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Time to integrate global climate change and biodiversity science-policy agendas

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Abstract

1. There is an increasing recognition that, although the climate change and biodiversity crises are fundamentally connected, they have been primarily addressed independently and a more integrated global approach is essential to tackle these two global challenges.
2. Nature-based Solutions (NbS) are hailed as a pathway for promoting synergies between the climate change and biodiversity agendas. There are, however, uncertainties and difficulties associated with the implementation of NbS, while the evidence regarding their benefits for biodiversity remains limited.
3. We identify five key research areas where incomplete or poor information hinders the development of integrated biodiversity and climate solutions. These relate to refining our understanding of how climate change mitigation and adaptation approaches benefit biodiversity conservation; enhancing our ability to track and predict ecosystems on the move and/or facing collapse; improving our capacity to predict the impacts of climate change on the effectiveness of NbS; developing solutions that match the temporal, spatial and functional scale of the challenges; and developing a comprehensive and practical framework for assessing, and mitigating against, the risks posed by the implementation of NbS.
4. *Policy implications*. The Conference of the Parties (COP) for the United Nations Framework Convention on Climate Change (COP26) and the Convention on Biological Diversity (COP15) present a clear policy window for developing coherent policy frameworks that align targets across the nexus of biodiversity and climate change. This window should (a) address the substantial and chronic underfunding of global biodiversity conservation, (b) remove financial incentives that negatively impact biodiversity and/or climate change, (c) develop higher levels of integration between the biodiversity and climate change agendas, (d) agree on a monitoring framework that enables the standardised quantification and comparison of biodiversity gains associated with NbS across ecosystems and over time and (e) rethink environmental legislation to better support biodiversity conservation in times of rapid climatic change.

KEYWORDS
ecosystem collapse, environmental legislation, Nature-based Solutions, protected areas, restoration, rewilding, wildlife management

Biodiversity is declining globally at unprecedented rates, eroding the very foundations of our economies, livelihoods, food security, health and quality of life world-wide (IPBES, 2019). At the same time, the overwhelming scientific consensus is that humanity is facing a climate emergency (Ripple et al., 2020), with anthropogenic greenhouse gas emissions altering climatic conditions, sea levels and the pH of surface ocean waters. Global strategies to halt these dual crises are often formulated separately within two international conventions (the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD)), yet biodiversity loss and climate change are interdependent issues (Garcia et al., 2018; Pires et al., 2018).

Rapidly changing climatic conditions are threatening the long-term survival of many species (Urban, 2015); they have already led to widespread local extinctions (e.g. Albano et al., 2021) and, in some cases, contributed to the global extinction of species (Cahill et al., 2013). Up to 50% of species could lose most of their suitable climatic conditions by 2100 under the highest greenhouse gas emissions scenario (Warren et al., 2018), while the current global redistribution of biodiversity (Pecl et al., 2017) is expected to escalate. For example, by 2070, 35% of mammals and 29% of birds are projected to have over half of their climatic niche in countries in which they are not currently found (Titley et al., 2021). Climate change is also increasing the frequency and intensity of extreme climatic events (Cai et al., 2014), which are threatening the integrity of many ecosystems across the globe, including two of the world's most diverse ones (coral reefs and humid tropical forests; França et al., 2020). The loss of biodiversity is moreover deepening the climate crisis: reduced species abundance, local extinctions, as well as the rapid degradation and/or loss of ecosystems such as mangroves (Thomas et al., 2017), tropical forests (Bonan, 2008), peatlands (Loisel et al., 2021) and seagrass (Waycott et al., 2009) are having a major impact on our planet's ability to store carbon, while reducing nature's and people's ability to adapt to and/or cope with changing climatic conditions.

Given these linkages, it is not surprising that there is an increasing scientific and political recognition of the need for a more integrated global approach to tackle the climate and biodiversity crises (Pörtner et al., 2021; Turney et al., 2020). How to design and implement solutions that fall under a 'combined' approach are questions likely to be at the centre of the global environmental discussions during meetings of the Conference of the Parties (COP) for the UNFCCC (COP26) and the CBD (COP15). Here, we aim to review the current set of political and scientific propositions for jointly addressing the threats posed by the climate and biodiversity crises, highlighting options with the greatest potential for delivering biodiversity gains. We then identify research priorities in applied ecology that must be addressed to improve the effectiveness of such options. Finally, we discuss potential systemic barriers to progress environmental efforts that fully integrate the climate and biodiversity agendas.

1 | INTEGRATING THE BIODIVERSITY AND CLIMATE CHANGE AGENDAS: THE PROPOSITION SO FAR

The idea that changes in the management of nature could help tackle the climate crisis has been promoted by the UNFCCC for over two decades; for example, the concept of Reducing Emissions from Deforestation and Forest Degradation (REDD) was brought to the table during the Kyoto protocol negotiations in 1997. These early discussions around REDD and REDD+, together with the development of the Ecosystem Approach by the CBD, ultimately gave rise in 2008 to the Nature-based Solutions (NbS) concept (Cohen-Shacham et al., 2019).

Nature-based Solutions are defined by the International Union for Conservation of Nature (IUCN) as *'actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits'*—a definition that clearly positions NbS as being consistent with long-standing natural resource management paradigms (see e.g. Holling & Meffe, 1996; Kellert et al., 2000). NbS have been endorsed in the IPBES Global Assessment (IPBES, 2019), the Climate Change and Land Report of the Intergovernmental Panel on Climate Change (IPCC, 2019) and the Global Adaptation Commission Report (Seddon et al., 2021). Although NbS have been defined as actions that have the potential to support multiple interlinked societal challenges (Figure 1), they have been globally hailed as a concept that promotes synergies between the climate change and biodiversity agendas (Seddon et al., 2021). In comparison to greenhouse gas emissions and carbon stocks, biodiversity is however multifaceted, spatially variable and famously difficult to measure (Pereira et al., 2013). This has led to NbS being rarely differentiated according to their impact on biodiversity, and very little being known about the realised potential for these solutions to deliver positive outcomes for biodiversity (Acreman et al., 2021; Seddon et al., 2020).

NbS specifically addressing the climate change crisis have attracted considerable traction in both governmental and private sectors (Faivre et al., 2017; Seddon et al., 2021); these solutions support climate change mitigation, adaptation or both. Recently, the potential role of NbS for climate change mitigation has been in the limelight (e.g. Girardin et al., 2021), likely due to the difficulties associated with estimating adaptation potential, which is largely reliant on place-based qualitative information that shifts across different

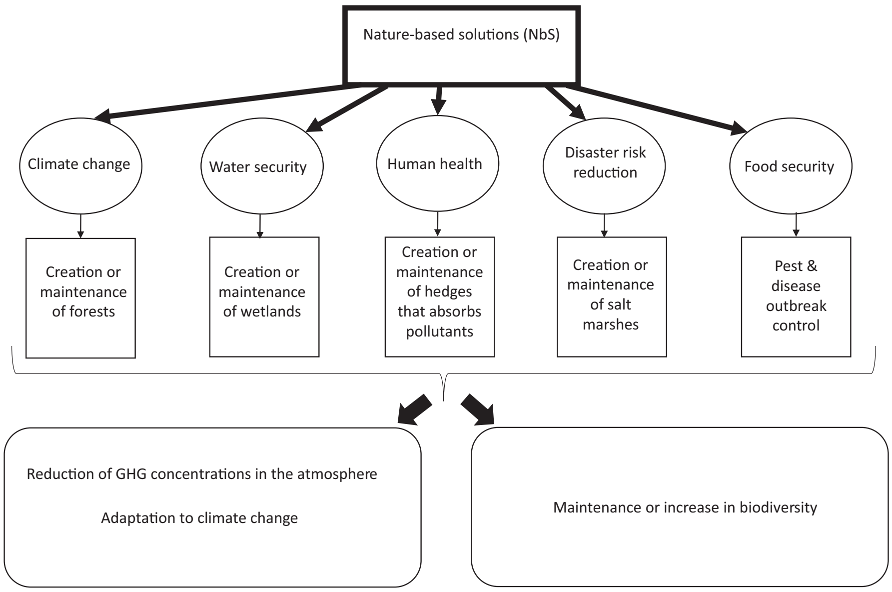

FIGURE 1 Examples of Nature-based Solutions (NbS) to address the climate crisis. NbS are defined by the International Union for Conservation of Nature (IUCN) as '*actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*'. Current societal challenges include climate change, water security, human health, disaster reduction risk and food security. Examples of NbS are given for each societal challenge. By definition, all NbS should provide biodiversity benefits; only NbS to address the climate change crisis are expected to help reduce greenhouse gas concentrations (GHG) in the atmosphere and/or support climate change adaptation; NbS aimed at addressing other societal challenges may or may not do so

societal groups and over time (Morecroft et al., 2019). Acting as an umbrella term, NbS refer to actions that aim to capitalise on existing biodiversity, or to increase biodiversity, to tackle societal challenges. As such, the setting up of new protected areas, as well as restoration and rewilding projects all have the potential to be NbS for addressing the climate change crisis (Eggermont et al., 2015).

1.1 | Protected areas

Increased protection of seascapes and landscapes is one of the key scientific and political propositions for jointly addressing the threats posed by the climate and biodiversity crises: the recent Leaders' Pledge for Nature, signed by 84 countries, includes a clear commitment to significantly increase the protection of the planet's land and ocean (Leaders Pledge for Nature, 2021); the most recent draft of the post-2020 global biodiversity framework by the CBD suggests that by 2030, at least 30% of the planet should be protected and conserved through well-connected and effective systems of protected areas (CBD, 2021). Dinerstein et al. (2020) argue for even higher commitments, with their Global Safety Net initiative calling for 50% of the terrestrial realm to be conserved to reverse biodiversity loss, prevent CO_2 emissions from land conversion and enhance natural carbon removal. This follows on from calls by scholars over the past decade for half of the Earth to be protected (Noss et al., 2012; Wilson, 2016).

Protected areas are a key strategy for conserving nature and halting the loss of biodiversity and can mitigate and promote adaptation to climate change (Roberts et al., 2017): a recent study spanning ca. 5.2 million km^2 across 63 countries, for example, showed how protected areas reduced deforestation rates by 41% (Wolf et al., 2021). Increasing the proportion of landscapes and seascapes being protected, however, comes with several societal, ethical, economic and philosophical challenges (Barnes et al., 2018). Their static boundaries may reduce their potential for protecting biodiversity under climate change (Elsen et al., 2020). As systems of protected areas expand globally, there is a risk that new protected areas will be biased towards places that are remote or unpromising for extractive activities (Devillers et al., 2015). Biodiversity protection in protected areas is not guaranteed: protected areas effectiveness can vary substantially, being likely to be reduced in situations where budgets are limited and governance lacks transparency and fairness (Dawson et al., 2018; Geldmann et al., 2019; Gill et al., 2017). Protected areas can sometimes negatively impact poor or marginalised people in low- and middle-income countries (Brockington & Igoe, 2006; West et al., 2006), with social tensions and conflicts being on the rise within and around conservation areas in these regions (Duffy, 2014; Lunstrum & Ybarra, 2018). 'Ambitious' targets to protect 30% or 50% of the lands and seas under national jurisdiction may also be insufficient to retain significant portions of the global biodiversity: in the Amazon region, even a 50% target is unlikely to be enough to avoid entire ecosystems being pushed over tipping points (Nobre et al., 2016), pointing out the need for multiple and complementary strategies. Furthermore, retaining existing levels of biodiversity in protected areas is not enough to mitigate and adapt to the climate breakdown we are facing: global carbon sequestration capacity needs to be expanded, local climate regulation needs to be reinstated and nature-based coastal and flood protection need to be restored to protect vulnerable communities.

1.2 | Restoration

Large-scale ecological restoration projects have gained significant traction in recent years, with research suggesting that the restoration of the planet's most degraded areas in combination with the protection of biodiversity hotspots could significantly boost carbon sequestration capacity while preventing about 70% of predicted species extinctions (Strassburg et al., 2020). The prominence of restoration has been further encouraged by the Bonn Challenge, which aims to restore 350 million ha of degraded and deforested lands by 2030, and the United Nations Decade on Restoration, which aims to spur actions to prevent, halt and reverse the degradation of ecosystems on every continent and in every ocean.

Restoration as a solution to jointly address the biodiversity and climate change crises is, however, far from straightforward in times of rapid changes in environmental conditions, with many of the issues identified so far exemplifying the complexity of meeting both biodiversity and climate goals with NbS. For example, the implementation of some restoration projects (such as wetland restoration) can have opposite effects on climate change mitigation and adaptation (e.g. increased coastal wetland coverage may lead to both increased greenhouse gas emissions and increased protection against extreme natural events; Cohen-Shacham et al., 2016; Huertas et al., 2019). Different projects may impact different dimensions of biodiversity, raising cost-effectiveness and prioritisation issues (e.g. how do you compare a restoration project that improves one dimension of biodiversity over a project that improves another?). Our understanding of how multiple stressors interact to shape biodiversity is limited (Cabral et al., 2019; Schulte to Bühne et al., 2021), and establishing targets for ecosystem restoration remains a significant challenge for most ecosystems (Perring et al., 2015; Pettorelli, Barlow, et al., 2018). Decisions on which site(s) to restore can profoundly affect outcomes and costs and may knowingly or unknowingly favour climate change mitigation/adaptation over biodiversity (or vice and versa; Strassburg et al., 2020). In addition, local increases in biodiversity do not automatically imply global biodiversity benefits, as, for example, restoration may simply increase the distribution of widespread generalist species (e.g. Lennox et al., 2018) not threatened with extinction.

2 | EVIDENCE GAPS AND RESEARCH NEEDS

An important step for nature and people is to significantly improve the integration of the biodiversity and climate change agendas so that win–win situations can be more easily identified; one cannot simply continue to independently manage landscapes, freshwater wetlands and seascapes for biodiversity conservation or climate change mitigation/adaptation, hoping that one will automatically benefit the other. Here, we identify five research areas in applied ecology where incomplete or poor information hinders the development of biodiversity and climate solutions.

1. *Agreeing on a framework to assess how climate change mitigation and adaptation approaches benefit biodiversity conservation*. Our understanding of the short-term and long-term biodiversity benefits and disbenefits associated with the deployment of NbS remains limited. To address this knowledge gap, a framework for comparing biodiversity benefits across climate change mitigation and adaptation projects is required (Chausson et al., 2020). Research over the past decade has highlighted the potential importance of functional diversity for ecosystem functioning and resilience (Duncan et al., 2015); similarly, much work has been done to quantify ecosystem collapse risk in a standardised manner (Bland et al., 2017). Admittedly, there remain significant challenges associated with the identification of appropriate metrics of functional diversity (Malaterre et al., 2019) and the practical implementation of ecosystem risk assessments (e.g. Bland et al., 2018). Yet these developments could represent a promising route for identifying biodiversity metrics that can be compared across sites and over time.
2. *Tracking and predicting ecosystems on the move or ecosystems facing collapse*. Climate change is impelling a universal redistribution of life on Earth (Pecl et al., 2017). To date, most efforts to track and understand this redistribution have focused on species (see e.g. Pettorelli et al., 2019), but there is growing evidence that ecosystems' distributions are changing—and will change more—in the coming decades (Barlow et al., 2018). The current focus on species redistribution may not only hamper our ability to predict how biodiversity redistribution will impact ecosystem services delivery, but also hinder the development of conservation management strategies while impairing environmental impact assessments (Pettorelli, Schulte to Bühne, et al., 2018). Tracking ecosystems has been challenged by a lack of agreement on what ecosystems are, how many different types can be distinguished and what ecosystem collapse represents. Developments in ecosystem identification and typology (Keith et al., 2020), ecosystem risk assessment (Bland et al., 2017) and meta-ecosystem theory (Loreau et al., 2003) may however provide the much-needed framework to track changes in ecosystem distribution and identify ecosystems occupying environmental niches about to shift beyond the ecosystem's ecological limits. Such knowledge is key to identify areas where the restoration of existing ecosystems is likely to fail, but also to identify situations where restoration is the only option to avoid passing tipping points.
3. *Predicting the impacts of climate change on NbS effectiveness*. Changes in climatic conditions are not only a threat to biodiversity but may also jeopardise the effectiveness of management actions aimed at retaining and improving biodiversity. This issue has been highlighted for some time when it comes to factoring in climate

change in protected area designation (see e.g. Hannah et al. 2007) and the incorporation of climate change adaptation into protected area planning (see e.g. Wilson et al., 2020). However, our understanding of how climate change may affect the ecological and socio-economic effectiveness of other NbS is much less detailed (Chausson et al., 2020). Research suggests that the success and pace of restorative actions will be determined partly by local climate trajectories, with, for example, forest regrowth expected to be slower in hotter and drier climates. Similarly, precipitation anomalies are expected to alter greenhouse gas emissions from wetlands, with potential impacts on carbon benefits associated with wetland creation or restoration (Nisbet et al., 2016). Local climate trajectories are however shaped by multiple drivers, which include global climate change but also local land use management practices and pace of change: for example, deforestation and agricultural intensification both exacerbate local climatic trends in the Amazon, leading to hotter and drier tropical forest frontiers (Maeda et al., 2021; Mu et al., 2021). Despite recent advances in climate change predictions, our ability to predict local climate trajectories remains limited, hampering our ability to assess the local suitability of various NbS for climate change mitigation and/or adaptation.

4. *Developing the knowledge and evidence needed to identify solutions that match the temporal, spatial and functional scale of the challenges*. The temporal and spatial extents of the challenges posed by biodiversity loss and the climate breakdown have significantly increased over the past decades, with more species and more ecosystems at serious risk from climate change, and the potential for nature to support climate change mitigation and adaptation have been rapidly eroded. Yet the scale of the responses to biodiversity threats has contracted in many cases over the same period, with approaches such as restoration increasingly aiming to tackle global threats such as climate change with localised, small-scale responses (Bellwood et al., 2019). Developing the knowledge and evidence needed to expand activities from local actions to larger scale responses in a manner that effectively and appropriately address the scale of drivers of declines is an important priority for turning the tide on biodiversity loss and climate change. In many situations, this will require improving our understanding of the co-dependencies between ecosystems and adopting approaches that explicitly acknowledge the telecoupled nature of our world.
5. *Risk assessment*. Actions labelled as NbS do not automatically deliver biodiversity benefits, and, in some instances, their poor design and implementation can have catastrophic direct and indirect consequences for biodiversity and local communities (e.g. Townsend et al., 2020). Risks posed by NbS have been highlighted on an ad hoc basis, but never presented in a comprehensive and systematic manner. We need research that facilitates the emergence of improved risk assessment processes associated with NbS implementation, through, for example, the clear identification of direct and indirect ecological and social risks posed by these solutions to other aspects of the land, wetland or seascape, or the external risks that could undermine the permanence of NbS. The quantification of these risks will require the collection of information on the local socio-ecological context (Seddon et al., 2021). Adaptive management approaches (Walters, 1986) and the development of a typology of risks associated with NbS may be particularly useful for identifying NbS that risk (a) not achieving meaningful climate change mitigation/adaptation and/or biodiversity objectives on the site where implemented, (b) being culturally inappropriate, (c) threatening neighbouring populations of species or ecosystems or (d) being unsustainable (ecologically, socially or financially) in the long term.

3 | RESHAPING THE CURRENT POLICY CONTEXT

Advancing the research that underpins the deployment of effective solutions to the climate change and biodiversity crises is not enough to significantly improve humanity's odds to successfully deal with global environmental change—for this to happen, major systemic changes are required (Nature Editorials, 2021). An important priority is to address the substantial and chronic underfunding of global biodiversity conservation, and the existing disparities between resources allocated to climate change mitigation and adaptation, and resources allocated to biodiversity conservation (Barbier et al., 2018). Recent estimates for delivering on the current global vision for nature protection suggest a total annual biodiversity conservation bill of $100 billion, which greatly exceeds current spending by the international community on biodiversity, thought to vary between $4 and 10 billion each year (Barbier et al., 2018; Dinerstein et al., 2017). These numbers are dwarfed by the amount of funding dedicated to climate change mitigation and adaptation—in the European Union alone, over 201 billion Euros were spent on climate change over the period 2014–2020 (Grzelbieluch et al., 2018). If we are to truly recognise the biodiversity and climate change crises as posing comparable and connected threats to humankind, then investment in addressing them should be better balanced between them. Similarly, efforts to remove pervasive financial incentives that negatively impact biodiversity, such as harmful agricultural subsidies, need to be stepped up to match the current global push to promote low-carbon sectors and green finance schemes (van Veelen, 2021). Existing estimates suggest that subsidies harmful to biodiversity are starting to decline, but not as fast as one had hoped; for example, global fisheries subsidies in 2018 still totalling about USD 35.4 billion (Sumaila et al., 2019).

More broadly, a joint approach to tackle the biodiversity and climate crises requires much higher levels of integration between the biodiversity and climate change agendas, which are currently primarily determined by the UNFCCC and CBD, themselves functioning under different levels of resources and political leverage. Other UN conventions have scope and carry out activities that are relevant to climate change and biodiversity conservation, such as Ramsar and the UN Convention to Combat Desertification (UNCCD), but these conventions are even more under-resourced than the CBD. Communication between UN conventions on climate change and biodiversity is currently promoted through the UNCCD, CBD and UNFCCC Joint Liaison Group; however, this group meets relatively rarely (UNCCD, 2021) and any recommendation put forward by this group needs to be supported by the COP of the three Conventions. The scientific advice underpinning decisions made by these conventions is informed, among other things, by the work carried out by independent scientific panels, such as the International Panel on Climate Change (IPCC) and the International Platform on Biodiversity and Ecosystem Services (IPBES). Issues such as NbS to address the climate change crisis could equally fall under the remit of these panels, but the IPCC would be expected to synthesise evidence that ultimately relates to decisions relevant to climate change mitigation and adaptation, and the IPBES evidence that ultimately relates to decisions relevant to biodiversity. The Global Environmental Facility (GEF) is the major financial entity that receives and distributes funding to assist countries in meeting the objectives set by UN conventions; however, each convention is allocated a specific budget, and GEF is accountable to each COP, which decides on its program priorities (Figure 2). Furthermore, GEF funding in priority areas such as the tropics seems to be related to governance and political considerations rather than biodiversity (Reed et al., 2020). For the moment, there is thus no global, legally binding, platform dedicated to advancing an environmental agenda that equally supports biodiversity conservation and climate change mitigation and adaptation; nor is there a nominated scientific platform dedicated to assessing the evidence and issues around NbS and their implementation, or a clear, major funding mechanism that univocally enables countries to choose to invest in projects that equally support biodiversity conservation and climate change mitigation and adaptation. Because of the imbalances in resources and political power, this disjointed, administrative-heavy approach is unlikely to deliver on biodiversity, and therefore unlikely to deliver cost-effective solutions to the climate change crisis. There is thus an urgent need to identify, or create, scientific, political and funding bodies that (a) bring together and develop the science of NbS and (b) articulate priorities and commitments that integrate concerns on climate change and biodiversity.

An additional priority is to agree on a risk assessment and monitoring framework that enables the standardised quantification and comparison of biodiversity benefits associated with NbS across ecosystems and over time. Without this, it will be difficult for policymakers to ensure that investments in nature can deliver on both climate change and biodiversity, and that the biodiversity benefits associated with NbS for climate change mitigation and/or adaptation are relevant to global biodiversity conservation efforts in the long term. Discussions around the monitoring of biodiversity have been happening for a long time, with multiple approaches and frameworks presented over the years (Collen et al., 2013). Biodiversity benefits can moreover be direct (e.g. reduction in extinction risk) or indirect (e.g. reduction in threats posed to biodiversity), with both types of benefits considered equally valuable by a number of organisations, rendering the task of agreeing on a given metric difficult. Such discussions could be carried out under the auspices of a designated scientific body tasked to provide the evidence behind the implementation of NbS; this could help change the focus from how to monitor all aspects of biodiversity and biodiversity changes, to how to detect

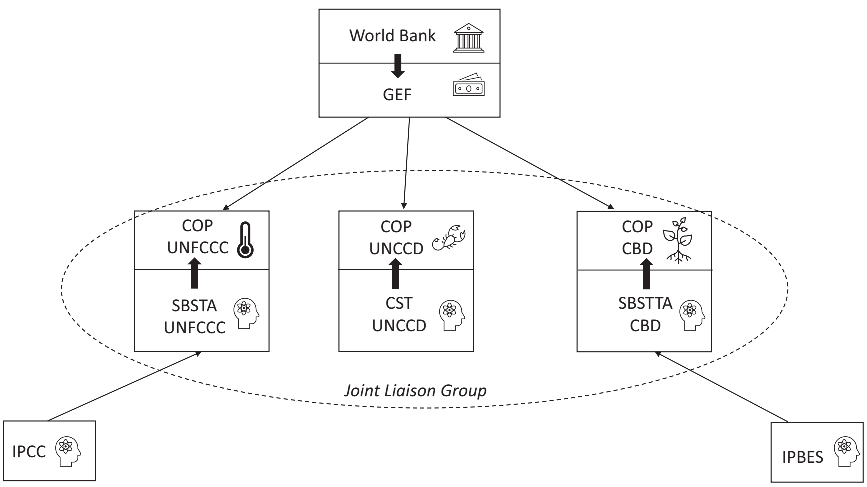

FIGURE 2 Global policy framework for tackling the biodiversity and climate crises. The United Nations (UN) Convention on Biological Diversity (CBD), the UN Framework Convention on Climate Change (UNFCCC) and the UN Convention to Combat Desertification (UNCCD) all have scope and carry out activities that are relevant to climate change and biodiversity conservation. Communication between UN conventions on climate change and biodiversity is currently promoted through the UNCCD, CBD and UNFCCC Joint Liaison Group. The science underpinning decisions made by these conventions is provided by the Subsidiary Body on Scientific, Technical and Technological Advise (SBSTTA) for the CBD, the Subsidiary Body for Scientific and Technological Advice (SBSTA) for the UNFCCC and the Committee on Science and Technology (CST) for the UNCCD. These advice bodies can collaborate with independent scientific panels, such as the International Panel on Climate Change (IPCC) and the International Platform on Biodiversity and Ecosystem Services (IPBES). The global Environmental Facility (GEF) established by the World Bank is the major financial entity that receives and distributes funding to assist countries in meeting the objectives of the CBD, UNFCCC and UNCCD; however, each convention is allocated a specific budget, and the GEF is accountable to each Conference of the Parties (COP), which decides on its program priorities

when local management actions are associated with significant benefits for global biodiversity.

Finally, there is a need for an overhaul of current environmental legislation to better support biodiversity conservation in times of rapid changes in climatic conditions. In many countries, legislative frameworks relevant to environmental management indeed focus on in situ conservation and the preservation of historical conditions, which have favoured the implementation of conservation projects aiming to restore previously observed benchmarks. However, global environmental change is driving some species far beyond their traditional ranges and some ecosystems far beyond their limits: in such situations, restoring historical conditions may not be a realistic objective, and the facilitation of the emergence of novel ecosystems may prove a more sensible and cost-effective alternative to jointly address the biodiversity and climate change crises. Policy based on a 'compositionalist' paradigm, predicated on the preservation of particular species assemblages and habitat types, thus need to evolve to also consider the benefits of a 'functionalist' paradigm, where the emergence and protection of resilient, resistant ecosystems is also valued (Pettorelli, Barlow, et al., 2018).

4 | CONCLUSIONS

Climate change can interact with other pressures to reduce biodiversity (see e.g. Cabral et al., 2019; Schulte to Bühne et al., 2021): a cohesive, multi-pronged approach to conserving biodiversity is therefore necessary. NbS can represent an additional, complementary, valuable way to address societal challenges, but broad joined-up thinking among scientific and practitioner communities involved in natural resource management is required to establish where and how NbS potential is best realised. Without it, some societal challenges may be inadvertently prioritised over others; opportunities to jointly and efficiently address these challenges using NbS may be missed; and the biodiversity benefits promised by NbS may seldom materialise. The current institutional set up is, however, not favouring integrated thinking, thereby hampering the rapid identification, prioritisation and implementation of solutions that deliver benefits on multiple fronts without biodiversity costs; it needs reforming.

The first priority to tackle the current global environmental crisis is to transition economies around the world to a sustainable, low-carbon future. The upcoming COPs present a clear policy window for addressing this priority, but also for addressing many of the issues and challenges detailed in this contribution. To progress environmental efforts that fully integrate the climate and biodiversity agendas, we argue this window should be used to (a) address the substantial and chronic underfunding of global biodiversity conservation, (b) remove financial incentives that negatively impact biodiversity and/or climate change, (c) develop higher levels of integration between the biodiversity and climate change agendas, (d) agree on a monitoring framework that enables the standardised quantification and comparison of biodiversity gains associated with NbS across ecosystems and over time and (e) rethink environmental legislation to better support biodiversity conservation in times of rapid climatic change.

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N.P. led the writing of the manuscript; all authors contributed critically to the drafts and gave final approval for publication.

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