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Scientists' warning: Six key points where biodiversity can improve climate change mitigation

Cássio Cardoso Pereira^{1*}, Walisson Kenedy-Siqueira¹, Daniel Negreiros¹, Milton Barbosa², Stephannie Fernandes³, Fernando Figueiredo Goulart¹, Simone Athayde³, Christopher Wolf⁴, Ian J. Harrison⁵, Matthew G. Betts⁴, Jennifer S. Powers⁶, Rodolfo Dirzo⁷, William J. Ripple⁴, Philip M. Fearnside⁸, Geraldo Wilson Fernandes¹

- 1 - Knowledge Center for Biodiversity and Departamento de Genética, Ecologia e Evolução, Universidade Federal de Minas Gerais, Belo Horizonte, MG, 31270-901, Brazil.
- 2 - Environmental Change Institute, School of Geography and the Environment, University of Oxford, South Parks Road, Oxford, OX1 3QY, United Kingdom.
- 3 - Department of Global & Sociocultural Studies and Kimberly Green Latin American and Caribbean Center, Florida International University, Miami, FL, 33199, USA.
- 4 - Department of Forest Ecosystems and Society, Oregon State University, Corvallis, OR, 97331, USA.
- 5 - Moore Center for Science, Conservation International, Arlington, VA, 22203, USA; and Freshwater Conservation Committee, IUCN Species Survival Commission.
- 6 - Department of Plant and Microbial Biology, University of Minnesota, St. Paul, MN, 55108, USA.
- 7 - Department of Biology and Earth Systems Science, Bass Biology Building 327, Campus Drive, Stanford University, Stanford, CA, 94305, USA.
- 8 - Instituto Nacional de Pesquisas da Amazônia, Manaus, AM, 69067-375, Brazil.

* Corresponding author: Cássio Cardoso Pereira
ORCID: <https://orcid.org/0000-0002-6017-4083>
Telephone: +55 31 3409-2609
Email: cassiocardosopereira@gmail.com

The focus on removing CO₂ from the atmosphere reflects increased public attention to climate change that potentially comes at the expense of other biodiversity challenges (Pereira et al. 2023a). This asymmetry between environmental agendas harms not only biodiversity but also climate-change mitigation because environmental issues are inexorably intertwined (Pörtner et al. 2023).

Climate-change related extreme weather events and disasters are emerging across the planet, resulting in unprecedented economic, social and ecological losses (Ripple et al. 2017). Solving the climate crisis is urgent, but the net-zero carbon emission commitments for 2050 are likely to fail if biodiversity issues are not fully integrated into the international climate agenda. It is well understood that biodiversity promotes multiple socio-environmental services and benefits, including water and air quality, crop pollination, food security, human health and well-being, and protection from soil erosion. Climate change can accelerate biodiversity loss, and the associated ecosystem degradation undermines ecosystem resilience and reduces climate-change mitigation by reducing carbon sequestration (Pörtner et al. 2023). This exacerbates the impact of extreme weather events, resulting in increased vulnerability and socioeconomic losses.

Given these linkages, there is increasing recognition of the need for a more integrated approach to tackle the climate and biodiversity crises. Below we list five ways in which the protection, conservation and restoration of biodiversity can improve climate-change mitigation.

1.) Conservation of carbon stocks and sinks.

Current approaches are unlikely to deliver the climate benefits they promise if native ecosystems are replaced by exotic monospecific stands and if biodiversity and ecosystem functioning are not part of planning. The misguided replacement of native vegetation with tree plantations as carbon sinks results in loss of tropical forests, savannas and grasslands to exotic stands of *Pinus* or *Eucalyptus*. This is a serious mistake, as each ecosystem has its own importance and must be preserved as it is, especially because much of the carbon is stored in the soil rather than in trees. For example, the preserved soil of a grassland acts as a carbon sink, but when vegetation is removed or replaced by a monospecific plantation, the sink can become a source. We must expand the protection of natural ecosystems in order to promote the maintenance of carbon stocks (Figure 1).



Figure 1. Six key points in which tackling the biodiversity crisis can contribute to an effective solution to the climate emergency (top). Below it is shown how these six key points can be translated into targets for solving the twin crises together. Illustration: Walisson Kenedy-Siqueira®

Protecting carbon stocks in ecosystems must be the first priority both for carbon stocks and for biodiversity (Portner et al. 2023). Native forests in the Amazon, the Congo Basin and in Southeast Asia are particularly important due to the co-occurrence of high carbon and biodiversity. Priorities vary among locations and at each moment in history at any given region. Because financial and human resources are always limited, these resources must be used to stem further losses before the restoration of degraded lands becomes a priority, since the carbon and biodiversity benefits of avoiding deforestation are very much greater than for planting trees both per hectare and per dollar invested. This is the case when resources from the national budget or from international sources are allocated in countries where substantial areas of native vegetation still exist and are rapidly being lost, as in Brazil. However, in countries or in subnational units (such as the Brazilian states of São Paulo and Minas Gerais) where unprotected native vegetation is relatively scarce and where the governments of these countries or states have their own financial resources, the restoration of ecosystems will become a priority for environmental funds.

2.) Biodiverse restoration.

Where restoration is the appropriate priority, the way that it is done has important consequences. Many countries have committed to restoring degraded land, with promises totaling millions of hectares by 2030. But restoration takes much more than planting trees and covering bare land with any type of vegetation. Restoration projects have generally used a standard for all types of ecosystems, with little species diversity and without even knowing the vegetation neighboring the location where the restoration takes place (Toma et al. 2024). We are creating new ecosystems that fail to meet one of the most important objectives of restoration: increasing environmental connectivity. By introducing a limited number of non-native species into a given region, we can inadvertently reduce the ecological functionality of the environment, making it more homogeneous and less diverse. Only restoration with a diverse array of native species can more quickly promote environmental connectivity and restore the benefits that ecosystems can provide to humans (Figure 1; Toma et al. 2024).

3.) Integrated conservation of fauna and flora.

The conservation of wild animals and their roles in ecosystems are key components of natural solutions to climate change, which can enhance the ability to prevent climate

warming beyond 1.5 °Celsius, potentially sequestering 6.5 Peta-grams of carbon per year (Schmitz et al. 2023). This may occur due to the role of animals in helping to mitigate and adapt to climate change that causes alteration in the fire regime and in the microclimate; animals help in increasing carbon stocks, trophic complexity, heterogeneity of habitats, and in the pollination, dispersal and propagation of plants (Pörtner et al. 2023). Conservation of forests must be integrated with the conservation of their resident fauna so that we can achieve our global climate mitigation goals (Figure 1).

4.) Use only existing areas of agriculture, pasture and silviculture.

Despite the importance of various kinds of plantations for human livelihoods, we must recognize that the expansion of these plantations is among the main drivers of fragmentation, loss of biodiversity and habitat, soil degradation, and impacts on non-climate ecosystem services, such as water supply. Forest loss is disproportionately affecting biodiversity in landscapes around the world (Betts et al. 2017). Improved land management in existing areas of agriculture, ranching and silviculture could sequester an additional 13.7 Peta-grams of carbon per year (Sha et al. 2022). The world's existing areas of plantations are sufficient for the human population to subsist and there is no need to devastate new natural areas for cultivation. However, lack of food can result from poor land-use choices, from economic inequalities impeding food purchase, and from transport barriers imposed by wars and natural disasters. We urge policymakers not to expand existing planted areas, thus slowing the loss of terrestrial and aquatic ecosystems around the world (Figure 1).

5.) Incorporate biodiversity into business models.

Solutions to the joint climate-biodiversity crises may partly lie in the private sector. Decades of experience have helped governments and corporations understand how to incorporate climate change into their business models; but economic incentives for socio-biodiversity conservation lag far behind. A high-level analysis by Fortune Global 500 shows that 83% of companies have climate-related goals, particularly in the transportation sector, while only 51% of companies recognize biodiversity loss in some way, and only 5% have set quantified targets beyond mere recognition (Claes et al. 2022). Businesses and financial institutions need to define sustainability more precisely in terms of biodiversity conservation, and incentives must be provided to do so. The Global Environment Facility (GEF) is on the right track by allocating essential resources to the Convention on Biological Diversity (CBD) (Pereira et al. 2023b).

Likewise, the private sector can achieve a Net Positive Impact (NPI), which, over a quantified timescale, can outweigh the biodiversity disturbances and damage associated with the NPI activities (Figure 1).

6. Joint biodiversity–climate conferences of the parties

To achieve net-zero emissions, it is necessary to align policies and actions across sectors and scales (Pettorelli et al. 2021). In 2021 the first joint report produced by the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) concluded that the world must tackle climate change and biodiversity loss together if either issue is to be successfully addressed. An important step towards solving this problem would be the integration of environmental conferences, increasing synergies among multilateral environmental agreements and international institutions. This would foster collaboration between experts on related topics, aligning methods and models and leading to a better assessment of trade-offs and interactions between different types of environmental impacts and policies (Figure 1).

Conclusions

To save the planet, conservation and the restoration of ecosystems must be considered to keep global warming below 1.5 degrees Celsius and to ensure a livable future. To achieve a sustainable future, we urgently need to commit to the key points presented here. Protecting a livable future will require rapid commitment not only from countries through actions in their national territories but also from emerging coalitions and governance models at all levels. Finally, we call on the media to foster a more balanced communication strategy to draw society's general attention to the role of biodiversity in addressing the climate-change crisis.

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Competing interests

The authors declare no competing interests.

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