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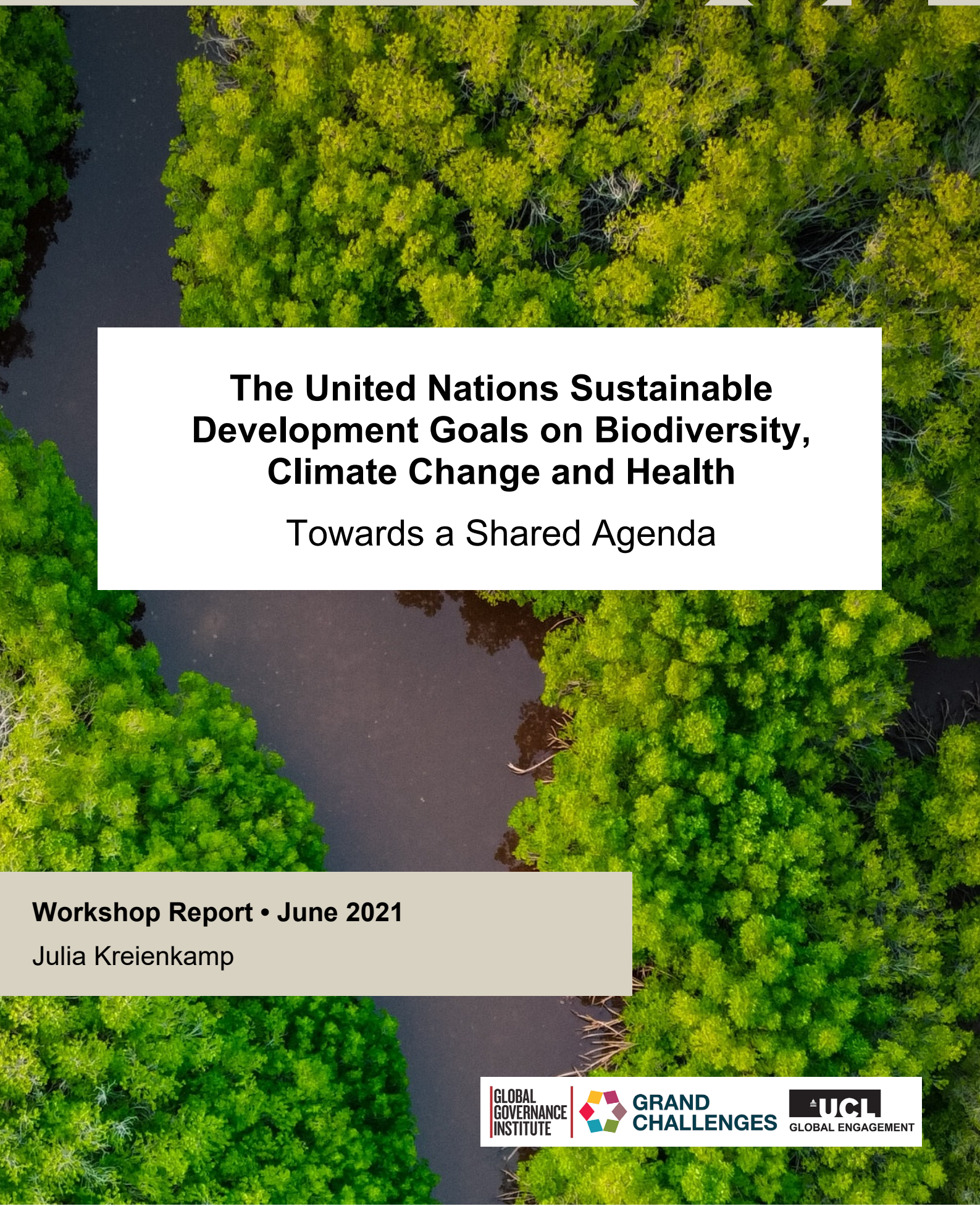

The United Nations Sustainable Development Goals on Biodiversity, Climate Change and Health

Towards a Shared Agenda

Workshop Report • June 2021

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A Shared Agenda for the United Nations Sustainable Development Goals on Biodiversity, Climate Change and Health

A stable climate and healthy ecosystems provide the basic underpinnings of human welfare and development. Failure to tackle global warming, mass biodiversity loss and other pressing environmental problems threatens the achievement of every single one of the Sustainable Development Goals (SDGs), with catastrophic consequences that will hit the poorest and most vulnerable communities first and hardest (UNEP 2021). International action has not matched the scale of the challenge. The adoption of the 2015 Paris Agreement on climate change has been a major milestone, delivering a roadmap for global decarbonisation. However, in terms of implementation, the international community remains largely off track and, without rapid systemic change, global temperature rises could breach the crucial threshold of 1.5°C as early as 2030 (Masson-Delmotte et al. 2018). When it comes to biodiversity, the track record does not look better. Of the twenty Aichi Biodiversity Targets agreed in 2010 none have been fully met a decade later (CBD 2020) and policymakers around the world are only just starting to grasp the devastating consequences of mass extinctions and accelerating ecosystem degradation (Watson 2019).

The decade ahead will be critical for redefining humankind's relationship with nature. In 2020, COVID-19 disrupted what was meant to be a 'super year' for biodiversity, climate change and sustainable development (UNEP 2019). At the same time, the pandemic has highlighted the deep interlinkages between human, animal and environmental health as well as the critical importance of tackling inequalities in order to enhance resilience to future shocks. UN Secretary-General António Guterres has now declared 2021 as the year to "reconcile humanity with nature" (Guterres 2021). Among other activities, this year will see two key global summits – the twenty-sixth Conference of the Parties (COP-26) to the United Nations Framework Convention on Climate Change (UNFCCC) in Glasgow, Scotland, scheduled for early November, and the fifteenth Conference of the Parties (COP-15) to the Convention on Biological Diversity (CBD) in Kunming, China, scheduled for October. COP-26 provides a crucial opportunity to review and strengthen national climate plans as well as finalise outstanding sections of the Paris Agreement's implementation guidelines. Meanwhile, COP-15 is expected to deliver a new global framework of

decadal targets for biodiversity to ensure that, by 2030, the world is on a path to achieve the CBD's 2050 vision of “living in harmony with nature” (CBD 2018a).

There is growing recognition that the climate and biodiversity emergencies are mutually reinforcing and cannot be addressed in isolation. Accelerating global warming is among the main direct drivers of change in nature, threatening the integrity and functioning of terrestrial, coastal and marine ecosystems (Díaz et al. 2019). In turn, the decline of vital ecosystems such as forests, mangroves and wetlands weakens their ability to act as natural carbon sinks, making it more difficult to mitigate global warming (Masson-Delmotte et al. 2020). Well-functioning ecosystems can also make vital contributions to climate change adaptation and disaster risk management, for example by providing protection from landslides or flooding. Yet, until recently, climate change and biodiversity have been largely treated as separate issues and there is still a lack of exchange and collaboration between expert and policy communities working in these areas. This is problematic because responses to climate change and biodiversity loss often have implications for the other, both positive and negative. The SDGs provide a useful albeit underutilised integrative framework in this regard, enabling collaborative governance across a set of interrelated transboundary issues.

This report builds upon the discussions of a workshop on “A Shared Agenda for the United Nations Sustainable Development Goals on Biodiversity and Climate Change,” hosted virtually on 4 May 2021 by the UCL Global Governance Institute (GGI), with support from UCL Grand Challenges and the UCL Global Engagement Office. The workshop brought together a diverse group of experts to discuss the need for more policy exchange and cross-disciplinary collaboration across SDGs related to the natural environment – those focused on climate action (SDG 13), life below water (SDG 14) and life on land (SDG 15) – exploring also why this is key to the achievement of other SDGs, in particular SDG 3 on good health and well-being. This report provides a summary of the discussion, with a focus on three major themes: (1) intergovernmental action at the interface of climate change and biodiversity, (2) the prospects for Nature-based Solutions (NbS) to deliver simultaneous benefits for biodiversity, the climate, and people, and (3) the interconnections between environmental changes and human health and their governance implications.

KEY TAKEAWAYS

- The 17 Sustainable Development Goals (SDGs) are interdependent and must be pursued together. Ultimately, the three goals related to the natural environment (SDGs 13, 14 and 15) underpin the delivery of all the other SDGs. Without rapid and coordinated action to address climate change, biodiversity loss and other pressing environmental challenges, the planet may soon be unable to sustainably support human development needs. Conversely, failure to meet the SDGs focused on human wellbeing and infrastructure could increase pressure on the planet and will greatly exacerbate exposure of vulnerable populations to climate and biodiversity-related risks. Thus, integrated action to implement the SDGs must be responsive to both biophysical reality and social context, including excessive and growing levels of inequality. Rapid systems-wide transitions are needed to reconcile our economies and societies with biophysical reality. COVID-19 could provide an important impetus to update legacy institutions at all levels of governance in order to deliver action on sustainability. However, such efforts must guard against siloed, narrow approaches and top-down 'fixes' to avoid adverse and unintended effects.

- Anthropogenic climate change and biodiversity loss share common drivers and dynamics. Both arise from socio-economic systems that incentive the overexploitation of planetary resources and their impact will be felt first and foremost by already disadvantaged communities, especially those residing in low-income countries. Yet, a fragmented global

governance landscape hampers efforts to address these issues in a more integrated manner. Intergovernmental institutions governing climate change and biodiversity have largely developed in isolation. There are multiple barriers to regime defragmentation, including institutional divisions and a lack of congruence of negotiating teams, which is often mirrored in siloes between national-level ministries and agencies. However, momentum is now growing to connect agendas in an effort to exploit synergies and avoid trade-offs, in particular in the wake of the Paris Agreement and the proliferation of net-zero emissions goals which has resulted in increased political interest in natural carbon sinks and decarbonisation technologies, with wide-ranging implications for biodiversity. Cross-cutting engagement between global organisations working on the science-policy interface – the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) – also provides opportunities for mutual learning and greater conceptual alignment.

- Unimpaired ecosystems provide a multitude of services for human welfare and the climate. Nature-based Solutions (NbS) aim to protect, restore and maintain natural or human-modified ecosystems with a view to addressing a range of societal challenges. They cover a variety of actions, from 'rewilding' natural habitats to greening cities to implementing regenerative agricultural practices, such as agroforestry. If designed well, NbS can advance biodiversity conservation as well as climate change mitigation and adaptation efforts, while helping local communities prosper. Forests in particular have received growing attention, given their critical role in carbon sequestration. Yet, narrow approaches to climate-focused NbS, often centred on large-scale tree planting, that do not take biodiversity science and/or local perspectives into account risk creating adverse effects while distracting from the urgent need to decarbonise the economy. If carefully designed, implemented, and monitored, NbS have the potential to deliver a 'triple win' for climate action, biodiversity and sustainable development. However, NbS do not offer silver bullet solutions and safeguards are needed to prevent them from inadvertently causing harm to nature or humans. Above all, NbS should be planned, designed and implemented for and *with* people to ensure that local needs, experiences and knowledge are taken into account.

- COVID-19 has served as a reminder that human health and wellbeing is inextricably linked to the health of the planet. About one quarter of the global burden of disease is attributable to environmental factors. Importantly, environmentally mediated health risks interact with and are constituted by social determinants of health – the wider set of societal drivers that affect health outcomes. Thus, the health risks posed by climate change, ecosystem degradation, pollution and other environmental problems are not distributed equally across populations but predominantly shaped by (and reinforcing of) existing socioeconomic inequalities. Efforts have been made to advance more holistic and integrated health agendas, bringing together a diversity of sectors and disciplines, with a view to inspiring concrete interventions (including NbS) that can deliver environmental as well as equitable health benefits. However, translating these concepts into action remains a key challenge, especially given the lack of effective evaluation tools and documented implementation evidence. Ultimately, a focus on the health, wellbeing and social justice implications of climate change and biodiversity loss also puts the spotlight on the people that governance interventions – whether at global, national or local levels – are meant to serve and the need to amplify their voices with a view to enabling bottom-up reform and innovation.

Advancing Human Development Within Planetary Limits

The Sustainable Development Goals (SDGs) are a set of 17 interlinked global goals and 169 sub-targets, adopted unanimously by all United Nations member states in 2015. They form the core of the 2030 Agenda for Sustainable Development, which seeks to provide a "blueprint to achieve a better and more sustainable future for all" by 2030 (United Nations n.d.). The SDGs cover a wider range of interdependent challenges, from ending poverty and hunger to enabling inclusive economic growth, improving health and education, tackling inequalities, promoting peace and justice, and protecting the climate and environment. They seek to inspire "a spirit of strengthened global solidarity," with goal 17 explicitly calling for strong partnerships across countries and sectors as a critical means to achieving sustainable development (UNGA 2015).

There is wide recognition that, to achieve the SDGs, an integrative approach is needed that takes into account both synergies and potential trade-offs between the goals. However, "there is little evidence that this is happening in practice," in particular when it comes to action on climate change (SDG 13) and biodiversity (SDG 14 and 15) (Seddon et al. 2020a, p. 1). Failure to implement the environmental goals in an integrated manner comes, ultimately, at the expense of all the other SDGs. For example, as we explore further below, the environment is a major underlying determinant of health (SDG 3) and interventions to limit climate change and ecosystem degradation can significantly reduce associated health risks. Such interventions, in turn, must be aimed at transforming socio-economic systems and infrastructures in a manner that is just and inclusive. To illustrate the interrelationships between SDGs focused on human wellbeing (1, 3, 4, 5, 10, 16), infrastructure (2, 6, 7, 8, 9, 11, 12), and the natural environment (13, 14, 15), Waage et al. (2015) have developed an analytical framework that organises these goals into three concentric layers:

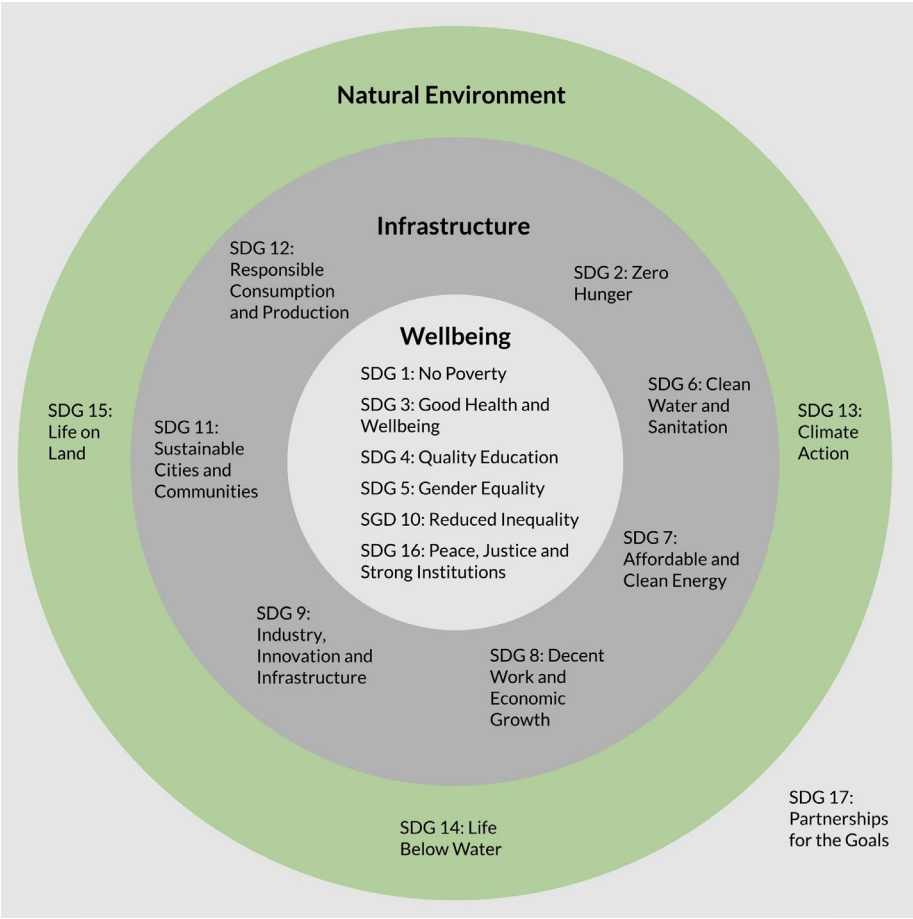

Image 1: Framework for showing interactions between the SDGs, based on Waage et al. (2015). The layered presentation serves to categorise SDGs but does not imply a hierarchy of goals or a linear direction of causation.

The integrity of the planet's biophysical systems – the outer layer of environmental goals – provides the foundation upon which all human-build systems rest. Yet, institutional delivery mechanisms for these goals remain weak and disconnected (Waage et al. 2015). Importantly, the outer layer also represents hard limits for human economic development. Among the most prominent efforts to conceptualise and quantify these limits is the planetary boundaries framework, first developed in 2009 by a group of environmental scientists. It defines a "safe operating space for humanity," delimited by a set of nine key biophysical variables that regulate the stability of the Earth system (Rockström et al. 2009). In other words, efforts to implement the SDGs aimed at improving human wellbeing and infrastructure must take account of the planet's 'safety margin' – the gap between current human pressure on the planet and the maximum pressure that Earth can support in the long term (Randers et al. 2018). Alarmingly, for almost half of the planetary boundaries, this safety margin has already been crossed (Steffen et al. 2015). There is growing recognition that, if we want to live in a world that is environmentally viable as well as just, peaceful and inclusive, we have very little – and continually shrinking – room for manoeuvre (Raworth 2017). Thus, going forward, a key question is how political reality can "be brought into alignment with biophysical reality to ensure our societies do not prosper at the expense of the ecological life support systems upon which they ultimately depend" (Pegram and Kreienkamp 2021). As outlined in this report, squaring human development with climate and environmental protection will first require that we step out of disciplinary, sectoral and policy silos with a view to designing more integrated governance mechanisms on the global, national and local level.

Intergovernmental Institutions at the Interface of Biodiversity and Climate Change

The international institutional landscapes for climate change and biodiversity governance have developed largely in isolation. Although climate change governance has a shorter history, it has long dominated the global environmental agenda. This is partly because, in contrast to climate change, biodiversity loss has rarely been framed as a quintessentially global challenge. As Gupta and Dube (2018) note, under international law, biodiversity is considered "a national resource that has to be protected under national jurisdictions, while the atmosphere, and hence climate, is considered a global common." Biodiversity has also proven more difficult to define, measure and operationalise. We can track anthropogenic emissions and changes in the concentration of greenhouse gases (GHGs) in the atmosphere with reasonable accuracy. However, there is no single metric that captures the variability among all living organisms and the different ecosystems that they form part of.[1] In fact, the vast majority of species on Earth remain unknown to humans (Latty and Lee 2019).

Despite these differences, climate change and biodiversity loss share many attributes. Both are extremely complex, multifaceted challenges that are systemically produced and/or amplified by human activity (Kreienkamp and Pegram 2020). Because they are mutually reinforcing and share many underlying drivers, they also present opportunities for shared solutions. However, on the global level, these opportunities remain largely underexplored and siloed approaches to climate change threaten to aggravate biodiversity loss. This section provides a brief overview of the existing intergovernmental landscapes for climate and biodiversity governance and explores the prospects for more cross-cutting engagement.

[1] The full definition of biodiversity ('biological diversity'), as contained in the Convention on Biodiversity (CBD) is "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (CBD 1992, Art. 2).

The global climate change regime

The issue of human-induced global warming was brought onto the international political agenda in the late 1980s, notably with the establishment of the Intergovernmental Panel on Climate Change (IPCC) and the first discussion of the problem in the UN General Assembly in 1988. Negotiations were launched in 1990, leading to the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and its opening for signature at the Rio Earth Summit that same year. The overarching aim of the UNFCCC is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system… within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (UNFCCC 1992, Art. 2). The Convention establishes that industrialised countries should take the lead in this effort, based on the principle of 'common but differentiated responsibilities and respective capabilities' (CBDR-RC), that is, their greater responsibility for climate change and greater financial and technological capacity. As a framework convention, the UNFCCC itself spells out few binding obligations beyond reporting and review requirements, but it enables the adoption of complementary legal instruments with more specific content. The first such instruments, the Kyoto Protocol, was adopted in 1997. For the first time, it established legally binding emission cuts, albeit only for industrialised states, in line with the principle of CBDR-RC.

The Kyoto Protocol was partly modelled on the uniquely effective 1987 Montreal Protocol, which governed the phase out of ozone-depleting substances (Held and Roger 2018). However, it became soon clear that the success of the global ozone regime would not be so easily replicated. From the start, negotiations under the UNFCCC were characterised by deep divisions, relating to the legal character of international obligations as well as the division of responsibilities. Over time, these divisions only grew as the United States, under a new Republican Administration, refused to ratify the Kyoto Protocol. The Kyoto Protocol eventually entered into force, triggering wide reaching policy changes in participating countries, including the spread of climate legislation and introduction of emissions trading in the EU. Although it faced numerous problems, the Protocol's Clean Development Mechanism (CDM) also pioneered project-based mitigation activities in low-income countries, while introducing an adaptation fund to support the most vulnerable countries. The absence of US support, however, meant that most high-income countries outside the EU refused to participate in a second commitment period to 2020. Emissions in emerging economies rose quickly (China overtook the US as the world's largest emitter around 2007), and climate vulnerable countries grew increasingly concerned about the regime's emphasis on mitigation. At the same time, parties struggled to agree on a successor treaty, with a key summit in Copenhagen in 2009 failing to deliver a binding agreement. The Copenhagen Summit did, however, sketch out the contours of the next phase of the regime, including voluntary pledges, a 2°C long-term temperature target, and a financial assistance goal of 100 billion per year by 2020 with a new Green Climate Fund to assist low-income countries.

Following the relaunch of negotiations in 2011, the twenty-first Conference of the Parties (COP-21) finally saw the adoption of a new global climate treaty – the 2015 Paris Agreement. The Agreement has been widely hailed as a historic milestone. For the first time, it establishes a long-term collective goal of keeping global average temperature rises to 'well below' 2°C above pre-industrial level, with an aspirational temperature goal of 1.5°C. It also specifies that, in pursuing this goal, parties aim to "to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (UN 2015, Art. 4.1), essentially establishing a global 'net zero' emissions target. Beyond mitigation, the Paris Agreement attends to a range of other issues, notably introducing a new global goal on adaptation. Unlike the Kyoto Protocol, the Paris Agreement includes no legally binding targets. Instead, it establishes a number of procedural obligations, with all state parties committing to submit voluntary pledges or 'nationally determined contributions' (NDCs), which must be updated every five years and progressively strengthened

over time. To facilitate this, parties must also engage in a five-yearly 'global stocktake,' a collective review of progress and implementation.

In terms of delivery, the Paris Agreement remains a "promissory note" (Christoff 2016). As an institutional innovation in global climate governance, the Paris Agreement has seen unprecedented levels of engagement. Having survived the temporary withdrawal of the United States under the Trump administration, the Agreement enjoys virtually universal participation by states. It has also encouraged a wave of climate commitments by sub- and nonstate actors, such as cities, businesses and investors, including through global-level platforms such as the 'Global Climate Action Agenda' (Hale 2016; Chan and Amling 2019) However, high levels of engagement do not automatically translate into high levels of action. To avoid potentially catastrophic levels of global warming, we need to see "rapid and far-reaching transitions" across socio-economic systems (Masson-Delmotte et al. 2018, p. 15). So far, systemic change is not forthcoming. Although many state parties have submitted new and strengthened NDCs throughout 2020 and early 2021, notably in response to the April 2021 Earth Day Summit organised by US President Joe Biden, aggregate pledges are still wholly inconsistent with the 'safe' 1.5°C goal, currently adding up to 2.4˚C projected warming, if fully implemented (Climate Action Tracker 2021). Thus, the Paris Agreement's success ultimately hinges on whether it can induce national ambition to be scaled up quickly and significantly – and then be turned into concrete action aimed at deep decarbonisation.

The global biodiversity regime

Since the early 1970s, global biodiversity governance has grown into a fragmented landscape of Multilateral Environment Agreements (MEAs), housed within several specialist UN Agencies and Programmes (notably UNEP, UNESCO and FAO). The remit of most of these institutions is limited to specific species, sites or sectors, with the exception of the Convention on Biological Diversity (CBD). Like the UNFCCC, the CBD emerged out of the 1992 Rio Earth Summit. It has three overarching objectives focused on (1) the preservation of biodiversity, (2) its sustainable use, and (3) the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources (CDB 1992, Art. 1). This broad mandate was largely the result of a compromise between high- and low-income countries, with the latter pushing for the Convention to go beyond conservation and deal also with issues related to sustainable development and appropriate benefit sharing (McGraw 2002). The CBD has been widely ratified, with the notable exception of the United States.

While the CBD recognises biodiversity conservation as "a common concern of mankind" (CBD 1992, Preamble), it is deeply rooted in the principle of sovereignty and it includes few hard-law provisions. State parties are required to prepare National Biodiversity Strategies and Action Plans (NBSAP), however, unlike NDCs under the Paris Agreement, these plans are not subject to a strong procedural framework aimed at ensuring transparency and increasing ambition. Like the UNFCCC, the CBD is a framework convention that lays out broadly stated goals and principles while allowing for the negotiation of subsequent legally binding instruments. Two such instruments have been adopted to date, namely the Nagoya Protocol on Access and Benefit Sharing and the Cartagena Protocol on Biosafety. However, with regard to biodiversity conservation, state parties have opted for an approach based on non-binding global targets rather than additional protocols (Harrop and Pritchard 2011).

To date, the most comprehensive global effort to tackle biodiversity loss is the CBD's Strategic Plan for Biodiversity 2011–2020 (CBD 2010). It includes a set of 20 targets – known as the Aichi Biodiversity Targets – that address five strategic priorities aimed at (1) addressing the underlying causes of biodiversity as well as (2) tackling direct pressures, (3) halting the loss of biodiversity, (4) enhancing its benefits to all people, and (5) supporting implementation of responses. The targets were purposefully designed to be 'SMART' – sufficiently specific and measurable, ambitious yet realistic, and time-bound (i.e. setting clear deadlines) – as well as aligned with sustainable

development priorities (Maxwell et al. 2015). However, global assessments of progress indicate that the international community has failed to deliver on the Aichi Targets, meeting none fully and only six partially (CBD 2020). Implementation has been stymied by a range of factors, including insufficient clarity of targets, weak institutional frameworks, inadequate funding, lack of capacity and other obstacles to translating global targets into national policies. This year, the fifteenth Conference of the Parties (COP-15) is expected to deliver a new framework to guide global biodiversity governance over the next decade.

A significant relatively recent development in global biodiversity governance has been the 2012 establishment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Similar to the well-known IPCC, IPBES is an independent intergovernmental body operating at the interface of science and policy. However, IPBES has a broader remit than the IPCC (Brooks et al. 2014) and it takes a different approach to knowledge-gathering, with an explicit commitment to include different scientific disciplines, stakeholders, and knowledge systems, including local and indigenous knowledge (Díaz et al. 2015). Since its inception, IPBES has become an increasingly important voice on biodiversity and ecosystems. Beyond completing reports on various themes, including the most comprehensive global assessment of biodiversity and ecosystem services ever completed (Díaz et al. 2019), IPBES has also promoted conceptual innovation in the biodiversity space, advancing a novel framework that accounts for the complex interactions between nature and people and the benefits that healthy biodiverse ecosystems provide to humans (Díaz et al. 2015).

Linking the global climate and biodiversity regimes: opportunities and challenges

The linkages between global warming and biodiversity loss are at least partly reflected in international law. The UNFCCC Convention text acknowledges the impact of climate change on ecosystems as well as the critical role of natural carbon sinks in mitigation efforts (UNFCCC 1992, Preamble, Art. 2, Art. 4.c). In turn, the CBD Convention, while not explicitly mentioning climate change, emphasises the need to address the underlying drivers of biodiversity loss “at source” (CDB 1992, Preamble). Such cross-referencing in treaties, decisions and other documents has increased and strengthened over time. For example, the 2010 Aichi biodiversity targets take into account the urgent need to reduce climate pressures on vulnerable ecosystems (Target 10) and highlight the potential for healthy ecosystems to contribute to climate change mitigation and adaptation (Target 15). The most recent biodiversity summit (COP-14) in Sharm El-Sheikh, Egypt, produced a decision specifically addressing the need for joint biodiversity and climate change action, including through more integrated national strategies and action plans and the effective implementation of ecosystem-based approaches for climate change mitigation, adaptation and disaster risk reduction (CBD 2018b). In the climate domain, the Paris Agreement is the first treaty to explicitly acknowledge the importance of “ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity” (United Nations 2015, Preamble) as well as the need to incentivise “non-carbon benefits” of protecting natural carbon sinks, specifically forests (ibid, Art. 5.2). At the most recent climate summit (COP-25), state parties went further by underlining “the essential contribution of nature to addressing climate change and its impacts and the need to address biodiversity loss and climate change in an integrated manner” (UNFCCC 2019).

Yet, divergent priorities, principles and rules as well as a lack of institutional integration continue to compromise the performance of both the climate and the biodiversity regime and limit opportunities for cross-cutting action. High-level commitments to enhanced integration belie a global governance reality that remains insufficiently responsive to the complex interdependences between the most pressing environmental threats. The biodiversity community has been more attuned to these complexities, with the CBD COP regularly urging action to address the interactions between climate change and biodiversity conservation (Maljean-Dubois and Wemaere 2017). The CBD secretariat has also sought to link these issues, in an effort to strategically reframe “biodiversity from a passive

victim of climate impacts to an active part of climate change solutions" (Jinnah 2011, p. 40). In contrast, the UNFCCC has been more hesitant to embrace calls for regime defragmentation.

There are several barriers to greater integration. Although the UNFCCC and the CBD have a shared history as Rio Conventions, the fact that the former is not housed under the United Nations Environment Programme (UNEP) – the institution best placed to 'anchor' global environmental governance efforts in the wider UN system (Ivanova 2021) – limits opportunities to galvanise greater coordination and coherence (Van Asselt 2014). More targeted efforts to link agendas, such as the Joint Liaison Group for the three Rio Conventions,[2] remain institutionally constrained and underfunded (Maljean-Dubois and Wemaere 2017). There has also been political resistance from some state parties to formally link UNFCCC and CBD agendas, grounded in concerns that doing so could dilute the integrity of each regime and undermine long-standing regime-specific rules and principles. For example, low- and middle-income countries have been wary about negotiating climate relevant provisions under the CBD and other environmental conventions that do not explicitly enshrine the CBDR–RC principle, which requires high-income countries to take the lead in reducing emissions (BASIC Group 2021). Non-ratification of the CBD by the United States further complicates efforts to defragment the two regimes. There is also a marked lack of congruence between negotiating teams for each Convention, meaning that they work "on the basis of political instructions that lack coherence and integration" (Deprez et al. 2021, p. 14). Ultimately, this is also a reflection of the lack of coordination between relevant national ministries and institutions, highlighting the importance of addressing siloes at different levels simultaneously.

These barriers notwithstanding, momentum for greater integration is growing. Nature has been declared a priority agenda item for the upcoming climate summit in Glasgow (UK COP-26, n.d.) and climate-related concerns are likely to feature prominently at COP-15 in Kunming, which is expected to deliver the next set of biodiversity targets (CBD 2019). Within the UN system, the SDGs provide a widely accepted holistic global framework that links climate and biodiversity action to wider sustainable development and wellbeing goals. Beyond the UN, other intergovernmental platforms, such as the G7, have also acknowledged that climate change and biodiversity challenges "are inextricably linked and must be addressed together" (G7 2019). So far, progress towards this goal has been most pronounced in the domain of research collaboration and information exchange, driven in large part by the work of IPBES and the IPCC. Notably, this year has seen the release of a joint report, resulting from first-ever IPBES-IPCC co-sponsored workshop, which identifies areas for integrated action and emphasises the pitfalls of isolated approaches (Pörtner et al. 2021). Among other interventions, the report proposes that a shift in how we frame and measure progress and growth – away from a narrow focus on GDP and towards the integration of natural capital and other indicators of welfare – could present a powerful leverage point, galvanising transformative change for the climate, the environment and people (ibid, p. 22).

Progress is still lagging behind when it comes to integrated rule development on the international level, joint approaches to finance and capacity building, and – crucially – national implementation. Deprez et al. (2021) note that few state parties coordinate production of their NDCs under the Paris Agreement and their NBSAPs under the CBD and that national 'net-zero' strategies are often silent on their compatibility with biodiversity targets. In this context, deepening linkages across international regimes and national agencies offers concrete opportunities for enhancing the effectiveness and efficiency of policy interventions. For example, harmonisation of reporting or joint capacity building initiatives will not just alleviate the risk of counterproductive policies but could also save time and resources in the long run. In addition, there is significant potential for mutual learning, both in terms of national implementation experiences[3] and international institutional innovation. In

[2] Beyond the UNFCCC and the CBD, this also includes the United Nations Convention to Combat Desertification (UNCCD).

[3] The availability of high-quality data will be essential to encourage such peer-learning. An example of a project that seeks to gather and compare data on the implementation of environmental conventions is the Environmental Conventions Index (ECI n.d.).

the biodiversity space, clearer procedural requirements, similar to the Paris Agreement's 'pledge, review and ratchet' system, could help align national level action with global biodiversity targets (IUCN 2018). In addition, ongoing efforts to catalyse and promote non- and sub-state climate action under the Paris Agreement can provide valuable insights for building a broad-based 'global action agenda' for biodiversity (Pattberg et al. 2019). In turn, the climate community has much to gain by taking on board the insights, gathered by IPBES, on the complex interactions between nature and people as well as IPBES' experience with engaging a range of different epistemologies. This will also require more nuanced framings of appropriate intervention scales, recognising that, despite important differences, both climate change and biodiversity loss are multilevel governance challenges rather than either 'quintessentially global' or 'quintessentially local' problems.

The Dangers of Siloed Approaches to 'Net-Zero'

One of the most obvious overlaps between the global climate change and biodiversity regimes is in the area of land-use change and natural carbon sinks, notably forests. Carbon sinks have received growing attention in the wake of the Paris Agreement and the subsequent flurry of national 'net-zero' emissions pledges. Global initiatives targeting forests, such as the UNFCCC-led mechanism for Reducing Emissions from Deforestation and Degradation (REDD+), provide opportunities for the development of integrated strategies, aimed enhancing and protecting carbon-sequestering sinks while also delivering benefits for biodiversity as well as local livelihoods (Carrapatoso and Geck 2018). However, REDD+ has also raised concerns over potential negative impacts on ecosystem integrity and local communities. In response, a set of governance safeguards has been developed – with input from the CBD – to prevent unintended environmental or social harm through REDD+. Yet, it remains unclear whether REDD+ projects are indeed improving biodiversity on the ground (Duchelle et al. 2018), with ecological benefits often seen as a positive 'side effects' of carbon abatement and afforestation rather than goals in need of explicit articulation (Panfil and Harvey 2015). There are also concerns that an overemphasis on forests crowds out other issues of land-use change and their underlying drivers (Seddon et al. 2019). For example, while the biodiversity community has long promoted the importance of healthy soils as well as marine and coastal ecosystems, their critical contribution to climate mitigation and adaptation has only recently been fully acknowledged (Masson-Delmotte 2020; Hoegh-Guldberg et al. 2019).

On a deeper level, distorted interpretations of the net-zero emissions concept – those that focus primarily on the 'net' rather than the 'zero' – risk distracting from the urgent need to drive forward deep decarbonisation whilst promoting largely untested decarbonisation technologies. Most scenarios of pathways compatible with the Paris Agreement's 1.5°C and 2°C temperature goals assume the future deployment of negative-emissions technologies, such as bioenergy with carbon capture and storage (BECCS). BECCS involves extracting energy from biomass, for example by burning wood, crops, or agricultural waste for heat and electricity, capturing the carbon emitted and then storing it underground. Yet, application of this technology at scale is subject to major uncertainties and would require the mass cultivation of fast-growing monoculture biofuel crops, with potentially devastating implications for biodiversity as well as food, water and land availability (Dyke et al. 2021). Greater levels of cross-institutional and cross-sectoral collaboration on global, national and local levels will be necessary to develop effective safeguards to ensure that net-zero strategies are both nature- and people-positive and do not contain loopholes that allow for the delay of decarbonisation action.

Promises and Pitfalls of Nature-based Solutions

Growing recognition of the interlinkages between climate change, biodiversity and human wellbeing has inspired the (re-)deployment of practices that work with nature in order to address a range of challenges, from climate change to health, food security or disaster risk management. So-called Nature-based Solutions (NbS) aim 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" (Cohen-Shacham et al. 2016). NbS are grounded in the recognition that healthy, biodiverse ecosystems provide a vast array of critical but routinely undervalued benefits to humans. These benefits are often referred to as 'ecosystem services,' a term that was first popularised through the 2005 Millennium Ecosystem Assessment.[4] For example, forests, wetlands or coastal vegetation zones provide not only habitats for abundant wildlife but also play a key role in carbon sequestration, water and air purification, and the prevention of natural disasters, such as floods and landslides – among other tangible services (e.g. provision of raw materials) and less tangible benefits (e.g. recreation and spiritual connectedness). This section, provides a brief introduction into NbS, outlining their potential to deliver cross-cutting benefits as well as the pitfalls of narrow carbon-focused agendas.

NbS is a broad concept covering a range of actions, including protecting or restoring natural ecosystems, enhancing the sustainability of managed ecosystems (e.g. crop- or timberlands) or creating novel ecosystems. As such, it serves as an umbrella framework for a range of ecosystem-related approaches that can differ substantially, ranging from 'hands-off' recovery efforts, such as rewilding, to more engineered solutions, such as the provision of green urban infrastructures (Cohen-Shacham et al. 2019). NbS have also found application in agriculture, for example through the integration of trees and shrubs with crops and livestock or the enhancement of natural irrigation systems (Sonneveld et al. 2018). NbS are already being implemented all over the world, including in the UK, where interventions range from open coast realignment schemes for flood protection (RSPB n.d.) to large-scale habitat restoration projects (Cairngorms Connect n.d.) to smaller-scale support for recreational green spaces and wildlife havens. Nesshöver et al. (2017, p. 1216) suggest that a core "strength of the NBS concept is its integrative, systemic approach." Well-designed NbS are not just ecologically viable but implemented by and for people, fully engaging local and indigenous communities, and ensuring an equitable distribution of benefits (Seddon et al. 2021). Engagement of these stakeholders is not just ethically imperative but also crucial to success since many NbS build on local and indigenous knowledge and experience, sometimes encompassing practices that have been used for centuries.

NbS are quickly gaining traction in policy and practice, with high-level endorsements from a diversity of stakeholders. They already form an integral part of many national and regional strategies, including for example the European Green Deal (EEA 2021), the UK's Green Recovery Challenge Fund (UK Government 2020), or US President Joe Biden's recently updated climate plans (The White House 2021). On the global level, NbS have been highlighted as key interventions in recent IPBES and IPCC assessments as well as UNEP's 'Making Peace with Nature' report (UNEP 2021) and are expected to be important themes at both COP-15 in Kunming and COP-26 in Glasgow. In the climate space, a major focus has been on forest-based NbS and their potential to reduce the amount of carbon in the atmosphere. As a result, a number of ambitious tree planting initiatives have been launched across the globe, such as the Bonn Challenge, which seeks to restore 350 million hectares of forest by 2030, or the Trillion Tree Campaign, which provides a platform to bring together reforestation efforts from governments, NGOs, businesses and other actors from all over the globe. Tree planting has also become a popular marketing tool, promising

[4] IPBES has recently put forward a more inclusive framing of ecosystem services as "nature's contributions to people (NCP)" (Díaz et al 2018).

tangible action to reduce negative private sector impacts on the climate and the environment (Neimark 2018).

While the NbS concept has attracted much attention, its broad scope and lack of clarity risks creating confusion, implementation challenges, and unintended consequences. There is a danger that NbS become a meaningless 'buzzword' or, worse, are implemented in a way that is harmful to the environment and/or local communities. Above all, overdrawn expectation regarding their potential contribution to global climate action – with some estimating that NbS could deliver one-third of the of the mitigation action needed over the next decade (Griscom et al. 2017) – risk diverting attention and resources away from the urgent need to decarbonise the economy (Knoll and Brancalion 2020). In particular, the narrow focus on large-scale tree planting as a simple, low-cost climate 'fix' bears risks for ecosystems and livelihoods, especially where the use of monoculture plantations is favoured over the restoration of natural forests (Lewis et al. 2019) or where trees are planted to replace biodiverse non-forest ecosystems such as savannas and grasslands (Veldman et al. 2015; Bond et al. 2019). If the wrong trees are planted in the wrong locations, afforestation initiatives can even be counterproductive in terms of net carbon emissions (Di Sacco et al. 2021). Moreover, poorly designed and implemented NbS can negatively impact local communities, if land use rights are disrespected and active participation is discouraged (Seddon et al. 2021) or if they disrupt the flow of vital ecosystem services, including those related to water and food provision (Parr and Lehmann 2019). Finally, an overemphasis on ecosystem 'usefulness' under NbS frameworks may also distract from more traditional conservation approaches focused on specific species or protected areas.

Efforts have been made to provide more clarity on what kind of interventions should (not) count as NbS, how to measure impact, and how to safeguard against unintended and undesirable consequences. This includes, for example, the Global Standard for NbS developed by the International Union for the Conservation of Nature (IUCN) (IUCN 2020a). In line with the IUCN framework but with a particular focus on climate-related NbS, Seddon et al. (2021) have outlined four guiding principles to ensure that interventions benefit both nature and people and do not distract from other changes that are urgently needed to address global warming:

1. NbS are not substitutes for the rapid decarbonisation of our economies;
2. NbS are not just about forests but they involve the protection, restoration and/or management of a wide range of ecosystems;
3. NbS are implemented in partnership with indigenous peoples and local communities, and should be designed to meet their rights and needs; and
4. NbS should explicitly support biodiversity and ecosystem health in a measurable way.

Existing NbS standards, guidelines and best practice recommendations emphasise the value of cross-sectoral and transdisciplinary collaboration, with mechanisms that support active participation by all stakeholders, above all the people that ultimately drive implementation on the ground. A people-centric approach to NbS is based on the recognition that people are part of, rather than separate from, nature. As such, NbS are always interventions in social-ecological, rather than just ecological systems (Okpara et al. 2018). To be effectively implemented, they must be responsive to local context, including the specific livelihood needs and capacities, socio-cultural institutions and power dynamics within the community (Huff and Tonui 2017). Ensuring that all voices are factored into decision-making processes is important to promote ownership of NbS and anticipate, monitor and evaluate their effects on local communities. For example, women typically hold much of the knowledge and experience with regard to sustainably using and managing natural resources, yet they are not always afforded meaningful participation in decision-making over these resources (IUCN 2020b). To guard against NbS that co-opt rather than engage, people should be at the centre of NbS research, policy and practice.

If carefully designed, implemented, and monitored, NbS have the potential to deliver a 'triple win' for climate action, biodiversity and sustainable development. However, scaling up this potential will require more coherent governance frameworks, a substantial increase of available finance, and greater willingness to translate high-level endorsements into robust, operational and verifiable targets (Seddon et al. 2020a; 2020b). While there are no 'one size fits all' solutions, we can learn much from the successes and failures of existing NbS and consistent evaluation and monitoring will be key to build a stronger evidence base going forward. Above all, NbS should not be promoted as silver bullet solutions but instead "be integrated as one piece of a multifaceted approach to address complex environmental problems" (Knoll and Brancalion 2020, p. 580).

Opportunities for Private Sector Engagement

Accelerating climate change and environmental degradation pose significant risks to businesses and investors. This is especially true for sectors where capital is directly generated from natural resources. For example, biodiversity loss in soil has significant implications for agricultural production, with almost a quarter of the world's land surface already degraded (Díaz et al. 2019). Similarly, the loss of animal pollinators puts up to 8% of current global crop production at risk (IPBES 2017). More than a third of commercial fish stocks are currently overexploited, threatening the sustainability of the fishing industry and in particular small-scale fisheries, which are a vital source of income and food for many coastal communities (FAO 2018). Ultimately, all sectors and industries are at risk of being affected by food shortages and natural resource scarcity as well as disruptions to supply chains and business operations due to the increasing frequency and intensity of extreme weather events.

Companies and capital markets are also exposed to transitional risks, including loss of consumer and investor confidence or the threat of legal action, if they fail to adapt to stricter environmental regulations, evolving market preferences and technological change. Conversely, early investments in more sustainable business models will support long-term viability and decrease risk exposure. The multiple benefits generated by well-designed and carefully implemented NbS make them an attractive investment opportunity for private sector actors. Yet, huge investment gaps remain. For example, despite rapidly growing public and private sector support for forest restoration and conservation, only 13-17% of the total annual funding needs in this area are currently being met and, of the money provided, only a small fraction comes from the private sector (Faruqi 2016). There is also a risk that NbS facilitate 'greenwashing' if they are promoted as opportunities to 'offset' environmentally damaging practices, rather than one element of a wider shift towards climate and nature-positive business models.

Interactions between Environmental Change and Human Health

Human health and wellbeing is inextricably linked to the health of the planet (as illustrated in Image 1 above). About one quarter of the global burden of disease is attributable to environmental factors (Prüss-Ustün et al. 2016), a figure which is likely to increase in light of accelerating climate change, biodiversity loss and other forms of human-driven environmental change. The COVID-19 pandemic has put the spotlight on the growing threat from zoonotic diseases – infectious diseases that jump from animal to human populations – driven by increasing human encroachment on natural habitats, wildlife exploitation, climate change and other sources of biodiversity destruction. It is estimated that about 75% of newly emerging infectious diseases originate in animals (UNEP 2020). Beyond

zoonoses, rapid environmental change presents a multitude of direct and indirect threats to human health, including through heat stress, pollution from fossil fuel combustion, extreme weather events, as well as food and water insecurity, all of which contribute to the environmentally mediated global health burden by increasing the prevalence of infections and noncommunicable diseases (NCDs) as well as injury, poor mental health and malnutrition (WHO 2018). Ecosystem degradation, accelerated by and combined with climate change, also diminishes our ability to respond to such health threats, including by depleting natural products critical to drug development (Neergheen-Bhujun et al. 2017) and accelerating antimicrobial resistance (Keen and Montforts 2012). In turn, the health sector itself is contributing to environmental change, with an estimated climate footprint equivalent to more than 4% of global net emissions (Karliner et al. 2019).

Environmentally mediated health risks interact with and are constituted by social determinants of health. Social determinants are non-medical factors underpinning health outcomes, broadly defined as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life” (WHO n.d.). These determinants account for most of the entrenched health inequalities within and between countries, including the uneven distribution of adverse health effects from climate change, pollution and environmental change (WHO 2008). Health risks attributable to environmental factors disproportionally affect children, indigenous people, minorities, the poor and other vulnerable communities, especially those residing in low- and lower-income countries (Prüss-Ustün et al. 2016). Importantly, these communities have typically contributed least to the problem. As such, the debate on environmentally mediated health threats is closely connected to wider social justice agendas and concerns over systemic power inequalities at global, national and local levels (Stephens and Church 2017). Air pollution is a particularly salient example for how health risks and vulnerabilities intersect with systemic inequalities and injustices. Differential exposure to air pollution, especially in urban settings, is well documented. In London, for example, where pollution stems mainly from road traffic, air quality is poorer in less affluent and ethnically diverse neighbourhoods – where residents themselves create few emissions because they are less likely to own a car (Aether 2019). Air pollution inequality is also growing between countries, as richer countries are effectively exporting emissions from the production of goods and services to manufacturing hubs in countries such as China and India (Haq 2017).

The COVID-19 pandemic has highlighted and, in many cases, exacerbated health and other inequalities stemming from social determinants. This is reflected, for example, in higher infection and mortality rates among ethnic minorities, poor communities, and other vulnerable populations (Mishra et al. 2021). In the UK, people from the most deprived areas were more than twice as likely to die from the virus than those in the most prosperous areas (PHE 2020). Adverse socio-economic consequences of lockdowns and other public health restrictions have also disproportionally affected already disadvantaged groups, including women, young people, and those in low-paid, low-skilled and precarious employment (Blundell et al. 2020; ILO-OECD 2020). Conversely, wellbeing benefits derived from lockdowns, such as more time spent in nature and green spaces, were more accessible to affluent populations (Gray and Kellas 2020). On the global level, the socio-economic disruptions caused by the pandemic have reversed significant progress on many SDGs (Gates Foundation 2020), plunging millions into poverty and deepening income inequality (World Bank 2020). Although it is now widely acknowledged that growing inequality will leave the world as a whole less resilient to future shocks, including the risk of another pandemic, the COVID-19 crisis appears to have largely failed to infuse a heightened sense of collective responsibility and solidarity. This is perhaps most evident in the highly inequitable distribution of COVID-19 vaccines, with rich countries scrambling over scarce supplies while many poor countries stand little chance of achieving mass immunisation in the near future (De Jesus 2021).

There is an urgent need for more integrated conceptual and practical frameworks that can inform the formulation of policies and strategies aimed at mitigating environmentally and socially mediated health risks, enhancing the sustainability and resilience of public health systems, as well as enabling

an equitable distribution of the positive health benefits we derive from nature. Efforts have been made to facilitate a global-level shift towards more holistic and transdisciplinary health agendas, notably under the banners of One Health, EcoHealth, and Planetary Health (see box below). While these conceptual innovations have helped illuminate the nature of the problem, there is still only little engagement with the health impacts of climate and environmental change in relevant international fora (Dasandi et al. 2021). In addition, a lack of rigorously evaluated real-life implementation experiences limits opportunities to learn from failure and scale up success. Various actors around the world have started experimenting with Nature-based Solutions (NbS) and other interventions, aimed at delivering climate action with an explicit focus on health co-benefits. For example, growing concerns over air quality have prompted many cities to simultaneously tackle pollution and carbon emissions, through greening urban environments and promoting cleaner infrastructure (C40 2019). However, there is still a dearth of standards and best-practice guidelines to comprehensively account for the health co-benefits – and potential adverse side-effects – of such interventions (Hess et al. 2020). Projects such as the Pathfinder Initiative (LSHTM n.d.), which aim to systematically document and assess health-supporting climate actions, can help drive forward the development of effective evaluation tools. Translating such insights into practice will also require greater institutional integration of public health and other relevant government sectors on both national and local scales.

Crucially, refocusing attention on the health and social justice implications of climate change and biodiversity loss puts the spotlight on the people that governance interventions – whether at global, national or local levels – are ultimately meant to serve. UNDP's recent 'Peoples' Climate Vote,' the largest public opinion survey on climate change ever conducted, suggests that a majority of people across the world are deeply concerned about global warming and environmental degradation and support more wide-ranging action to tackle these crises (UNDP 2021). People are not just passive 'recipients' of governance. They can actively shape governance outcomes as voters, consumers or activists. Activism may be channelled through non-governmental organisations but it can also involve less formal, more confrontational tactics. Non-violent civil disobedience has emerged as an important tool of environmental activism, in particular for groups whose voices are usually absent or silenced in mainstream political discourses, including indigenous communities and young people. Global school strikes in response to the climate crisis, for example, have served as a powerful platform for children and young people, a constituency whose health and wellbeing is particularly affected by future environmental change but which is typically not yet able to vote in elections. Amplified by the savvy use of social media, "the school strikes are helping to shift global public opinion away from a technical discussion amongst a relatively small community of activists, policy experts, industry leaders and scientists, towards a broader, moral debate about our individual and collective roles and responsibilities for a more sustainable future" (Hayward 2020, pp. 3-4). Beyond 'disobedient' activism, youth groups and others have also increasingly pursued judicial avenues to push for greater climate and environmental protection, with some notable successes (Gerretsen 2021). However, growing environmental mobilisation has in many cases been accompanied by attempts to crackdown on civic space, from social media attacks to criminalisation to physical persecution (ICNL 2020; Snaith 2021). For many frontline defenders, activism has become increasingly dangerous, with lethal attacks against land and environmental defenders on a record high (Global Witness 2020). Protecting, supporting and amplifying such voices will be key to demonstrate how climate change and biodiversity loss are impacting the health, wellbeing, livelihoods and future opportunities of people all over the world, helping to galvanise global-level action.

Towards More Holistic Global Health Agendas

A range of concepts exist that aim to capture the interactions between environmental change and human health. Widely endorsed by international and national agencies, **One Health** stresses the need for collaborative and interdisciplinary approaches to address health challenges emerging at the interface of humans, animals, and the environment. While its scope is often defined quite widely, in practice, One Health approaches have focused primarily on bringing together the medical and veterinarian community to address emerging zoonotic diseases, antimicrobial resistance, and issues related to food safety (Mackenzie and Jaggo 2019). **EcoHealth** aims to promote "sustainable human and animal health and well-being, through healthier ecosystems," with a strong focus on "process, as well as outcome" (Waltner-Toews 2009, p. 519). It seeks to integrate concerns related to biodiversity, sustainable development, equity and participation and has more frequently included disciplines from the social sciences and humanities (Lerner and Berg 2017). **Planetary Health** is a more recent concept that is quickly gaining traction in the research and policy communities. Informed by the planetary boundaries framework (Rockström et al. 2009) and the need to safeguard health and wellbeing for all in the face of large-scale anthropogenic environmental change, Planetary Health has a broad focus on "the health of human civilisation and the state of the natural systems on which it depends" (Whitmee et al. 2015, p. 1978).

Although there are differences between these approaches in terms of their core focus and contributing disciplines (Lerner and Berg 2017), their values and visions are largely complementary. In particular, they share a recognition that human health and wellbeing cannot be conceptualised and addressed in isolation from environmental drivers and that more comprehensive, systems-based approaches are necessary to address complex health issues under the wider framework of the 2030 Agenda for Sustainable Development. Going forward, a major challenge will be to take these frameworks "from concept to decisive action" (Pongsiri et al. 2019) and developing adaptive multi-level governance tools and institutions capable of effectively advancing more integrative agendas.

Conclusion: Towards a Shared Agenda on Biodiversity, Climate Change and Health

Legacy socio-economic systems are increasingly at odds with biophysical reality. Over the past fifty years, while the human population has doubled and global gross domestic product (GDP) has seen a four-fold increase, GHG emissions have increased dramatically and biodiversity has been in constant decline, with other measures of environmental sustainability similarly affected (UNEP 2021). Meanwhile, more than 8% of the global population remain in extreme poverty, hunger and food insecurity are on the rise, 2.2 billion people remain without safe drinking water, and about half of the world's population lack access to essential health services (United Nations 2020). These and other development indicators will be negatively affected by the devastating impact of the COVID-19 pandemic, pushing the world further off track of achieving the 2030 Agenda for Sustainable Development. A systems-wide transition is needed to address these threats to human welfare within the parameters of what the Earth can support.

Change needs to happen fast. To deliver on the aspirational 1.5°C goal of the Paris Agreement, the global community needs to reduce GHG emissions by 45% over the next decade and reach net-zero emissions by 2050 (Masson-Delmotte et al. 2018). At the same time, the accelerating loss of

biodiversity urgently needs to be halted and reversed, which will require addressing a range of underlying drivers, above all rapidly changing land and sea use (Díaz et al. 2019). The good news is that there are many synergies between these goals, which can be exploited to also deliver tangible benefits to human communities around the globe. However, top-down imposition of narrowly defined agendas – such as the promotion of large-scale monoculture tree plantations for carbon sequestration – threaten to undermine this potential.

There is increasing recognition that the climate and biodiversity emergencies need to be addressed together. However, many of the high-level commitments made – including the flurry of calls for a 'green recovery' from COVID-19 – are yet to be turned into action. To ensure that such action is both environmentally and socially sustainable, we need concepts, models, tools and institutions that value the critical contributions of nature to human wellbeing. We also need governance frameworks that guard against siloed approaches by enabling cross-sector, transdisciplinary collaboration as well as broad participation, grounded in the recognition that the burden of climate change and biodiversity decline is not equally shared. Such frameworks already exist (the SDGs being the most prominent) but remain underutilised. Ultimately, a shift towards ambitious integrative action will require disrupting path dependencies in the ideas and practices that shape our socio-economic systems, notwithstanding powerful vested interests in the status quo – something that will be impossible without significant political will.

Research has an important role to play in galvanising such political will and in driving forward integrative perspectives on interlinked sustainable development challenges. Working across disciplinary boundaries remains challenging for a number of reasons, including institutional obstacles, methodological and conceptual barriers, time constraints, vested interests in protecting disciplinary identities – but also the sheer complexity involved in thinking holistically about global-level problems. Yet, ultimately, successful transdisciplinary collaboration can make this task less intimidating. "Boundary objects" – ideas, concepts or tools that offer enough interpretive flexibility to travel between discipline (Star and Griesemer 1989) – can help create shared space to identify common drivers and solutions. For example, the ecosystem services framework or the social determinants of health concept both have the potential to serve as useful boundary objects driving forward transdisciplinary discussion on the environmental SDGs and their interactions with health and other sustainable development objectives (Ford et al. 2015; Graham and White 2016). Even more fundamentally, a wider change of mindset could challenge some of the boundaries that we habitually draw between the environment and the social world, recognising that humans are part of nature and that social disparities are often at the root of environmental problems.

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