



## Making Global Climate Action work for nature and people: Priorities for Race to Zero and Race to Resilience

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### ABSTRACT

There is increasing recognition in science and policy that the current nature and climate change crises are highly intertwined, and that these need to be jointly addressed. Within the United Nations Framework Convention on Climate Change (UNFCCC), the Race to Zero (R2Z) and the Race to Resilience (R2R) campaigns foster climate action by cities, regions, businesses, investors, and civil society organizations for mitigation and adaptation. The campaigns are part of UNFCCC-backed institutional arrangements linking intergovernmental climate governance with actions beyond national commitments to support the implementation of the Paris Agreement, also referred to as the Global Climate Action Agenda (GCAA). Both mobilization campaigns highlight and promote the contribution of nature to climate mitigation, adaptation, and resilience. Yet, the integration of nature in climate ambition is more complex than indicated in the calls to action. We here identify key areas of concern in the alignment of climate and biodiversity goals, discussing the biophysical and socio-ecological considerations relative to (i) practices for enhancing land-based and marine sinks to limit warming; (ii) the unpredictability of biodiversity dynamics under climate change; (iii) the spatial scale at which actions can be implemented; and (iv) the types of metrics that can be used for tracking progress. We provide recommendations for the two mobilization campaigns to integrate in their criteria and metrics frameworks to support effective and equitable actions that deliver for climate, but also for nature and people. We then make a call to action for transdisciplinary knowledge production and dissemination that strengthens science-policy interactions.

### 1. Introduction

The vital contribution of nature to climate mitigation and adaptation has gained increased recognition in science and policy. In a pivotal decade for action for climate and biodiversity, mobilization campaigns

are playing an important role in elevating leadership and ambition beyond national governments. Within the United Nations Framework Convention on Climate Change (UNFCCC), two mobilization campaigns endorsed by the Convention's Secretariat are mobilizing cities, regions, businesses, investors, and civil society organizations to undertake

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ambitious climate actions to limit global temperature rise to 1.5°C and enhance resilience worldwide. Race to Zero (R2Z) is a campaign that aims to mobilize non-state and subnational actors to take swift and rigorous action to collectively halve global emissions by 2030 for a healthier and fairer zero carbon world. Its sibling campaign, Race to Resilience (R2R), aims to accelerate adaptation solutions with the ambitious goal of increasing the resilience of four billion people in vulnerable communities who are most at risk from climate impacts. Participation in the campaigns is done through membership, where actors register their pledges and must meet a set of criteria to enter and stay in the campaign. Both campaigns have become increasingly aware of the importance of biodiversity protection and recovery to reach agreed climate targets. R2Z, for example, recently updated its membership criteria and has included guidance for integrating nature in tackling climate change. R2R made nature a key focus for adaptation in its recently developed metrics framework.

This increasing acknowledgment of the relevance of biodiversity to climate mitigation and adaptation represents a major step forward for both campaigns. Nonetheless, the current criteria and metrics are broad and miss important opportunities. Integrating nature in climate mitigation and adaptation actions is not without risks, as the benefits for climate, biodiversity, and social goals do not always mesh (Fig. 1). With

this contribution, we aim to identify recommendations that will help the R2Z and R2R campaigns to promote pledges that work for climate, nature, and people. We begin with a contextualization of the mobilization campaigns. We then discuss the biophysical and socio-ecological considerations relevant to ecosystem management across four areas of concern: (1) practices for enhancing land-based and marine carbon sinks to limit warming; (2) the unpredictability of biodiversity dynamics under climate change; (3) the spatial scale at which actions can be implemented; and (4) the types of metrics that can be used for tracking progress of pledges. These areas of concern are not exhaustive. Nor are their boundaries rigid. Nonetheless, they provide entry points for identifying priorities. We conclude with recommendations, which we hope will be considered by the mobilization campaigns and open avenues for transdisciplinary research.

## 2. Biodiversity in the mobilization campaigns of the Global Climate Action Agenda (GCAA)

### 2.1. Why the GCAA and its mobilization campaigns matter

The GCAA is a conventional term that broadly refers to institutional arrangements within the UNFCCC that connect intergovernmental

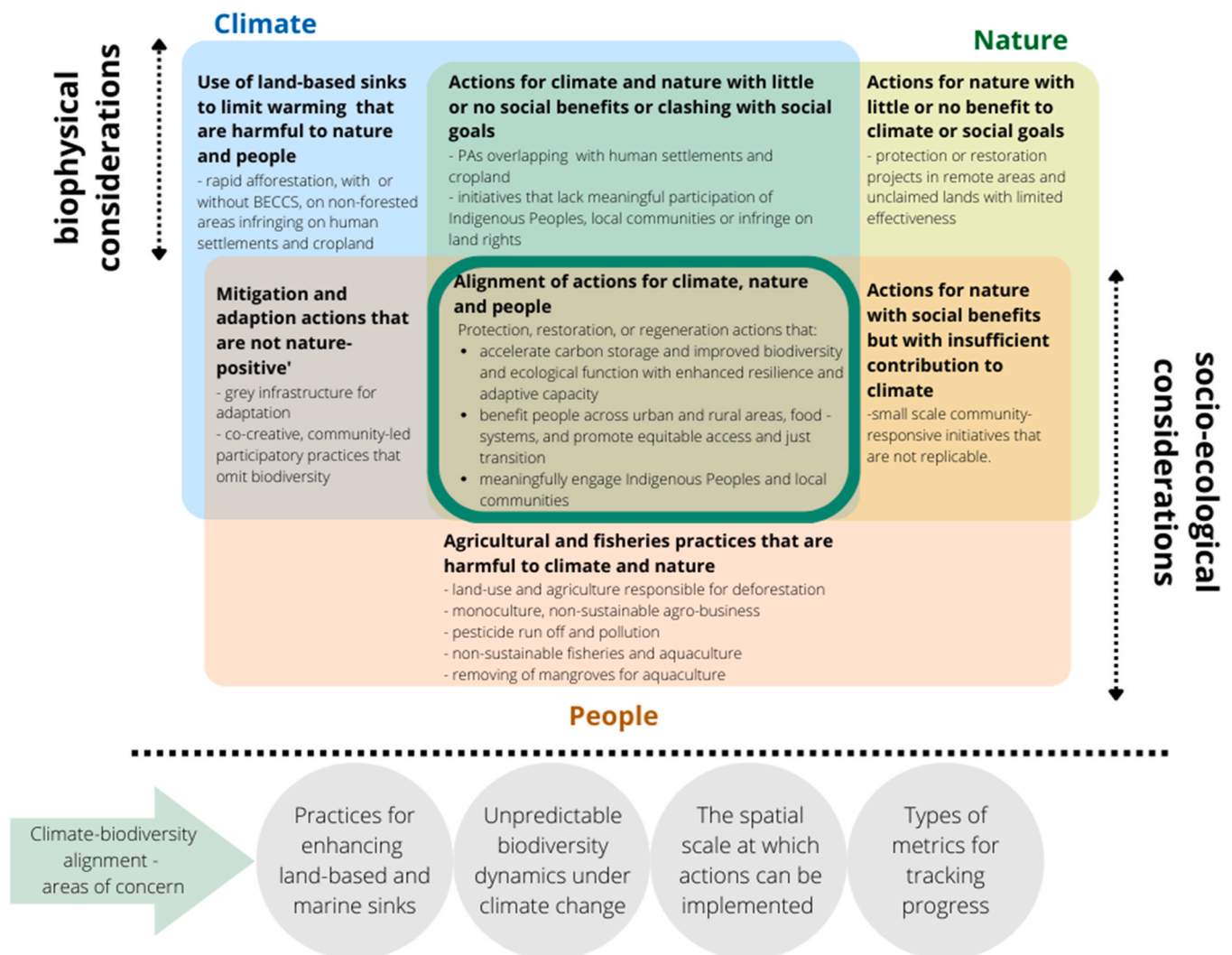


Fig. 1. Diagram illustrating generic trade-offs and the area of overlap for targeted joint action for climate, nature, and people, taking into account biophysical and socio-ecological considerations. The central overlapping area highlights alignment of climate, biodiversity, and social goals. The areas of no or partial overlap describe generic imbalances and trade-offs. Four areas of concern provide entry points for priorities to strengthen commitments by non-state and subnational actors to work for climate, nature, and people.

climate governance with commitments beyond national pledges with the aim to accelerate the implementation of the Paris Agreement (Chan et al., 2021; 2019). Historically, non-governmental environmental organizations (NGOs), business, local governments, Indigenous Peoples, and the women's movement have been central to environmental multilateralism, forming 'constituencies' within the UNFCCC and performing functions like observing, influencing, and holding the inter-governmental process and governments accountable (Kuyper et al., 2017). Over time, these actors, also referred to as non-Party actors in relation to the UNFCCC, have transitioned from being mere observers to becoming active contributors to implementation through various governance approaches at local, regional, and transnational levels (Chan et al., 2021). Though the effectiveness of non-state and subnational actions is questioned by some (Jernnäs and Lövbrand, 2022), their role in achieving climate targets is recognized by others (Chan et al., 2021; Widerberg, 2017). To assess and enhance their effectiveness, conceptual and analytic frameworks have been established (Hale et al., 2020; Kuramochi et al., 2020).

The GCAA is currently the largest UN-led action agenda with a considerable level of institutionalization in terms of political processes and commitment (Hale, 2020). Within the GCAA, the R2Z and R2R campaigns are supported by the Global Climate Action Portal (formerly known as NAZCA Portal). Progress is reported periodically under the leadership of the High-Level Climate Champions appointed successively by governments presiding over the UNFCCC since 2016 (Chan et al., 2016). Currently, the campaigns provide guidance for non-state actor pledges through membership criteria. Membership is facilitated through Partner Initiatives, which oversee members' adherence to established criteria and fulfillment of their commitments.

Recent policy reports by the IPBES-IPCC Co-Sponsored Workshop Report (Pörtner et al., 2021) and the IPCC's Sixth Assessment Report (IPCC, Intergovernmental Panel on Climate Change, 2023) highlight the importance of protecting and recovering nature for climate mitigation and adaptation. These reports are backed by a growing literature in applied ecology (Pettorelli et al., 2021; Turney et al., 2020) and governance (Widerberg et al., 2022; Pattberg et al., 2019). R2Z membership has been steadily rising since 2020 (Sevil et al., 2022) reaching over 14,000 members in 2024, as stated on its website. This growth has significant potential to enhance climate commitments that also address the biodiversity crisis worldwide. Both campaigns acknowledge the critical role of implementing Nature-based Solutions (NbS), which are actions to protect, sustainably manage, and restore ecosystems (IUCN, International Union for Conservation of Nature, 2016). For example, R2Z's campaign's theme Nature and Land Use highlights NbS, while nature figures prominently in R2R's metrics framework. While the IUCN has published global standards to guide effective and equitable implementation of NbS (IUCN, International Union for Conservation of Nature, 2020), membership criteria for the campaigns are developed independently, which risks misalignment and unintended consequences for nature and people. Refining and aligning criteria and metrics between the two campaigns is therefore essential to promote coherent, nature-positive climate action among actors beyond governments. Such a step is key to ensure that these campaigns meaningfully support the simultaneous implementation of the Paris Agreement and the Convention on Biological Diversity's Kunming-Montreal Global Biodiversity Framework.

## 2.2. R2Z and R2R: State of Play

In 2022, R2Z updated its criteria following consultations with about 200 experts and civil society representatives. Previous criteria had been kept deliberately broad to encourage member participation. The primary aim of the criteria update has been to minimize greenwashing and double-counting for all climate mitigation commitments by non-state and subnational actors. As nature has gained renewed significance in the implementation of the Paris Agreement, particularly in achieving

'net zero' emissions – which incorporate emission reductions, carbon dioxide removal, and offsetting strategies – concerns are mounting about the proliferation of such pledges by non-state and subnational actors relying on offset credits (emission reduction offsets or carbon removal offsets) to meet their net zero targets, often with limited transparency on their practices (Hale et al., 2022). Offset credits allow entities to compensate for their carbon dioxide emissions by investing in projects for carbon reduction or removal elsewhere. These offsets are commonly traded on voluntary carbon markets and include practices such as forest conservation and land-based carbon removal, some of which are nature-based, such as agroforestry, and others may harm biodiversity, such as monoculture tree planting (Dooley et al., 2022). Reliance on offsets raises concerns, as their emission reduction and carbon removal benefits are often overstated. When deployed at large scales, they risk overstepping planetary boundaries with irreversible consequences (Deprez et al., 2024). Additionally, there are growing concerns about potential adverse impacts on ecosystems and communities, including violations of human rights and dispossession of Indigenous Peoples from their land (Günther and Ekardt, 2023). These concerns were discussed during the 2022 consultations by expert groups on 'Nature, Land Use, and Deforestation' and, to some extent, on 'Carbon Offsets, Carbon Dioxide Removal and Responsible Communication of Claims'. Following deliberations, emerging themes were added to the updated membership criteria, including 'embedding nature at the heart of leadership practices and protecting biodiversity and halting deforestation' and 'empowering communities and stakeholders' [1].

The R2Z criteria come in two categories: (1) 'Starting line' criteria outline minimum requirements for membership, (2) 'Leadership practices' map out more robust pathways for leading entities [8]. Members are expected to comply with a 5-step process: pledge, plan, proceed, publish, persuade (known as 5 P's). Criteria for nature and biodiversity have been included under the leadership practices for the 'pledge' and 'plan' steps (Table 1). The updated criteria go beyond merely urging avoidance of harm to biodiversity, they also call for embedding equity principles and delivering positive outcomes for nature. Importantly, they clearly state that interventions supporting nature cannot substitute direct emission reduction within a transition pathway away from fossil fuels, urging commitments to prioritize the latter. However, the criteria update, which limited its scope to land-based nature when discussing climate-nature interrelations, overlooked marine systems and ocean biodiversity despite oceans being a campaign theme.

R2R criteria have not been updated yet. R2R's starting line criteria are currently limited to 4 P's: pledge, plan, proceed, and publish. Leadership practices do not figure in the criteria. Instead, R2R has a theory of change to scale adaptive capacities, which consist of a linear progression from inputs to outputs to outcomes to goal. Nonetheless, nature features prominently in R2R's work, including in the metrics framework, whose aim is to guide members' actions (Table 1). For example, NbS are acknowledged in the metrics framework as climate risk-reduction strategies [2]. Additionally, R2R facilitates adaptation pledges that work with, or support, wildlife and ecosystems in conjunction with the Sharm El-Sheikh Adaptation Agenda [7].

## 3. Improving the R2Z and R2R criteria and metrics frameworks: Biophysical considerations

### 3.1. Practices for enhancing land-based and marine sinks

Efforts to safeguard and enhance land-based carbon sinks are critical for climate mitigation (Shin et al., 2022; Lewis et al., 2019). These encompass a broad range of approaches, including initiatives to halt deforestation, restore degraded ecosystems, and improve landscape management, as well as bioenergy with carbon capture and storage (BECCS) and large-scale afforestation. However, not all these approaches align positively with biodiversity goals. Land-based carbon dioxide removal methods, including BECCS and large-scale

**Table 1**  
Overview of existing criteria and frameworks, outlining how R2Z and R2R have taken steps to integrate nature.

	R2Z	R2R
<b>General membership criteria</b>	<p><b>Starting Line Criteria:</b></p> <ul style="list-style-type: none"> <li>- “lay out common procedural requirements for all individual members to meet, below which members cannot fall if they wish to remain in the campaign”</li> <li>- “Known as 5 P’s, these criteria require members to Pledge, Plan, Proceed, Publish, Persuade”.</li> </ul> <p><b>Leadership practices</b></p> <ul style="list-style-type: none"> <li>- “map out example pathways for leading entities to light the way to a net zero economy”.</li> </ul>	<p><b>Starting line criteria:</b></p> <ul style="list-style-type: none"> <li>- pledge, plan, proceed, publish (4 P’s)</li> </ul> <p><b>Theory of change to scale adaptive capacities:</b></p> <ul style="list-style-type: none"> <li>- Inputs/activities, expected output of actions, expected outcomes, goal (pledge)</li> </ul> <p><b>Metrics Framework</b> serves as a guide for partners and High Level Champions on how to manage and develop their work</p>
<b>How mobilization campaigns have taken steps to integrate nature</b>	<p>R2Z’s criteria were updated and came into effect in June 2022 following a consultation process. Key expert groups whose work focused on nature and biodiversity: “Nature, Land Use, and Deforestation”, “Carbon Offsets, Carbon Dioxide Removal and Responsible Communication of Claims”.</p> <p><b>Emerging themes:</b></p> <ul style="list-style-type: none"> <li>- embedding nature at the heart of leadership practices and protecting biodiversity and halting deforestation</li> <li>- empowering communities and stakeholders.</li> </ul> <p>Updated criteria include guidelines for nature in the <b>leadership practices</b> for the “pledge” and “plan” steps of its 5Ps:</p> <p>Pledge</p> <ul style="list-style-type: none"> <li>- <b>Protect nature:</b> “Pledge to halt deforestation, protect biodiversity, making your activities consistent with climate resilient development. Pledge to make finance consistent with climate resilient development including ending deforestation and conversion of other natural ecosystems, and respecting biodiversity”.</li> </ul> <p>Plan</p> <ul style="list-style-type: none"> <li>- <b>Integrate nature:</b> Drawing on the Convention on Biological Diversity, integrate the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.</li> </ul> <p><b>Exclusions:</b> marine systems and ocean biodiversity were not considered in the criteria update. The summary report states that the nature, land use and</p>	<p><b>Metrics Framework:</b> metrics classifications include ecosystems, nature-based solutions to reduce risks.</p> <p><b>Sharm El-Sheikh Adaptation Agenda’s</b> impact systems include water and nature, and coastal and ocean systems. They encourage nature-based solutions and adaptation solutions with nature.</p>

**Table 1 (continued)**

	R2Z	R2R
	<p>deforestation working group specifically decided to limit its scope to land-based nature given the capacity of the group and timelines for the work and noted the need to address marine systems and ocean biodiversity.</p>	
<b>Sources</b>	<p>Summary Report: Race to Zero criteria consultation 3.0 (2022) [1]</p> <p>Starting Line and Leadership Practices 3.0 (2022) [8]</p>	<p>Campaign overview Metrics Framework (2021) [2]</p> <p>Sharm El-Sheikh Adaptation Agenda (2022) [7]</p>

afforestation, figure prominently in future mitigation scenarios (IPCC, Intergovernmental Panel on Climate Change, 2019; IPCC, Intergovernmental Panel on Climate Change, 2023). BECCS involves converting land-grown biomass into heat, electricity, or fuels while capturing the combustion CO<sub>2</sub> and storing it underground; it can significantly reduce local biodiversity (Deprez et al., 2024; Creutzig et al., 2021; Hof et al., 2018; Burns, Nicholson, 2017). Rapid afforestation, particularly monoculture in non-forested areas can also harm biodiversity and reduce ecosystem resilience to climate change (Seddon et al., 2022; Deprez et al., 2021; Doelman et al., 2020), with species-rich dry grasslands being particularly vulnerable (Abreu et al., 2017). In the long term, these approaches may erode carbon storage capacity, undermining the mitigation goals they aim to achieve (Dooley and Kartha, 2018). These paradoxical consequences are known as bio-perversities (Lindenmayer et al., 2012, Roberts et al., 2020). It is crucial that the updated R2Z criteria, which address these issues and establish limits on land-based carbon sinks, are consistently applied. Moreover, R2R currently lacks a mechanism to prevent bio-perversities due to the absence of corresponding criteria. This could be addressed by aligning R2R criteria with R2Z ones.

Marine ecosystems, such as seagrass meadows, mangrove forests, and salt marshes, are highly efficient carbon sinks that also support adaptation in multiple ways, including coastal protection and improved resilience of food provision (Krause-Jensen et al., 2018; Macreadie et al., 2021). Despite their overall efficacy, variations in outcomes—such as mangrove restoration impacts on above-ground species recovery versus fish diversity (Ram et al., 2021)—highlight the need for conservation and recovery efforts tailored to the local ecosystem and surrounding landscape (Lee et al., 2019). With the updated R2Z criteria focusing exclusively on land-based nature (Table 1), the absence of guidance for marine-based sinks currently leaves a gap in implementation guidance that risks promoting climate solutions that fail to deliver for marine wildlife, and the people that depend on it.

### 3.2. Protecting and recovering biodiversity under climate change

Rapid and unpredictable changes in climatic conditions are making environmental and wildlife management outcomes more uncertain. Human-induced climate change has triggered mass movement of species worldwide (Pecl et al., 2017), challenging species dispersal capacities and adaptability to rapidly changing environmental conditions (Imbach et al., 2013). This increases unpredictability in ecosystem dynamics, with management and conservation outcomes, in terms of biodiversity and ecosystem provisions, becoming more uncertain (Locatelli et al., 2014; Simonson et al., 2021). Altogether, sustainable adaptation and mitigation planning is thus becoming more challenging. Climate and ecological modeling can help address this issue to some extent, but it has limitations in offering actionable guidance for biodiversity conservation, as scenario overviews do not prescribe specific actions or



strategies. This underscores the importance of criteria to ensure that nature positive mitigation and adaptation strategies account for ecological contexts, with criteria and metrics for monitoring at both local and landscape levels.

Marine and ocean systems present distinct challenges and vulnerabilities for nature protection, restoration, and sustainable management under climate change (Leclerc et al., 2020; Strauß et al. 2022). For example, species movements in marine systems are even less predictable than in terrestrial ones (Brito-Morales et al., 2020). Terrestrial ecosystems tend to be prioritized (Malhi et al., 2020), which heightens the risk of misalignment of climate and biodiversity goals in nature-based strategies for marine and oceanic systems, including island ecosystems, underscoring the need for robust guidance and criteria in this area. In that respect, the current exclusion of oceans and marine systems from the R2Z criteria is a significant implementation gap.

### 3.3. Spatial scale of actions

Recent scientific consensus highlights the importance of protecting large wildlife populations and vast intact habitats for maintaining key processes underpinning the biosphere's health. This has spurred calls to protect half the Earth (Dinerstein et al., 2020, Jung et al., 2021) and, if not half, at a minimum 30 % of land and oceans (Roberts et al., 2020) by 2030, a target recently adopted by the Kunming-Montreal Global Biodiversity Framework.

Yet the typical scale of conservation actions is far from matching these kinds of figures, being limited in comparison to the typical scale of the threats to biodiversity (Pörtner et al., 2021). Worse, while the temporal and spatial extents of these threats have significantly increased over the past decades, the scale of the responses has contracted in many cases over the same period, with localized, small-scale projects becoming more common (see e.g., Bellwood et al., 2019). Examples of conservation efforts at scale do exist and include the Great Eastern Ranges [3] and Gondwana Link in Australia [4], the Greater Virunga Transboundary Collaboration [5] in East Africa, and Atlantic Forest Great Reserve [6] in Brazil. But these remain rare. To streamline large scale approaches to nature recovery, the knowledge base around how to scale up responses needs to be expanded; this research field, however, remains in its infancy (Pettorelli et al., 2021).

A pressing challenge is that restoration interventions can create trade-offs and unintended consequences when implemented at scale, with some strategies improving certain ecosystem aspects while weakening others. To address this issue, multiple facets of ecosystems and their contribution to well-being must be considered at varying scales. For example, in arid and semi-arid regions, initiatives promoting vegetation recovery and forestation improve erosion control but can exacerbate groundwater shortages. This is because forests consume more water than the grasslands they replaced, with some research reporting up to 49 % reduction in watershed streamflow due to forestation efforts (Feng et al., 2012, Han et al., 2020, Deng et al., 2020). This well-known challenge can easily be overlooked, particularly with pressure to achieve rapid carbon sequestration results. R2Z and R2R campaigns have an important role to play to encourage large-scale interventions; to achieve this potential, however, their criteria need to reflect the challenges associated with the upscaling of nature recovery efforts and help minimize adverse outcomes.

### 3.4. Metrics and tracking progress

Being able to understand and account for trade-offs requires high-quality data and continuous systematization of evidence to understand the replicability of interventions in different contexts and their scalability potential. There are persistent knowledge and metrics gaps that make it difficult to align the measuring and monitoring of climate and biodiversity targets. Whereas the global climate temperature goal of 1.5 °C is a single target for which there is a well-established metric,

biodiversity and climate adaptation and resilience are multifaceted concepts that are more difficult to measure (Pettorelli et al., 2021; Malaterre et al., 2019; Pereira et al., 2013). Because of this, NbS can easily become solutions that deliver for climate mitigation but only partially deliver for nature and people. For example, solutions may fail to support the recovery of threatened species, only boosting the abundance of common ones (see e.g., Lennox et al., 2018). They may have opposite effects on climate change mitigation and adaptation (with for example increased coastal wetland coverage leading to both increased greenhouse gas emissions and increased protection against extreme natural events; Huertas et al., 2019).

Both R2Z and R2R recognize that mitigation and adaptation efforts should not be compartmentalized, as emphasized in their first joint report (Marrakech Partnership, 2022). Critical progress in this direction would be for R2Z to develop a metrics framework to be aligned with the R2R's. A harmonized metrics framework across campaigns would enhance the effectiveness and coherence of climate action for nature and people.

## 4. Improving the R2Z and R2R criteria and metrics frameworks: Socio-ecological considerations

### 4.1. The nexus of climate, biodiversity, and social justice

Addressing the climate, biodiversity, and food crises will intensify competition for land, water, and coastal resources. Food production, for example, consumes half of Earth's habitable land and accounts for one-third of human-caused emissions (Dudley and Alexander, 2017), while extending this competition to coastal and marine environments through fisheries. Competing demands on land, including considerations such as food sovereignty, livelihoods, and land ownership and management systems can pose significant barriers to addressing the interconnected climate and biodiversity crises, (Dooley et al., 2022, Gardner et al., 2023). This is because safeguarding of ecosystems, managing land use, and promoting social justice are closely intertwined.

The concept of 'socio-ecological system' encapsulates the complex interactions between ecosystems and social structures, including rules, norms, institutions, and practices (Costanza, 2014). This concept is gaining prominence in global sustainability research (Kelly et al., 2019) and provides insights into social vulnerability and protection (Kok et al., 2016). It also aids in identifying barriers and opportunities for enhancing the well-being of nature and people. Here, we review socio-ecological considerations to examine how these considerations influence, and are influenced by, the growing role of non-state actors in governance.

### 4.2. Practices for enhancing land-based and marine sinks: impacts on people

Nature protection and restoration can deliver key social benefits, contributing to health, water security, and economic opportunities. However, competing demands for land and water underscore the complex trade-offs in ecological, social, and economic dimensions of land-based carbon removal strategies like BECCS, afforestation, and tree-planting. While aimed at carbon sequestration, these strategies may degrade ecosystems and compete with food production, potentially leading to dispossession of local communities, including violations of Indigenous Peoples' rights (Dooley and Kartha, 2018).

The protection and recovery of intact ecosystems stand out as effective actions to address both climate and biodiversity crises. Protected Areas (PAs) are defined as "a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008). While prioritizing global areas for ecosystem protection and restoration (Dinerstein et al., 2020; Strassburg et al., 2020), strict conservation measures can

violate Indigenous Peoples and local communities' rights, affecting local farmers, fishers, and pastoralists, and placing a burden on the Global South (Obura et al., 2021). Tensions over land and water use between conservationists, residents, and developers can be exacerbated (Corbera et al., 2019; Ratner et al., 2017), and these are expected to escalate even further with projections of 25–75 % increases in global agricultural products (van der Esch et al., 2017). Blue carbon strategies involving marine and coastal protection and restoration can also have negative societal impacts. In coastal regions, for example, land-use and tenure disputes often disrupt mangrove restoration projects. Additionally, clearing of mangrove forests for aquaculture can intensify these challenges, with power imbalances often reinforcing pre-existing inequities (Lovelock and Brown, 2019).

While R2Z's updated criteria aim to address these risks with a focus on empowering communities and stakeholders (Table 1), they fall short of capturing complexities from competing claims on land and coastal areas. The limitation is mainly due to the criteria remaining broad with insufficient consideration of social risks associated with land-based carbon removal practices and PAs. Large-scale monoculture crops (whether for farming or fuel, including BECCS) must be off limits for the interlinked benefits for climate, nature and people to be achieved, and must come with enforcement mechanisms. Both R2Z and R2R criteria should consider introducing clear guidelines to address these risks.

#### 4.3. Socio-ecological implications of supporting biodiversity under climate change

As species distribution is being reshuffled in response to climate change, biological corridors and habitat conservation requirements change, often clashing with land use and ownership in agricultural areas (Pecl et al., 2017), potentially undermining adaptation efforts. While land conversion via agricultural expansion can sometimes be a strategy to adapt to a changing climate (Fedele et al., 2020), its detrimental effects on biodiversity can weaken farmers' ability to cope with climate impacts in the long term, contributing to food and livelihood insecurities (Zavaleta et al., 2018). Coastal and marine areas, connected to agriculture through aquaculture and fisheries, are particularly at risk. They face additional challenges from agricultural runoff pollution and habitat loss (Lovelock and Brown, 2019). Excessive reliance on land and coastal zones for carbon removal, including BECCS and tree-planting, can intensify these risks and detract from the critical goal of rapid decarbonization before 2030 for 1.5°C pathways, with devastating effects on food systems and livelihoods.

Both R2Z and R2R can enhance their guidance by recognizing social vulnerability and land tenure conflicts arising from climate-induced conservation changes and by adding criteria to counteract over-reliance on unrealistic land-based and marine strategies for mitigation and adaptation.

#### 4.4. The spatial scale of actions: mixed benefits for people

The social benefits of PAs vary as they have been shown to reduce poverty in some cases (Andam et al., 2010; den Braber et al., 2018) and exacerbate it in others (Brockington and Wilkie, 2015; de Sherbinin, 2008). A recurrent trade-off is that PAs limit the land available to vulnerable communities who depend on that land for their livelihood (Anaya and Espírito-Santo, 2018). Livelihoods near PAs depend not just on agriculture but also on other sectors, such as tourism. Tourism can intersect with agriculture and often can influence, and be influenced by, decisions around PAs and restoration efforts. The Glasgow Declaration on Climate Action in Tourism, launched in 2021, highlights the sector's importance and aligns with the growing focus on various sectors in the Paris Agreement's implementation (Oberghassel et al., 2022). For instance, mangrove protection or restoration sites face threats from both aquaculture and tourism, and local communities often rely on both sectors for their livelihoods (see, e.g., Lavorel et al., 2020).

Inclusive and equitable partnerships between PAs and Indigenous Peoples and local communities do exist and provide valuable insights into best practices in conservation. For example, the Atlantic Forest Great Reserve (AFGR) in Brazil, covering 2.2 million hectares across 50 municipalities, conserves the largest continuous remnant of the threatened Atlantic Forest biome by adhering to principles of effective conservation (Borges et al., 2021). These principles bridge nature conservation and the economy by promoting a restorative economy based on community-driven entrepreneurship (Jiménez and Basurto, 2022). Participatory practices empower Indigenous Peoples and local communities as guardians of PAs, fostering intersectoral collaboration for large-scale transformation.

While the participation and empowerment of Indigenous Peoples and local communities is recognized by both mobilization campaigns and is being emphasized in R2Z's updated criteria, stronger wording to secure commitments that empower Indigenous Peoples and local communities can strengthen fairness and inclusion in the scaling up in PAs and wildlife restoration.

#### 4.5. Metrics and monitoring: actors and beneficiaries

As commitments are not always credible and do not consistently deliver on their promises, tracking should capture more than just the promised potential. It should also encompass the actual achievements recorded (Chan et al., 2022) and the methods by which those achievements are attained. Developing metrics that can help assess progress and gaps in inclusive participation and equitable sharing of benefits will be important. R2Z's updated criteria acknowledges the need to include equity and empowerment in metrics and recognizes that the operationalization and measurement of equity is complex and contested. Yet, advancements in this area are indispensable for ensuring transparency and accountability of both campaigns and in the GCAA more broadly.

R2Z and R2R equally highlight the responsibilities of businesses as key actors. Businesses are both contributors to the causes and vulnerable to the impacts of biodiversity loss and climate change. While exposure varies by sector, all are affected (Panwar et al., 2022). Many have committed to climate and biodiversity actions (Smith et al., 2020). However, financial incentives alone cannot drive actions. Businesses that incorporate climate and biodiversity goals into decision-making can contribute positively to socio-ecological goals while achieving their climate targets. For instance, Viva Agua, an initiative based in Brazil, supports local biodiversity in the Miringuava water basin, aiming for water security, nature conservation, and climate adaptation (Viva Agua, 2022). It also promotes sustainable agriculture and tourism, which refer to practices that take into account economic, social, and environmental impacts. While private actors like Viva Agua are taking steps, a significant gap remains. New tracking methodologies are needed to assess not only whether commitments are increasing but also the types of actor collaborations, which can contribute to evaluating equity and inclusivity in stakeholder participation.

Many of the global priority areas for nature protection and carbon storage are on Indigenous Peoples land (Dinerstein et al., 2020). But this neither guarantees their recognition nor the protection of nature if the unjust treatments of Indigenous Peoples and local communities are not remedied. Research suggests that many nature-based initiatives come short of respecting the rights of Indigenous Peoples and local communities and perpetuate existing injustices (Rodríguez de Francisco et al., 2013; Townsend et al., 2020). Integrating criteria for meaningful participation and empowerment of Indigenous Peoples and local communities is a clear priority: in that respect, the first step is for R2Z to develop a metrics framework harmonized with R2R's one. This harmonized metrics framework should encourage data collection on collaborative actor configurations and equitable participation. Subsequently, a consultation process to update criteria for R2R should be considered to add further rigour and raise the bar for adaptation actions.

## 5. Conclusions and recommendations

Based on the biophysical and socio-ecological considerations across the four areas of concern, we believe that the R2Z and R2R campaigns could significantly enhance their contribution to tackling the biodiversity and climate crises by following the recommendation below.

Recommendations for R2Z:

1. Large scale afforestation and monoculture tree-planting (with or without CDR through BECCS) must be off limits for the interlinked benefits for climate, nature and people to be achieved.
2. Criteria for leadership practices must be strengthened to ensure that net zero pledges do not harm biodiversity and ecosystem services delivery.
3. Criteria for natural carbon sink creation/restoration in oceans and coastal zones must be established, including for blue carbon interventions.
4. Criteria to enhance land-based and marine sinks must not solely aim for climate mitigation and carbon removal, but should promote multiple objectives for climate mitigation, biodiversity protection and recovery, and human well-being.
5. Criteria to ensure that pledges demonstrate meaningful participation of Indigenous Peoples and local communities must be strengthened.
6. A metrics framework for R2Z must be developed. It should be aligned with the R2R metrics framework. It should include tracking methodologies that capture inclusive participation in interventions, particularly of Indigenous Peoples and local communities. It should encourage monitoring at both the local and landscape scale, and help track the distribution of benefits across local actors. It should help assess how actions are delivering on climate mitigation, biodiversity protection and recovery, and human well-being objectives.

Recommendations for R2R:

1. Criteria should be updated and aligned with R2Z.
2. Leadership practices should be developed. They should promote the inclusion of Indigenous Peoples and local communities in the management of PAs with high climate adaptation and biodiversity potential.
3. The R2R metrics framework should be updated to advance knowledge on the contributions by Indigenous Peoples and local communities to adaptation through nature-stewardship and build a knowledge base to support inclusion, thereby facilitating reporting on their role in tackling the climate change and biodiversity crises. It should include tracking methodologies that capture inclusive participation in interventions, particularly of Indigenous Peoples and local communities.

To minimize duplication of efforts, criteria for both R2Z and R2R should be harmonized with one another, and both should be informed by the IUCN Global Standard for NbS. We do not suggest that these are the only measures that would improve alignment of ambition for climate, nature, and people within the GCAA. Some of the recommendations apply to both R2Z and R2R and would require coordination. We recognize that the concerns identified in this contribution are highly context dependent. Nonetheless, we do believe our recommendations support the mobilization campaigns' objectives of achieving higher standards and improving transparency with better data and tracking. We also make a call to action for forging transdisciplinary collaborations across ecology, social sciences and policy that are purposefully tailored to the GCAA. Such collaborations can open avenues for research and co-creation of knowledge that strengthens the interconnectivity between science and policy. The opportunity to align ambition by multiple actors beyond national governments in a way that works for climate, nature, and people should not be missed.

## CRedit authorship contribution statement

**Idil Boran:** Conceptualization, Investigation, Resources, Project administration, Writing - original draft, Visualization, Writing - review & editing. **Nathalie Pettorelli:** Conceptualization, Investigation, Writing - original draft, Writing - review & editing. **Alexandre C. Köberle:** Investigation, Writing - original draft, Writing - review & editing. **Ricardo Aguiar Borges:** Investigation, Writing - review & editing. **Adriana De Palma:** Writing - review & editing. **Deborah Delgado:** Writing - review & editing. **Andrew Deneault:** Writing - review & editing. **Alexandra Deprez:** Investigation, Writing - review & editing. **Pablo Imbach:** Investigation, Writing - review & editing. **Neil R. Jennings:** Investigation, Writing - review & editing. **Anke Manuela Salzmann:** Investigation, Writing - review & editing. **Oscar Widerberg:** Writing - review & editing. **Sander Chan:** Conceptualization, Investigation, Writing - original draft, Writing - review & editing.

## Declaration of Competing Interest

Alexandra Deprez contributed to the Race to Zero 2022 Criteria Consultation process as an expert member of the Offsetting, Carbon Removals and Responsible Communication of Claims working group.

## Data Availability

No data was used for the research described in the article.

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