PLOS CLIMATE

REVIEW

Going beyond market-based mechanisms to finance nature-based solutions and foster sustainable futures

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OPEN ACCESS

Citation: Chausson A, Welden EA, Melanidis MS, Gray E, Hirons M, Seddon N (2023) Going beyond market-based mechanisms to finance nature-based solutions and foster sustainable futures. PLOS Clim 2(4): e0000169. https://doi.org/10.1371/journal.pclm.0000169

Editor: Pamela McElwee, Rutgers University: Rutgers The State University of New Jersey, UNITED STATES

Published: April 6, 2023

Funding: This work was supported with funding from the Oxford Martin School's Biodiversity and Society Programme (University of Oxford), the Rotary International Global Grant (#GG2123471 to EAW), and the Environmental Change Institute (University of Oxford). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

Abstract

Failure to address the climate and biodiversity crises is undermining human well-being and increasing global inequality. Given their potential for addressing these societal challenges, there is growing attention on scaling-up nature-based solutions (NbS). However, there are concerns that in its use, the NbS concept is dissociated with the social and economic drivers of these societal challenges, including the pervasive focus on market-based mechanisms and the economic growth imperative, promoting the risk of greenwashing. In this perspective, we draw on recent research on the effectiveness, governance, and practice of NbS to highlight key limitations and pitfalls of a narrow focus on natural capital markets to finance their scaling up. We discuss the need for a simultaneous push for complementary funding mechanisms and examine how financial instruments and market-based mechanisms, while important to bridge the biodiversity funding gap and reduce reliance on public funding, are not a panacea for scaling NbS. Moreover, market-based mechanisms present significant governance challenges, and risk further entrenching power asymmetries. We propose four key recommendations to ensure finance mechanisms for biodiversity and NbS foster more just, equitable, and environmentally sustainable pathways in support of the CBD's (Convention on Biological Diversity) 2050 vision of "living in harmony with nature". We stress that NbS must not be used to distract attention away from reducing emissions associated with fossil fuel use or to promote an agenda for perpetual economic growth and call on government policy makers to decenter GDP growth as a core economic and political target, refocusing instead on human and ecological well-being.

Introduction

Calls to recognize the dependency of economies on the biosphere have been growing with the urgency of addressing the climate and biodiversity crises [1,2]. Lack of attention to this in both public and private sector decision-making has generated an unsustainable status quo, where

the importance of ecosystems and biodiversity in securing 'use' benefits (e.g., water quality, disaster risk reduction, soil health, carbon sequestration, livelihoods) and non-use values for people and nature have been overlooked [1]. As a result, there has been growing attention to the role of nature-based solutions (NbS) for addressing societal challenges, notably to mitigate and adapt to climate change [3,4]. These interventions are defined as 'actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits" [5]. However, the fundamental structural drivers of biodiversity loss and climate change are rarely made explicit when discussing NbS. This includes the narrow free-market frame through which policy decisions are often made [6] and the imperative for economic growth as measured through GDP [7]. Nature is presented as a solution to human problems [8] often without considering the social and political drivers of environmental challenges [9], fueling criticism towards NbS (e.g., [10,11]). Yet, reversing biodiversity loss is dependent on addressing these underlying drivers to generate the enabling environment for NbS to be successful [12].

Dominant NbS narratives (i.e., values-driven stories that are assumed to be factual about problems and their proposed solutions, in which concepts like NbS are embedded; [13] have been called out for upholding neoliberal values and framings of nature at the expense of others [14–16]. Neoliberalism, as an ideology, promotes the notion of unrestrained 'free' markets, privatization, deregulation, and reduction in government spending [17] to unlock a growth-focused vision of development [18]. Although NbS can be viewed in a plurality of ways, neoliberalism is often reflected through the instrumental values and technocratic perspectives underpinning dominant NbS frames [19] as well as the growing prioritization of private-led initiatives over public investment for public goods [20]. Proponents of this view often describe nature purely as a commodifiable asset class, promote market-based mechanisms (notably carbon markets) as the main way to fund nature recovery and position the private sector as central stewards (issues raised in [4,21,22]). Many view NbS as a mechanism to unlock finance and bridge the funding gap between biodiversity and climate initiatives, currently estimated to be on the order of 878.9 to 891.3 billion USD [23,24]. Yet, challenges in securing finance remains a key barrier to scaling place-based NbS (i.e., interventions designed in-tune with specific social, ecological, and political contexts) [25–27], which require the need for diverse private and public finance flows as called for in targets 18 and 19, respectively, of the recently adopted Kunming-Montreal Global Biodiversity Framework (GBF) [28]. In addition to bridging the biodiversity funding gap, channeling private capital flows towards biodiversity conservation and NbS may also drive certain capital flows away from activities that degrade and damage biodiversity and ecosystem services.

Indeed, there are promising opportunities for private finance to contribute to scaling-up NbS and delivering climate resilient landscapes. For example, co-financing between public and private actors has been identified as a key steppingstone to design and maintain urban NbS [29,30]. Opportunities to invest in NbS, such as through credit-based schemes, also provide an avenue to meet corporate commitment for biodiversity and climate, while increasing, in theory, the flows of finance to people and biodiversity. Avenues for channeling sizable private finance flows are growing–for example, Climate Asset Management recently secured USD $650 million for its natural capital strategies focusing on landscape regeneration [31]. However, these are currently limited to 'mature' revenue-generating NbS, such as in the context of agricultural production (e.g., agroforestry) or forestry (e.g., managing diverse species forests to boost the resilience of timber production), as well as nature-based carbon offsets [32]. These represent a restricted subset of the broader portfolio of NbS needed to tackle climate change

and other societal challenges at scale, and recent concerns over the validity of carbon offsets for avoided deforestation also undermine scaling voluntary carbon markets [33,34]. For some mechanisms, such as green bonds, the scattered and small-scale nature of most NbS also conflicts with the large-scale nature of portfolios needed to attract private finance [24].

Considering these limited avenues for private finance flows, calls have been made to substantially scale up financial instruments and market-based mechanisms (hereafter simplified to market-based mechanisms) [23,32,35]. These currently represent a small proportion of finance for NbS [32], and include bond markets [36], biodiversity credits [37], wetland mitigation credits [38], the use of biodiversity and nutrient credits in the recently adopted biodiversity net gain legislation in the UK [39], or mechanisms to monetize avoided costs (where revenues are generated through capturing a portion of cost savings to beneficiaries; [32]). There has been a particularly strong push by the private sector and multilateral bodies to attract private capital flows for NbS (e.g., [23,40]), including through blended finance schemes whereby public grant funding is used to stimulate finance from private and institutional financiers by mitigating investment risks [35]. Calls for a global scaling-up of natural capital markets as the main mechanism to address climate change and ecological breakdown have also been made (e.g., [41]). Such mechanisms are closely intertwined with, and dependent upon, innovations like natural capital accounting to create tradable financial asset classes from biodiversity and ecosystem services.

Although mechanisms for trading natural capital assets (e.g. through carbon or biodiversity credits) present an attractive opportunity to bridge the biodiversity funding gap, there are pitfalls and risks with their establishment which can compromise NbS effectiveness and scaling if not addressed. A significant concern is also that the financialization of natural capital (i.e., the commodification and trading of natural capital assets in financial markets) conveniently furthers the interests of those benefiting from capital accumulation, while reducing pressures on business and government to tackle the climate and biodiversity crises at their root, in turn increasing the risk of greenwashing. Notably, this can occur where the implementation of NbS reduces pressures to decarbonize at the source, which delays the rapid decarbonization needed to meet the Paris Agreement and tackle biodiversity loss, while increasing economic inequalities [4,22]. While natural capital accounting can provide a powerful tool to constrain economies within biophysical boundaries [42,43] and support environmental management [44], the financialization of natural capital can also reinforce the values (market-based and instrumental), social relations, and human-environment relations that sit at the core of the biodiversity and climate crises [45], while reinforcing existing power and wealth inequalities. Our concern is that this inhibits transformational change, as characterized by "a fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values", which is essential to address both the climate and biodiversity crises [46,47].

Here, we draw on recent research, governance, and practice to explore risks and pitfalls in efforts to scale market-based mechanisms for NbS, in relation to fostering transformation and catalyzing actions that deliver for people, climate, and biodiversity. Although diversifying financial flows by leveraging private finance through well-regulated natural capital markets is important, and the effectiveness of such mechanisms should be explored, we believe there currently is a lack of attention to its risks. This includes risks associated with the de-prioritization of landscapes where these schemes are not cost-effective, how these schemes are governed, including how costs, benefits, and risks are distributed, and how people's diverse knowledges, values and priorities are (or are not) reflected in the design and implementation of these mechanisms. Calls to channel resources and efforts to scale up market-based mechanisms should be embedded in an honest value proposition of their potential, appreciative of limits to scalability and impact. We reflect on these issues, proposing four key recommendations for proponents of

NbS, with a focus on actors financing NbS (public and private) or those supporting efforts to scale-finance (including private sector coalitions and NGOs), to foster just and equitable transformative pathways in support of the CBD 2050 vision of "living in harmony with nature".

The pitfalls of a narrow focus on market-based mechanisms to finance nature-based solutions

While a plurality of mechanisms to channel finance for investments in nature is required, including market-based mechanisms, we are concerned that complementary finance mechanisms, such as fiscal policy measures or direct cash transfers [24,48], are often perceived as politically intractable and therefore largely sidelined. This is an issue because developing the scientific, technological, and governance know-how for scaling natural capital markets on a global scale will not be quick, even if it were feasible or desirable, though addressing the climate and biodiversity crises is of the utmost urgency. Below, we highlight 5 additional pitfalls of de-prioritizing public funding and chiefly relying on natural capital markets to scale up NbS.

A. Limits to scalability. The potential of financing NbS through natural capital markets (i.e., where natural assets representing biodiversity or ecosystem services are traded) is constrained for several reasons. First, the quantification and mapping of flows of ecosystem services remains difficult and prone to error, even at the landscape scale [49,50]. Further, accounting for the impact of climate change on these services remains challenging [51]. Ecosystem service valuation, despite substantial progress, is in turn limited by a bias of available data towards certain geographies and types of ecosystem services–mainly, those that are instrumental, tangible, or easily measured with numerical metrics [6,52]. And, for biocredit schemes (i.e., tradeable credits based on biodiversity to incentivize conservation and restoration), incorporating the multifaceted aspects of biodiversity meaningfully remains challenging [37].

Second, as mentioned, the subset of NbS attractive to private investors is already primarily restricted to commercially mature sectors (notably forestry, agriculture, and water) and the growing carbon credit market [32]. Many ecosystem services (notably supporting, regulating, and cultural ones), and the natural and social capital on which they are based, are non-rival and or non-excludable, meaning that private property regimes and markets alone are ineffective and inappropriate institutions to manage them sustainably [53,54]. Further, although natural capital markets beyond carbon credits are emerging (e.g., biocredits), these are a long way from maturation, although exceptions exist (e.g., the US wetland credit schemes) [38]. And, while the ostensibly large untapped potential of the carbon market is often used to attract investors (e.g., [55]), this mechanism alone is not enough to scale up NbS. A recent analysis estimates that 80% of potential implementation opportunities for NbS in tropical forest regions are currently not financially viable (in terms of return on investment) through a purely market-based approach (e.g., voluntary carbon offset mechanisms) when considering the costs of implementation, management, and monitoring [56]. These transaction costs conflict with institutional investor appetite for near-term, competitive returns [20]. Given that verifying biodiversity credits meaningfully is currently more onerous than for carbon [37], this suggests further constrained potential for these schemes. Although lowering the transaction costs of verifying transactions and credits through technology (e.g., such as through advances in eDNA) can make these schemes more cost-effective, significant barriers remain. More fundamentally, lack of market maturity can make it difficult to set adequate prices meeting the needs of Indigenous Peoples and Local Communities (IPLCs) and biodiversity conservation, in part because of a potential mismatch with investor willingness to pay for credits [37]. Therefore, although well-regulated natural capital markets can contribute finance for NbS, alternative funding mechanisms remain essential to scale NbS, as discussed below [23].

B. Reinforcing the separation of people and nature. When nature is described purely in terms of something that works for people [57,58] it tends to reinforce the human-nature dichotomy (i.e., the separation of non-human nature and human-culture) [59]. Though placing a monetary value on the many ways nature supports human economies enables the inclusion of some values in national and corporate accounting and hence decision making, the risk is that the potential of NbS to provide just and hence sustainable, long-term, benefits to people and nature together will be undermined [19]. In the context of natural capital markets, the disconnect between people and nature is reinforced, because such markets are built from and promote a framework which extracts and categorizes elements of nature from its whole [60]. This is evident where natural capital markets are used to stimulate financial flows from distant actors for their capital gain. This matters because unchecked pressures to ensure monetary returns for distant investors can risk jeopardizing social-ecological resilience, as these may interfere with the dynamic, place-based interactions between people and nature which sustain NbS [61,62]. For example, a narrow focus on monetizable aspects of natural capital such as carbon stocks can generate market-pressures to optimize landscapes for these, instead of the holistic management necessary for delivering bundles of benefits and ultimately resilient NbS [63,64]. The challenge resulting from the separation of external investors and place-based NbS is recognized by private finance institutions, as it also makes transactions and 'asset performance' difficult to manage' [32]. Addressing our shared, global socio-environmental challenges requires deep cultural and systemic shifts and resetting human-nature relations [65,66], including how landscapes are valued, and for whom.

C. A limited view of barriers to scaling nature-based solutions. While establishing natural capital markets may appear attractive to channel finance from the private sector, this alone will not shift behavior of actors profiting from extracting industries. While monetary valuation incorporates some economic dimensions of nature's value into policy decision making, it does not address significant barriers to scaling NbS, such as path dependency [67,68] and siloed decision-making [27]. A narrow focus on economic rationality also sidelines the need for transformation in social relations and power dynamics [69], bolstering the power of those benefiting from extraction [70]. Such transformation requires careful management, regulation, and a prioritization of rights-based approaches and devolved, local decision-making, as is advocated through the concept of 'locally led adaptation' [71]. Further, framing nature as a provider of commodifiable, monetizable services can also crowd out values and intrinsic social motivations driving stewardship (e.g., relational values), thereby hindering pro-environmental behavior change in certain contexts [21,72–74].

D. Challenges in governance and achieving equity for IPLCs. Natural capital markets for NbS present significant governance challenges. We recognize that interventions harnessing market-based mechanisms for finance, when carefully designed in close partnership with local communities (Guideline 3 for successful NbS; nbsguidelines.info), can help secure flows of finance towards them. For example, recent research suggests a forest carbon offset in Panama provided financial stability to poorer participants to diversify income sources, although income inequality, overall, remained unchanged [75]. However, the uncritical assumption that 'market-forces' will generate shared prosperity, such as promulgated by Chami et al. (2022) [41], overlooks the challenge of ensuring distributional equity (i.e., how benefits and costs are distributed) and procedural equity (i.e., equity in decision-making) [76] particularly where there are strong pressures to generate returns on investment for investors. For example, in the context of urban NbS, co-funding by private actors has been found to lead to a bias in NbS towards more affluent areas, because NbS (such as city parks) will be more successful at realizing revenue streams in these areas [25,29]. Even where schemes explicitly focus on ensuring benefits flow back to less affluent areas, it isn't clear how effectively finance will reach the

intended custodians of nature, or how issues of elite capture will be addressed. These remain a cross-cutting issue in natural resource management whereby the powerful co-opt finance and benefits [77,78].

Establishing environmental markets where unsecured rights and pre-existing conflicts over land have not been addressed can furthermore drive the exploitation of people and nature [79–81]. This is a significant concern because IPLCs have been historically disenfranchised in market-based conservation schemes due to power imbalances or lack of transparency in finance flows [37]. Although IPLCs steward at least 17% of global forest carbon, there remains a significant lack of progress on the legal recognition of IPLC forest tenure rights [82]. It also remains unclear the extent to which or how the design and implementation of NbS financed by such markets will uphold the knowledge, values, needs and aspirations of IPLCs across a diversity of governance contexts given the significant barriers to upholding their rights (e.g. [83]). In turn, this conflicts with efforts to design schemes which support and center the IPLCs whose territories contain the natural "assets" investors are attempting to monetize. Natural capital valuation through standardized metrics currently remains largely incongruent with the incorporation of plural local knowledges and other worldviews (i.e., other, non-Western ways of knowing and relating to nature, such as Buen Vivir or Swaraj; see [84,85]) so crucial to delivering effective NbS, including those of IPLCs [86,87]. The notions of 'capital' and 'assets' can further conflict with, de-legitimize, and crowd-out worldviews of IPLCs from environmental decision-making. In turn, IPLCs become subject to the agendas of external actors, as 'partners' or passive beneficiaries, rather than decision-makers and leaders for their own territories, reinforcing unequal power dynamics in global environmental governance [22]. Similarly, with biodiversity credits, current schemes fail to balance scientific understandings of biodiversity with socio-cultural values [37], which challenges aligning credit schemes with the knowledges, needs, values, and aspirations of IPLCs. Emerging biocultural valuation methods may address this [88,89], but adds a layer of complexity to designing credits, and might pose constraints to their fungibility (i.e., ensuring they interchangeable and comparable). While calls for knowledge inclusion in environmental decision-making have grown louder, discussions around biodiversity and climate are still largely dominated by natural scientists, economists, as well as large international NGOs and multilateral organizations that often embody a Western epistemology upholding a technical and dualistic interpretation of nature [90] (e.g., the portrayal of nature as a tool to address societal challenges), and the prioritization of global, and scientific, knowledge over local and traditional knowledge. These imbalances in who is at the table and whose knowledges are deemed credible in global environmental decision-making reinforce inequalities on the ground. While safeguards are advocated as key to mitigate these potential harms to people and biodiversity, they may suffer from a lack of enforceability and accountability and can exacerbate existing inequities [91,92]. In sum, although co-financing mechanisms to draw in a plurality of private, public, and philanthropic funding sources are crucial to scale up NbS, these can only promote equity and justice through robust and equitable governance.

E. Reinforcement of Global North Global South power imbalances. International markets for natural capital, such as carbon or biocredit markets, risk creating mechanisms led by, and for, Northern interests, reinforcing structural inequalities between the Global North, and South (i.e., the 'developed' and 'developing' worlds). They require high levels of technical expertise and financial resources to design and implement them, most of which are locked in the North. The intricate and expensive legal coding mechanisms required to define rights to natural capital assets (the case for any financial asset), so that profit can be derived from these, can further skew the balance of power towards wealthy investors [93]. This risks reinforcing the existing global divide in power that characterizes geopolitical relations between the Global

North and South and between the powerful and the marginalized [94,95], as past environmental programs have (e.g., REDD+). This global power divide manifests in the increasing appropriation of earth's resources by wealthy nations and corporations across the globe [96,97], while economic flows from the South to the North are estimated at more than $10 trillion per year, outstripping development aid by a factor of 30 [95]. If not designed to harmonize with local needs and aspirations, market-based mechanisms will promote increasing concentration of power to investors in the North, in turn, reinforcing the divide, while compromising locally led investments and landscape management needed to deliver for people and nature [98]. Currently, through Northern-led funding mechanisms, less than 2 percent of global climate finance reaches IPLCs in the Global South [99]. Any mechanism which does not explicitly address and work to rectify this, will further marginalize the voices and needs of IPLCs on the ground, and amplify existing injustice and inequalities rooted in the historic and present exclusion and suppression of IPLCs within environmental decision-making and initiatives [100], in turn compromising effective NbS [4]. Exposure to the boom-and-bust cycles inherent in global capitalism may also further exacerbate the vulnerability of countries and local communities in the Global South [20]. It is crucial to consider several questions–Who defines and governs natural capital markets? Who ensures private finance flows to the right places, ecosystems, and people? How are the "right" places and people defined? In the current political economy, any proposal to scale up natural capital financial markets and generate new asset classes without meaningfully addressing the above questions risks perpetuating injustice and the appropriation of nature by actors in the Global North [101].

Four recommendations for proponents of nature-based solutions

We now reflect on these pitfalls to frame recommendations for government policy, market, and financial instrument design, as well as NbS implementation, to support high-integrity actions delivering for nature, people, and equity. This includes the need for more holistic valuation appreciative of systemic connections (biophysical, and human-nature) and diverse held-values, transformative finance mechanisms which address power imbalances with IPLCs and go beyond market-based mechanisms, and finally, a policy shift in economic visions and goals.

A. Recognize nature-based solutions as place-based partnerships between people and nature that harness diverse values. We argue that NbS should reflect regenerative, sustainable relationships with the natural world, such as those long recognized by many Indigenous cultures [48,86,87,102,103]. In other words, NbS are not equivalent to natural capital and ensuing ecosystem services; they are place-based partnerships involving people working with nature, as a part of nature, to harness co-benefits and address societal challenges [4,19]. To manage landscapes sustainably, including through Nature-based Solutions (NbS), it is important to recognize land as a system of mutual relationships and responsibilities, a notion often rooted in the cultural-spiritual context of many IPLCs [87]. It is crucial to ensure that any mechanism to finance NbS supports this, which in turn requires addressing the potential disconnect between distant financial actors and their priorities, and the place-based human nature interactions underpinning NbS. This can be achieved, in part, by strengthening relations between investors and entities overseeing projects on the ground, as well as with social and environmental NGOs, and supporting efforts to mainstream non-monetary metrics to help identify 'successful' investments [32].

Addressing this potential disconnect is key to ensure NbS deliver plural benefits, particularly for the people inhabiting the landscapes where NbS are implemented. Growing evidence shows that the many benefits of NbS are co-produced by people and nature, through the protection, management, and restoration of ecosystems and working landscapes in a way that accounts for

the values, needs, and priorities of local stakeholders and rights-holders [104–108]. Accommodating a greater diversity of values in decision-making, therefore, is crucial to deliver healthy, resilient landscapes [84,109]. Hence, when framing NbS, there is a need to embrace diverse perspectives and values and retain a core focus on the co-dependency of people and nature, rather than the notion of nature working for people (i.e., the ecosystem-service lens) [19].

Shifting away from a narrow "nature for people" perspective allows recognizing the many benefits fostered by NbS through human-nature relations. Indeed, this sits at the core of the argument by IPBES that narrowly valuing nature through the lens of the market has played a major role in driving biodiversity loss [6]. Other values include relational values–the value of place-based relations with one's natural and social worlds–that underpin stewardship [110–112]. Further, recognizing plural worldviews, values, and knowledge systems, such as those of IPLCs, is crucial to design inclusive funding policies and mechanisms (market-based or other), with a focus beyond quantifiable aspects of biodiversity or ecosystem services [45,69].

B. Recognize the role of IPLCs as leaders of nature-based solutions. Welcoming plural values, perspectives, and knowledges, in turn requires reframing how IPLCs are characterized in NbS discourses. Despite the emphasis on the importance of IPLCs as effective stewards of lands and biodiversity, and increasing emphasis on the need for indigenous-led solutions [113,114], IPLCs are often portrayed as 'partners' for or passive 'beneficiaries' of environmental policy decisions within global policy discourses, including for NbS [22]. For example, Chami et al. (2022) portray IPLCs as mere *subjects* 'to be employed' or 'partners' to deliver their vision of a nature-based economy [41]. In turn, this reinforces power asymmetries between IPLCs and external actors. Instead, for effective NbS finance and implementation, it is crucial to recognize the role of IPLCs as *active leaders*. Emphasizing this point, WEF (2023) recommends IPLCs be co-investment leaders in NbS [113]. This implies that the 'solution' must be shaped first and foremost by IPLCs around their needs and perspectives, rather than those of external actors (as specified in Criterion 1 of the IUCN standard; [115]). It is then crucial to engage IPLCs from the very beginning through inclusive processes, and ensure that their knowledges, values, needs, and aspirations are upheld [115,116], while simultaneously supporting Indigenous entrepreneurship, as exemplified by the Indigenous-led funds, such as the Amazon Fund to increase direct access to climate finance [117], or the Pawanka Fund (https://pawankafund.org). The way existing natural capital markets currently reduce nature to a commodity that distant financial actors can purchase the rights to reflects the scenarios many Indigenous Peoples groups [101] as well as some policy makers [118], warn about and actively push against within NbS discourses [22]. Mechanisms for financing and implementing NbS must pay attention to historical and present impacts of colonial legacies and Indigenous-settler government relationships [87] while protecting Indigenous land and resource rights [86]. It is also important to identify when and where market mechanisms such as biocredits may not be appropriate for IPLCs [37], as Indigenous peoples and their aspirations are not globally homogenous [119]. The desire to scale these schemes could otherwise infringe on locally led approaches. To promote effective Nature-based Solutions (NbS) that benefit both nature and people, it is important to go beyond superficial representation of Indigenous Peoples and Local Communities (IPLCs) in global NbS discourses. This requires creating fair mechanisms that address power imbalances between rich and poor countries as well as powerful and marginalized actors.

It is also crucial to pay attention to potential power shifts resulting from increasing flows of finance which may jeopardize transparency, equity and further marginalize local communities. Developing robust governance mechanisms that ensure NbS are responsive to local communities' priorities and preferences, are attentive to diverse and marginalized actors within broader communities, and that have appropriate accountability mechanisms in place, is a critical challenge. Increasing focus should be placed on collaborative partnerships between investors, local

communities, governments, or non-government organizations which are founded on trust-based, risk sharing arrangements that balance financial returns with positive impact [32,51].

C. Recognize alternative modes of finance. Innovative financing mechanisms to increase the flow of private finance to NbS, such as biodiversity focused green bond mechanisms, will play an important role in scaling NbS. However, bridging the nature recovery funding gap requires complementary modes of generating finance, beyond market-based mechanisms [23,120]. Here we highlight four critical examples:

i. ***Repurpose harmful government subsidies***. It is crucial for governments to repurpose harmful government subsidies towards actions that are environmentally beneficial, such as positive economic incentives rewarding sustainable land management, as called for in the recently adopted Kunming-Montreal Global Biodiversity Framework (GBF) [121]; see Target 18). For example, the Environmental Land Management Scheme (ELMS) in England is designed to financially reward sustainable farmland management for the generation of public goods [122]. Currently, subsidies are instead shoring up exploitative, extractive industries (notably in the fishing, agricultural, and fossil fuel sectors), with recent research showing these aggregate to a total of $1.8 trillion USD per year [123]. Alone, repurposing harmful agricultural subsidies could double funding annually for nature, globally [24].

ii. ***Tax environmentally harmful activities.*** Significant funding for NbS can be leveraged through taxation of environmentally harmful activities–for example, scaling a tropical carbon tax, as recently implemented by Costa Rica and Columbia, could yield an additional USD 13 billion each year towards NbS [24]. Simultaneously, environmentally beneficial activities, such as the implementation of green roofs and sustainable drainages systems (SuDS) in urban areas, should be incentivized through supportive tax regimes [26]. Both repurposing environmentally harmful subsidies and implementing tax regimes to incentivize environmentally beneficial activities would send a clear and powerful signal to markets that nature is valuable, thereby further catalyzing private finance [24].

iii. ***Direct funding of nature.*** Governments can also directly fund investments in nature, including as part of COVID-19 recovery measures [120], while also making bailouts for corporate finance or polluting industries conditional to achieving social and environmental objectives [124]. Beyond supporting crucial ecosystem services, such direct investments in nature have strong economic multiplier effects for jobs and economic output [125–127], often greater than those associated with investments in traditional sectors (e.g. manufacturing, oil, and gas) [128,129]. Increased fiscal spending for nature to deliver public goods would also align with recent shifts in macroeconomic policy aimed at supporting the COVID-19 recovery or tackling inflation [20]. Development banks are also playing a crucial role in mainstreaming NbS. For example, the European Investment Bank, through the natural capital financing facility, is providing reduced interest loans to the city of Athens to roll out blue-green infrastructure as a large-scale climate solution, across 400 sites within the city boundaries [26]. Finance can further be scaled-up through common asset trusts, whereby both private and public entities fund the protection of the commons, with their contribution weighed by the marketable and public benefits they derive, respectively [53].

iv. **Decolonial finance mechanisms.** Unconditional cash transfers or debt relief schemes could substantially relieve the burden of debt on poor countries' national budgets, towards allocating resources for addressing environmental and social challenges [130]. A recent analysis shows that conservation basic income could generate between $466 billion to $6.73 trillion USD annually [131] which would help foster locally-led NbS in the Global South.

D. Shift away from the imperative for economic growth. Although the potential of NbS for economic growth should be harnessed where growth is desirable (e.g., in supporting the growth of the nature restoration sector or supporting more sustainable modes of development across lower income countries), NbS should not be used as a tool to promote an agenda for perpetual growth. The imperative for economic growth is a key driver for scaling natural capital markets and is a formidable barrier to transformational change, in that it is a core aspect of the economic paradigm which drives unsustainable development [18,132]. Failure to recognize this directly counters the notion of transformation as characterized by a system-wide reorganization across technological, economic, and social factors. In the near term, this represents significant challenges as it requires breaking economic dependency on growth while avoiding growing inequality, job losses, and tackling inflationary pressures. Yet, overcoming these challenges is necessary because perpetual economic growth in a finite world jeopardizes progress towards addressing the climate and biodiversity crises [7,54,132]. This is because economic growth is coupled (in absolute terms) to energy demand and material footprint (i.e., increasing demand for land and exploitation of natural resources) [133,134]. This renders reductions in aggregate resource use and the rapid CO_2 emissions reductions necessary to stay within 2.0C, unfeasible [132,135]. Therefore, instead of seeking to promote "nature-based" economic growth, we argue that it is crucial to decenter GDP growth as a core economic and political target, refocusing instead on human and ecological well-being [136]. This includes embracing alternative metrics accounting undervalued public goods and services, including through ecosystems and biodiversity, and the socioeconomic distribution of these [137]. Delivering a future where nature and people thrive requires focusing on developing and maintaining circular economies, in harmony with nature, rather than economies narrowly and dangerously focused on GDP-based economic growth as an end-goal. We fear that limiting finance for NbS reliant on economic growth will jeopardize efforts to foster genuine transformational change.

Conclusions

As nature-based solutions gain popularity, there is need for critical reflection on how they are financed, for this holds important implications for how NbS impact natural ecosystems and the people dependent upon them. Well-regulated financial markets can play an important role in leveraging finance for place-based NbS that support good ecological health and human well-being, but there is evidence that potential pitfalls are being ignored in the rush to scale up funding. To stay true to the value propositions of NbS, it is crucial to ensure that financial instruments and natural capital markets demonstrably address both justice and biodiversity protection, as one cannot be realized at scale without the other [138]. This is also key to ensure these schemes do not enable the exploitation and extraction of resources and profits from marginalized communities. Calls for scaling-up natural capital markets should also be balanced with alternative modes of finance such as fiscal policy measures, debt relief schemes, or decolonial climate reparations. The potential of scaling NbS through natural capital markets is otherwise limited to landscapes where these schemes are cost-effective for investors. Actions that strengthen governance structures to support IPLC-led NbS in countries where NbS are implemented are also essential.

Fostering a transformative shift away from neoliberal, growth-based economic paradigms, towards valuing our relation and interdependency with the natural world [139] also requires markets and policies that are informed by more holistic valuation methods beyond financial, incorporating plural benefits and held values (e.g., through multi-criteria analysis, [140]; or risk-opportunity analysis beyond cost-benefit analyses, [141]), and that are grounded in

sustainability and well-being, rather than narrowly focused on efficiency, short-term profits, and economic growth [6]. In turn, this will help direct financial flows to the people and landscapes that need it.

Finally, we stress the importance of recognizing how the financialization of natural capital is underpinned by the worldviews and power dynamics responsible for climate change and biodiversity loss. Solutions embedded in relational values that reflect the interdependency of ecosystem health and human wellbeing are needed. Achieving the CBD 2050 vision of 'living in harmony with nature' requires attending to the issues of power, politics, and justice which sit at the core of the unsustainable status quo and shape flows of money and capital. It is essential for those advocating for NbS to avoid narratives that replicate or reinforce existing power asymmetries in environmental governance [22]. As history shows us (e.g., the American civil rights movement, feminist and environmental movements, or Indigenous-led movements; [142]), tackling power imbalances requires welcoming peaceful social resistance, collective action, and harnessing the power of grassroots movements, as called for by the UN Secretary-General António Guterres [143]. This is crucial to provide an enabling environment for scaling NbS. By confronting the injustices pervasive in the status quo, we can take steps towards a future where both humans and nature thrive.

Acknowledgments

We thank David Nemecek, Alison Smith, Beth Turner, and Stephen Woroniecki for their comments, revisions, and critical reflections to previous drafts, greatly contributing to the work. We also thank two reviewers and the associate editor for their thorough reviews which improved the manuscript substantially.

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