructure greening activities that reshape large-scale infrastructure projects (roads, railways, dams) so that they incorporate more environmental dimensions. This is not a new type of assistance, but rather adds to and amplifies the ecological safe-guards and offsetting involved in existing projects. NbS is thus not central to these initiatives, but an additional goal that is achieved through environmental streamlining. Unlike the first two forms of cooperation, infrastructure greening initiatives are mostly funded by Chinese state corporations or multilateral development banks associated with China (China Ex-Im Bank, the Asian Infrastructure and Investment Bank). In terms of overall finance and number of on the ground projects, this is the largest category, characteristic across both Africa and Asia and likely to crop up in Latin America as BRI infrastructure projects expand

there as well. The vast majority of these projects may have minimal ecological components, yet are referred to as NbS because of their additional forestry and carbon sequestration elements.

China's environmental turn has been widely described as a top-down endeavor and in many ways our regional findings, discussed in the next section, support this. There is a predominance of Chinese state ministries and institutions involved in many of China's initiatives in the Global South, especially in the triangle and bi- and multilateral cooperations, but also in the infrastructure greening projects. That said, Chinese NGOs, private sector actors, and lower-level state institutions are also highly involved (Guttman et al., 2021; Liu & Bennett, 2022; Oliveira et al., 2020), many of which have established activities around supporting the Green BRI or simply fostering improved overseas engagement practices long before NbS became emphasized. This follows the "top down, bottom up" model of Chinese environmental governance, through which China's top-down bureaucratic structure is coupled with bottom-up participation of local level organizations (Ouyang et al., 2020). Thus, while the central government is no doubt the pivotal player, none of these global cooperations could be realized without a dense network of corollary players working on the ground (Owen, 2020; Rofel & Rojas, 2022).

#### 4. Evidence from the Global South

This section provides an overview of China's ongoing initiatives related to the forestry-climate-biodiversity nexus across Asia, Africa, and Latin America, with a particular focus on the rise of the NbS label within these initiatives. The sub-sections discussing Asia and Africa include table overviews of relevant initiatives. As noted, these tables are not necessarily exhaustive given the hazy borders of NbS, but they provide a thorough overview meant to guide future research. The

**Table 2**  
Global platforms working on NbS that China funds or co-leads.

Global platforms co-led or co-funded by China				
Platform	Partners	Status	Description	Primary relation to NbS
NbS Asia Center	Led by IUCN and China's MNR	Planned	Regional hub in Asia (to be located in China) promoting the IUCN Global Standards for NbS.	Research and policy development
UNEP International Ecosystem Management Partnership (UNEP-IEMP)	Led by UNEP and Chinese Academy of Sciences	Active since 2011; involved in NbS since 2019	A South-South center for piloting new approaches to ecosystem restoration, conservation, climate, and improving livelihoods. Active in NbS and EbA pilot projects, including the Climate Ecosystems Livelihood (CEL) program.	Funding and implementation
Global Center on Adaptation	Hosted by the Netherlands, with private and public partners, including China's National Center for Climate Strategy and International Cooperation (under China's MEE)	Established 2018, involved in NbS since its establishment	Provides policy advice and technical assistance on climate adaptation issues with the aim of developing innovative solutions to drive adaptation at scale. Regional office in Beijing; Huang Runqiu from China's MEE sits on the advisory board. Dedicated program on Infrastructure and NbS.	Policy development, funding, and implementation
Great Green Walls for Cities (GGWC)	Led by FAO with other global partners, in partnership with China's National Forestry and Grassland Administration	Planned, to be completed by 2030	Creates urban green areas across the African Sahel and Central Asia, with thirty participating countries. The project will use NbS, specifically forest-based solutions for climate mitigation and urban development.	Future funding and implementation
FAO-China South-South Cooperation Program	FAO and China's Ministry of Agriculture and Rural Affairs (MARA)	Established in 2009, renewed in 2015 (Phase II) and 2021 (Phase III)	Supports agricultural extension work in twenty countries across the Global South including aquaculture, livestock, crop production and resilience, and agroforestry. While not yet using the language of NbS, the program provides support for climate-resilient agriculture and agroecology.	Funding and implementation
Southern Climate Partnerships Incubator (SCPI) (also called UN Climate Partnerships for the Global South)	Implemented by UN (Executive Office of the Secretary-General and Office for South-South Cooperation) through funding from China Ministry of Foreign Affairs	Launched in 2016; not active since 2018	Promoted South-South and triangular cooperation for climate action to implement the Paris Agreement and SDGs. Featured renewable energy and EbA projects between China and Africa, but has since been discontinued.	Past funding

section discussing Latin America contains no such table because at the time of writing the authors did not uncover any Chinese-led or funded NbS initiatives in the region. Instead, the section discusses why Sino-Latin American environmental relations have been slower to develop and reviews those environmental collaborations that do exist on which future NbS are likely to be built.

#### 4.1. Central and Southeast Asia

China's path towards greater global engagement began with its turn towards the country's overland neighbors. President Xi Jinping first announced the BRI in 2013 in Kazakhstan, then elaborated upon it in a following trip to Indonesia. Efforts at strengthening existing trade routes and opening new ones through Central and Southeast Asia were underway well before 2013, but the BRI signaled the central state's focus on connectivity to and through the two regions and catalyzed a rapid rise in transnational investment and other engagements. As a result, financial flows and exchange with Central and Southeast Asia have skyrocketed and ongoing expansion in connectivity infrastructure have all facilitated China's transnational gaze toward the south and west.

China has much stronger historical connections to Southeast Asia than to Central Asia, due in part to the barrier of historical Sino-Soviet tensions in Central Asia as well as to the comparative connectivity and historically strong migration flows and cultural ties with Southeast Asian countries by sea. While China's engagements in Central Asia are also hampered by negative public opinion and infrastructural challenges (Van Der Kley & Yau, 2021), China's FDI to the region has grown impressively in recent years (increasing by a magnitude of 3.5 in the 2010s), primarily through transport infrastructure and energy. Southeast Asia, on the other hand, is the fastest growing region in the world

and is increasingly seen as a diplomatic battleground between China and Western countries who have announced various diplomatic strategies targeting the 'Indo-Pacific' (Shambaugh, 2020; Strangio, 2020). China's FDI in Southeast Asia grew twentyfold between 2005 and 2019, though it remains behind that of the EU, US, and Japan (Goh & Liu, 2021).

It is therefore unsurprising that Chinese engagements across Asia are numerous and diverse, including many that are promoted as environmental interventions, sustainable or green cooperation, or which adopt other environmental terms (Table 4). China's 2017 announcement, calling on a shift toward a more environmental focus for the BRI and proposing the BRIGC, led to a flourishing of greening discourses across most of China's platforms and projects across Asia (Geng & Lo, 2022). Many of those labeled BRI projects are poised to be re-labeled NbS in the years to come.

Among the projects and platforms that China is participating in with environmental components, some are exclusively dedicated to implementing activities that might all be construed as NbS, while others engage in NbS in a much more circumscribed way, by launching specific projects that could fall under the NbS umbrella. One particularly active platform is the China-ASEAN Environmental Cooperation Center, first proposed in 2007 and officially established by China's MEE in 2010. The Center has hosted nine high-level forums over the past decade, along with regular dialogues, training programs, and information sharing partnerships. The China-ASEAN Green Envoys Program established by the Center also hosts activities for sharing experiences and technologies in low-carbon development, the green economy, conservation, and environmental risk assessment and management. These activities are increasingly viewed through an NbS lens. The China-ASEAN Center's 2021–25 strategic plan, for example, states that "special emphasis" will be placed on NbS going forward.

**Table 3**  
Types of cooperation characteristic of China's NbS interventions in the Global South.

Type of Cooperation	Description	Examples (see Tables 4 and 5 for specific project details)
<b>Triangle Cooperation</b>	China partners with or provides funding to the UN or another third party to establish a new program or body for achieving NbS-related goals globally.	Any initiative with the UN functioning as a third party, including: <i>UNEP-IEMP; EbA South; FAO China South-South Cooperation Program; Southern Climate Partnerships Incubator; China-Africa Environmental Cooperation Center.</i>
<b>Multi- and Bi-lateral Cooperation</b>	South-South cooperation on NbS directly between the Chinese government (or sub-national organization within China) and a recipient country or countries. Typically does not include the UN or any third party mediator.	Initiatives wherein Chinese actors are directly connected with other national actors, including: <i>Asia-Pacific Network for Sustainable Forest Management &amp; Rehabilitation; Sino-ASEAN Network of Forestry Research Institutes; Lancang-Mekong Environmental Cooperation Center and Initiative; China-ASEAN Environmental Cooperation Center; Yunnan Ecological and Environmental Cooperation Office; China-Africa Green Development Project; China-Africa Bamboo Center.</i>
<b>Greening Infrastructure</b>	Chinese-funded infrastructure projects (roads, railways, dams, ports, etc.) that include environmental measures, plans, or offsets relating to NbS.	Mostly BRI and development bank initiatives, including: <i>Karot Hydropower Project biodiversity plan; Vientiane Saysettha Development Zone; Mombasa-Nairobi Railway wildlife corridors; Karuma Hydropower Station fish passages; Isimba Hydropower Station biodiversity monitoring; Nigeria Erosion and Watershed Management Project.</i>

The Lancang-Mekong Cooperation Mechanism (LMEC), another MEE-affiliated platform established in 2017, offers a similar range of programs increasingly oriented towards NbS. Like the China-ASEAN Center, LMEC offers a mix of roundtable dialogues, workshops, training programs, demonstration projects, and joint research initiatives. Its priority areas are likewise wide-ranging – including environmental industries, biodiversity conservation, sustainable infrastructure, and climate change adaptation and mitigation, among others – yet held together by a core focus on technology transfer and large-scale ecosystem management initiatives. LMEC's most recent 2023–27 strategic plan explicitly connects this focus to NbS for the first time, stating its aim to “facilitate joint research and demonstration cooperation on Nature-Based Solutions and build ‘Lancang-Mekong Nature-based Climate Solutions: Climate Adaptation Cooperation Network’” (LMEC, 2023, p. 10).

There are fewer green cooperation projects in Central Asia, in part reflecting China's lower overall engagement in the region, but those we document do have a strong NbS orientation. Here, the main platform is the China Center for the Shanghai Cooperation Organization's Environmental Cooperation (CSEC), established in 2014 (the Shanghai Cooperation Organization (SCO) is a regional intergovernmental grouping comprising China, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Russia, India, and Pakistan). Like the China-ASEAN Center and LMEC – which are, like the CSEC, affiliated under MEE – activities are chiefly comprised of dialogues, training programs, information sharing, and joint research in areas of mutual interest. To date, these areas have focused on practices and technologies with which China has expertise, such as wastewater treatment, eco-city construction, and especially desertification prevention and control. Such technology-focused cooperation (including the ‘ecological engineering’ of large-scale tree and shrub planting) aligns with China's emerging conception of NbS and will likely be labeled as such in the coming years.

#### 4.2. Africa

After a long hiatus, Chinese diplomacy in Africa was rekindled during the 1950s and 60s, when the Chinese government provided aid and other support for national liberation movements and development projects (Taylor, 2009). Agriculture featured heavily in these initiatives, a trend which continues to this day (Bräutigam & Xiaoyang, 2009). In the early 2000s, China's resource investments in Africa escalated sharply as well, making agriculture and natural resources the foremost investment areas on which contemporary Sino-African environmental diplomacy builds (Alden et al., 2008). As with Chinese investment in Central and Southeast Asia, the announcement of “greening” the BRI in 2017 has shifted the tone of these investments. Since then, many more

projects related to meeting environmental objectives began to emerge across the African continent (Table 5).

One of the first of these Chinese-backed environmental initiatives in Africa was not framed as NbS, but rather as “Ecosystem-based Adaptation” (EbA) – a closely related term, sometimes used interchangeably with NbS. This project, “EbA South” (running from 2013 to 2020), was funded by the GEF Special Climate Change Fund, implemented by UNEP, and executed by China's National Development and Reform Commission (NDRC) through the Chinese Academy of Science (CAS) (Mills et al., 2020). The project concerned not only Africa, but also parts of Asia Pacific, with the broad intent of building climate resilience starting with three pilot projects in Mauritania, Nepal, and the Seychelles. In 2016, following the launch of EbA South, China cooperated with UNEP to establish the Climate Ecosystem Livelihoods flagship program, which has undertaken other nature-based interventions in Africa with Chinese support. Foremost among these interventions are projects to assist with Africa's Great Green Wall (GGW) for the Sahara and the Sahel Initiative, a pan-African program with a strong reforestation focus (Berrahmouni & Sacande, 2014; Goffner et al., 2019). Since 2017, Africa's GGW has in fact become a primary target of Chinese environmental assistance in Africa, given that it is explicitly mentioned in the Forum on China-Africa Cooperation (FOCAC) agreements – the defining multilateral accords governing Sino-African relations.

The large focus on assistance with Africa's GGW is in part because of China's experience with its own GGW. China's GGW — more formally called the Three North Shelterbelt, as discussed above — is a massive re/afforestation effort aiming to create a vast vegetative barrier to prevent dust storms, reduce desertification, and, most recently, mitigate climate change (Chu et al., 2019). With already 60 billion trees planted across a 4,500 km desert border region in northern China, the project is said to represent the largest artificial forest in the world (Teh, 2017). Despite its similar name, Africa's GGW was conceived independently by a series of African leaders beginning around 2005. Formally initiated in 2007, Africa's GGW was envisioned as a 7,000 km long, 15-kilometer-wide band of vegetation reaching across the Sahel, from Senegal in the west to Djibouti in the east (Goffner et al., 2019). Over the years, the vision for the project has shifted away from a singular band of trees toward a mosaic of various land use activities (FAO, 2020), more in line with the Chinese approach. Yet, tree and shrub planting remains by far the dominant activity.

Now more than 15 years into the construction of Africa's GGW and having met as little as 4% of the original goals (UNCCD, 2020), new approaches and assistance are needed. China's involvement began in 2017, when the Xinjiang Institute of Ecology and Geography (XIEG) of the Chinese Academy of Sciences signed a memorandum of understanding with the Pan-African Agency for the Great Green Wall on

**Table 4**  
China's NbS-related initiatives in Central and Southeast Asia.

NbS-related initiatives in Central and Southeast Asia with Chinese support				
Project	Target countries	Partners	Dates	
<b>Environmental networks and cooperation</b>				
China-ASEAN environmental cooperation center and forums	ASEAN countries	China's MEE and MOFCOM along with ASEAN Secretariat, ASEAN Center for Biodiversity, member country ministries, UNEP, and global NGOs	Proposed 2007, established 2011	Facilitates environmental cooperation among China and ASEAN countries through joint research, training, and policy dialogues. NbS is specifically highlighted in the 2021–2025 strategic plan and the first batch GDI project, China - ASEAN Mangrove Conservation Partnership.
China Center for Shanghai Cooperation Organization Environmental Cooperation (CSEC)	Central Asian countries	Shanghai Cooperation Organization (SCO), China's MEE, member country environment ministries	Established 2014	Facilitates environmental cooperation among China and SCO members through joint research, training, and policy dialogues. Programmatic focus on preventing desertification and sustainable urban development.
Asia Pacific Forests Network (APFNet)	Asia-Pacific countries (includes both SE and Central Asia)	Major Chinese universities and academies along with forestry departments of member countries, global NGOs, and industry organizations	Since 2008	Advances sustainable forest management and rehabilitation in Asia-Pacific. Includes the Sino-ASEAN Network of Forestry Research Institutes (SANFRI), the APFNet Scholarship Program, and regional dialogues.
Lancang-Mekong Environmental Cooperation Center and Initiative (LMEC)	Mekong countries	China's MEE and MOFCOM, along with provincial actors, target country governments, UNEP, and NGOs	Proposed 2015, established 2017	Facilitates environmental cooperation among China and Mekong countries in order to promote regional development. Includes policy dialogues, capacity-building, joint research, and mainstreaming environmental policies.
Yunnan Ecological and Environmental Cooperation Office	Select SEA countries	Yunnan MEE along with LMEC, select SEA countries, and World Bank	Since 1994	Carries out environmental protection foreign aid projects in Mekong countries, as well as applying for World Bank and multilateral loans for provincial projects in Yunnan.
China-Uzbekistan Cooperation on Aral Sea Restoration	Uzbekistan	Xinjiang Institute of Ecology and Geography under the Chinese Academy of Sciences, group of Uzbek research institutes	Since 2019	Sharing of Chinese experiences and technologies in agricultural water saving, ecological restoration, desertification control, biodiversity conservation, and sustainable management of water resources.
China-Thailand Joint Laboratory for Climate and Marine Ecosystems	Thailand	China's State Oceanic Administration and Thailand's Ministry of Natural Resources and Environment	2013	Includes eight marine cooperation projects and six sub-projects, including spatial planning, the establishment of a marine data center, and bilateral personnel exchanges.
<b>BRI-related projects</b>				
Karot Hydropower Project	Pakistan	China's Three Gorges Corporation and Pakistan ministries	Completed 2022	The first large-scale hydropower project of the BRI and part of the China-Pakistan Economic Corridor. The project contains environmental safeguards as indicated in the Karot Biodiversity Management Plan.
Vientiane Saysettha Development Zone	Laos	China's MEE and Lao-China Joint Venture Investment Co. along with Laos Ministry of Natural Resources and Environment	Since 2021	Low carbon demonstration zones to mitigate climate change and facilitate green and low-carbon transition. Will also provide green spaces in the center of the capital.
Renewable energy integration in Myanmar	Myanmar	Global Environmental Institute, Myanmar's Ministry of Education Department of Research and Innovation	Since 2016	Facilitating the sharing of Chinese experience to deepen Myanmar's capacity for conducting renewable energy and low-carbon development by introducing policy making toolkits and conducting technical exchange.
Forest restoration and ecological agriculture development	Laos	China's Jiarun Agriculture Development Co. and Lao Ministry of Planning and Investment	Since 2021	Aims to restore forest and establish ecological agriculture in over 5,000 ha of land in Sanamxay district of Attapeu province.
China-Laos-Thailand railway	Laos, Thailand	Laos-China Railway Company Limited, a Sino-Lao joint venture	Since 2017	Electric transportation, along with ecosystem restoration and afforestation elements.
Jakarta-Bandung high speed railway	Indonesia	PT Kereta Cepat Indonesia-China	Since 2015	Electric transportation, along with ecosystem restoration and afforestation elements.
Peshawar-Karachi motorway	Pakistan	China State Construction Engineering Corp, Pakistan Ministry of Communications, China Pakistan Economic Corridor Authority	Since 2017	Six lane, 1,100 km highway construction project including ecosystem restoration and afforestation elements.
Angren-Pap railway	Uzbekistan	China Railway Tunnel Group, Uzbek Railways	2014 – 2016	Electric railway covering 123 km, including ecosystem restoration and afforestation elements.
Kosekoy-Inonu highspeed railway	Turkey	China Railway Construction Corp, China National Machinery Import/Export Corp, Cengiz İnşaat, IC İċtaş İnşaat	2008 – 2014	Electric transportation, including ecosystem restoration and afforestation elements.

promoting environmental efforts in Africa. In the ensuing years, researchers from XIEG have been involved in a number of local ecological projects, including sand control and quicksand fixation technology in Mauritania; ecological restoration of shrub grassland in Ethiopia; and technical support for sustainable management and protection of a shelterbelt in Nigeria (Xinhua, 2021a). Chinese-backed satellite remote-sensing has also reportedly been used by Ethiopia since 2019 to improve

the resilience of its agriculture sector and curtail desertification (Xinhua, 2021b). While the extent of on the ground activities cannot be confirmed from current news and policy reports, Africa's GGW project in particular and the Sahel region more broadly continues to be one of the primary focuses of Chinese NbS assistance in Africa.

In the FOCAC Dakar Action Plan, which outlines Sino-African cooperation from 2022 to 2024, China has pledged to continue to



**Table 5**  
China's NbS-related initiatives in Africa.

NbS-related initiatives in Africa with Chinese support					
Project	Target countries	Partners	Dates		
<b>UNEP-related projects</b>					
Ecosystem-based Adaptation through South-South Cooperation (EbA South)	Pan-Africa and Asia-Pacific (with pilots in Mauritania, Nepal, and Seychelles)	GEF project implemented by UNEP and executed by China's NDRC	2013–2020		Builds climate resilience in developing African and Asia-Pacific countries using EbA through capacity building, knowledge support and concrete, on-the-ground interventions.
Africa's Great Green Wall Joint Research	Mauritania, Nigeria, Ethiopia	China's MoST and UNEP-IEMP	2019–2022		Research to investigate desertification in key areas of Great Green Wall in Africa and to develop applied green belt technologies, sustainable livelihoods, and ecosystem restoration.
Formation Mechanism and Control Regimes of Desertification	Mauritania	China's NSFC and UNEP-IEMP	2019–2023		Develops an index system of wind and sand disaster risk assessment in Mauritania and examines the scope of the Great Green Wall in Africa.
Driving Mechanisms of Land Use and Land Cover Change in the Sahel	Sahel countries	China's NSFC and UNEP-IEMP	2017–2021		Develops a high-precision automatic land use/cover type extraction algorithm and land use/cover mapping every 5 years with a spatial resolution of 30 m over the past 30 years.
Coherent Integration of the Environmental Dimension of SDGs in Regional and National Policy Frameworks	19 African countries	UNEP, along with UNRCOs, UNCTs, AUC, and AUDA-NEPAD	2022–2024		One of the first batch of GDI projects, this initiative aims to help African countries integrate environmental dimensions of SDGs in country-level planning and programming processes.
<b>Forum on China-Africa Cooperation (FOCAC) projects</b>					
China-Africa Green Development Project	Pan-Africa	China, 53 African countries, and AU	2022–2024		The sixth element of China's "nine projects" cooperation plan introduced at the 2021 FOCAC summit in Dakar.
Declaration on China-Africa Cooperation in Climate Change	Pan-Africa	China, 53 African countries, and AU	2022–2024		China and Africa will speed up South-South and trilateral cooperation on climate change, and promote the construction of low-carbon and low-greenhouse gas demonstration zones.
China-Africa Environmental Cooperation Center	Pan-Africa	China's MEE and AU, supported by UNEP	Initiated in 2015, established in 2018		Provides services and support to African countries to contribute to the SDGs and the AU's 2063 Agenda.
China-Africa Bamboo Center	Ethiopia and sub-Saharan Africa	China's NFGA and the International Bamboo and Rattan Organization	Announced in 2018		A continental hub for sustainable bamboo management and processing, with a focus on technology transfer and expertise sharing from China.
<b>BRI-related projects</b>					
Mombasa-Nairobi Railway, wildlife corridors	Kenya	China Road And Bridge Corporation	2014–2017		A 480-kilometer railway installing 79 bridges and 14 wild animal tunnels. Also includes measures to reduce impacts on mangroves.
Nema Railway Phase I, wildlife corridors	Kenya	China Comm Construction Group	2018–2019		Adopts a 6.5-kilometer bridge across the park to minimize the impact on wildlife crossing.
Karuma Hydropower Station, fish passages and restoration	Uganda	China Hydropower Construction Corporation	2013-present		Includes special fish passages and other ecological restoration along the Nile in northern Uganda.
Isimba Hydropower Station, biodiversity monitoring	Uganda	China International Water & Electric Corporation	2015–2019		Includes efforts to mitigate river water leakage impacts along the Nile in central Uganda.
Eliion Resources Group Industrial Park, ecological restoration	Nigeria, Imo State	Eliion Resources Group	MoU signed 2018		Cooperation in the fields of desert governance, eco-tourism, and clean energy. Current status unknown.
<b>Multilateral development bank projects</b>					
Erosion and Watershed Management Project	Nigeria	China and Nigeria's Ministry of Environment	2012–2022		Reduces vulnerability to soil erosion in targeted sub-watersheds in Nigeria, including forests and grasslands.
Upgrading of Base-Gicumbi-Rukomo-Nyagatare Road	Rwanda	China Ex-Im Bank	2014–2024		Includes environmental protection to reduce risk of landslides and erosion and forestry carbon sequestration.
Water Valorisation for Value Chains Development Project	Senegal	Africa Growing Together Fund (AGTF), financed by the People's Bank of China	2019–2024		Climate-smart agriculture project covering three agroecological areas, with a US\$30 million loan from the AGTF.
Malagarasi Hydropower Project	Tanzania	AGTF	2020–2026		Provides reliable renewable energy to the Kigoma Region, including forestry carbon sequestration.
Dodoma City Outer Ring Road Construction Project	Tanzania	AGTF	2019–2024		New dual-carriage way around Tanzania's capital city, Dodoma, including forestry carbon sequestration.
Kabale-Lake Bunyonyi/Kisoro-Mgahinga Roads Upgrading Project	Uganda	China and other donors, along with Uganda National Roads Authority	2020–2025		Paves two road links in Southwestern Uganda, including an environmental management plan and impact control.

work with Africa to prevent and combat desertification through the GGW and facilitate expert exchanges and field demonstrations (MOFA, 2021). FOCAC in Dakar also led to the establishment of the China-Africa Green Envoys Program and the China-Africa Green Innovation Program, along with the proposal that the Chinese government will assist with ten green development, environmental protection, and climate action assistance projects in Africa, including most notably Africa's GGW. Lastly, a China-Africa Environmental Cooperation Center was officially

launched, planning to establish a China-Africa marine science and blue economy cooperation center among other things (UNEP, 2018).

While BRI investment on the African continent remains largely focused on infrastructure, the rhetorical (and in some cases empirical) "greening" of these projects is evident. Table 5 reveals a number of road and hydropower projects that have incorporated ecological elements, such as fish passages, ecological corridors, and so forth, in order to mitigate impacts to and restore local ecologies surrounding the projects.

These infrastructure-related ecological investments, however, remain largely an afterthought (see, for example, [Jiang, 2020](#)). The same can be said of many multilateral development bank projects, such as those financed by the Africa Growing Together Fund (AGTF), a US\$2 billion facility sponsored by the People's Bank of China and administered by the African Development Bank. These projects, too, are largely infrastructure-based with some ecological restoration elements that require further on the ground research to determine their full extent.

#### 4.3. Latin America and the Caribbean

Of all regions discussed, Latin America and Caribbean (LAC) has had the least engagement with Chinese NbS. China's environmental investments in LAC are largely focused on green energy projects, such as wind power in Brazil's Northeast and solar power in Northern Argentina ([Nascimento et al., 2021](#); [Rubio & Jáuregui, 2022](#)). Despite continued growth in influence, limited investment is a consequence of general geographic and geopolitical challenges China has faced in what is considered the "backyard" of the US ([León-Manríquez & Alvarez, 2014](#)). For the most part, China's long historical relations with LAC have been mediated through both the US and former European colonial powers and often based on trade in specific resources that rarely included environmental safeguards ([Ray et al., 2017](#); [Ray & Chimienti, 2017](#)). Only within the past decade have new relations built on services, technologies, and cultural exchange developed between China and the region ([Borquez, 2020](#)), and the possibility of increased investment in ecosystem services is now a hot topic of debate in a region that holds 40% of the world's biodiversity ([Costa, 2022](#); [UNEP-WCMC, 2016](#)).

While China does not currently fund NbS projects in LAC ([Ozment et al., 2021](#)), the concept of NbS is likely to enter China-LAC relations as environmental diplomacy in the region deepens. One strategic area of cooperation is sharing "the concept and practice of Ecological Civilization" through the BRIGC ([Villa, 2022](#)). Initially, Latin American involvement in the BRI was limited, with the first Latin American country to endorse the BRI, Panama, joining five years after its launch ([Jenkins, 2022](#)). Since then, 22 LAC countries have joined the initiative ([Nedopil, 2023](#)) and Sino-Latin American relations have developed more independently, outside the purview of Euro-American control. The dissemination of technologies and standards along the BRI ([Qi & Dauvergne, 2022](#)) and possibilities for "decoupling from Western standards" are a recurring topic in the literature on China's role in the region ([Weins et al., 2020](#)).

Building mostly on Chinese tech companies' engagement in LAC, the BRI is seen as a possibility to network Chinese stakeholders currently still concentrated, e.g., in Brazil, China's biggest trading partner in the region but not a part of the BRI ([Rubio & Jáuregui, 2022](#)). The expansion of the BRI across LAC may diffuse this historic concentration and, along with it, spread concepts like NbS and Ecological Civilization through a broader regional network. Yet, acknowledgement of China's environmental ambitions as an opportunity for the region is still very limited since such a network has not yet been consolidated ([Villa, 2022](#)). A rare recognition came from the ex-director of CELAC (Community of Latin American and Caribbean states) and the UNEP-director for Latin America who argued for the region's reorientation towards green recovery after the pandemic and stressed the potential that lies in Ecological Civilization, among other "green deals" ([Bàrcena & Heileman, 2020](#)). In the future, Villa notes, "speaking China's language of ecological civilisation and sustainable development could help to curry diplomatic favour" for LAC and thus may become more integrated in high-level policy discourse.

Another opportunity for boosting China's involvement in Latin American NbS projects is the launch of the Kunming Biodiversity Fund, through which China earmarked 1.5 billion yuan (ca. 220 million USD) for biodiversity conservation across the developing world. This has piqued interest in the region in accessing funds for conservation projects that combine biodiversity and carbon goals, such as avoided

deforestation projects that generate credits through Brazilian carbon markets ([Costa, 2022](#); [Prazeres, 2022](#)). Furthermore, debt-for-nature or debt-for-climate swaps provide a potential conduit for increased Chinese investment in NbS in LAC. As China is becoming a major (bilateral) creditor to the Global South, discussions over "debt trap diplomacy" are becoming more salient ([Brautigam, 2020](#)). [Simmons et al. \(2021\)](#) identified countries under environmental and Chinese debt stress, including Ecuador, Venezuela, Bolivia, Jamaica, and Argentina, all of which have accumulated significant debts to China and according to the authors are likely to become borrowers that may pay their debts in kind as China is pioneering green bonds ([CCICED, 2019](#); [Harlan, 2021](#)).

Whatever the source, increased Chinese funding for NbS in LAC is likely to build on existing regional and bilateral environmental agreements. One of the earliest bilateral cooperations is the 2005 agreement between the Ministry of Agriculture of Brazil and the Environmental Protection Administration of China, which defined the exchange of information on policy and technology as priority areas, including the management of forests, water quality, and the marine environment. Similarly, a 2007 MoU with Chile established priority areas for environmental cooperation expanding the two countries' bilateral free trade agreement with climate change, biodiversity, and natural resource topics. Following that, the 2010 cooperation agreement with Costa Rica details sharing of best practices, joint projects, studies, and exchange of experts and delegations.

More recently, bilateral agreements and MoUs have been initiated with LAC countries on the topic of forestry, such as those signed with Mexico (2012), Peru (2013), and Uruguay (2016). There are also agreements that include environmental aspects such as agricultural MoUs with El Salvador (2007), Venezuela (2008), Panama (2017), Dominican Republic (2018), and a MoU with Colombia (2015) on the joint development of model projects that could open spaces for cooperation on NbS with those countries ([Asociación Ambiente y Sociedad, 2021](#)). In 2017 Guyana created country guidelines for sustainable forest management after controversies surrounding a Chinese logging company ([Bulkan, 2016](#); [Guyana Forestry Commission, 2022](#)).

Beyond bilateral agreements, the most recent and primary regional cooperation is the China-CELAC Forum. Through this forum, China and LAC countries have agreed to a "Joint Action Plan for Cooperation in Key Areas (2022–2024)," which is likely to serve as the most significant basis for cooperation facilitating the diffusion of standards in green and technological development ([MOFA, 2021](#)). For the first time, this plan includes a section on sustainable development, as well as other environmental topics that are further up on the list. The plan's section 9, for example, foresees a strengthening of "exchanges and cooperation in areas such as forest protection, protection of natural areas, prevention and control of desertification, prevention and combat of illegal wildlife trafficking and forest crimes, sustainable trade in forestry, and bamboo cultivation and utilization." This plan will provide the legal architecture on which China's NbS in LAC in the future are likely to build; but up to this point, no significant investments in this direction have been pledged or planned.

## 5. Conclusion

Amidst rising geopolitical tensions and hard power politics, world powers are also increasingly leveraging soft power as a complimentary policy domain. This is especially true for China, which, after initiating unprecedented infrastructure investments across the Global South through the country's BRI, has embraced environmental diplomacy. This shift is marked by the creation of environment and development focused initiatives, such as BRIGC in 2017 and the Global Development Initiative in 2021 ([Rudyak, 2023](#)). There is a push from within the Chinese government to share globally the lessons learned from decades, if not centuries, of experimentation with large-scale ecological projects to prevent desertification, flooding, pollution, and, most recently, climate change. These projects find strong resonance with the discourse

of NbS, although they may push the term to its conceptual limits, blurring the boundaries between the natural and the engineered (Yeh, 2022). While Chinese institutions, such as MNR, have adopted IUCN's definition of NbS, Chinese institutions also advocate expanding the definition to allow countries to explore how to deploy the concept as best fits their particular eco-developmental circumstances. It is precisely this exploration in which China is currently engaged and with which China is helping other countries across the Global South engage in as well.

China's assistance with NbS in the Global South is not geographically even. In central Asia, and especially Southeast Asia where China's diplomatic ties have historically been strongest, a diversity of projects that fall under the broad umbrella of NbS are ongoing, many of which are beginning to be actively re-branded as NbS. The scale of involvement is lower in Africa, where diplomatic relations with China have not historically been as strong. Yet, Sino-African cooperation through FOCAC and UN projects demonstrate that the historically predominant focus on agriculture and infrastructure is being reframed in terms of NbS. Alongside this reframing of existing projects, new projects exclusively devoted to NbS are cropping up, especially through UNEP-IEMP. Latin America, in contrast to both Africa and Asia, has yet to see any dedicated NbS projects established in partnership with China. The discourse of NbS also, at this point, plays no role in the greening of Chinese-backed infrastructure projects in Latin America. This is largely because Chinese infrastructure projects in the region – green or otherwise – are much less than in Asia and Africa where BRI projects are overwhelmingly located. Given that many Latin American countries only recently joined the BRI and strong diplomatic relations with China are only beginning to cement, China's NbS-related interventions in Latin America are only on the horizon.

While our research reveals a considerable list of initiatives that have recently emerged related to NbS across the Global South, a note of caution is in order given the methodology deployed. The desk-based research methods used in this article require further fieldwork to investigate the conditions of these projects on the ground. Our findings present a broad overview of the discourse and aspirations of NbS in China, including a general indication of what is – at most – happening on the ground. It is very likely that many of the listed projects are more rhetoric than reality (as with most environmental initiatives in the Global South, Chinese-led and otherwise) and follow-up research is required to determine the extent of implementation across regions.

Yet, regardless of the specificities of what is happening on the ground, our research reveals a clear embrace of the concept of NbS by policymakers and academics within China. When it comes to China's overseas environmental assistance, NbS plays a strong and growing role. This is because, we argue, NbS provides an opportunity for China to showcase its environmental engagements on the global stage, fulfilling President Xi Jinping's mandate to "construct a global Ecological Civilization." China's embrace of NbS, therefore, is not coincidental but directly related to the potential for this concept to serve as a tool for helping China's vision of an Ecological Civilization "go global" by assisting with concrete NbS interventions across the world. It is this international promotion that China is pursuing, alongside the more conventional set of Western actors, that will shape the future of NbS in the global arena. Through the discourse of NbS and its practical examples as discussed in this article, the international community can better understand the goals and practicalities of China's environmental approach, which is increasingly finding its way onto the global agenda.

#### CRedit authorship contribution statement

**Annah Lake Zhu:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing, Funding acquisition. **Niklas Weins:** Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Investigation. **Juliet Lu:**

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#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

Data will be made available on request.

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