



The risks of leaving biodiversity behind: Seven points to consider for climate change mitigation

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In what is being referred to as the “Mitigation COP”, biodiversity objectives must not be overlooked, but should be reconciled with ambitious climate mitigation policies aimed at phasing out the use and production of fossil fuels. Biodiversity is the basis of human well-being. It includes the diversity of organisms and species and the different functions they perform on ecosystems. This diversity underpins many Nature Contributions to people, including such important aspects as the production of healthy, nutritious food, the provision of clean water and air, support for recreational activities and the preservation of cultural identity and traditions¹.

In addition to its multiple benefits for human society, biodiversity plays a central role in climate regulation, with biodiversity and ecosystems together contributing to the removal of around 50% CO₂ emissions every year². The link between climate and biodiversity is however, highly complex (See Box 1). This interdependence means that the negative impacts of climate change on biodiversity threaten not only the long-term capacity of the Earth’s ecosystems to provide various Nature Contributions to people³ but also the capacity of the ecosystems to regulate climate itself. Despite this intricate relationships and feedback mechanisms, biodiversity is still largely overlooked in the design of climate change mitigation policies and instruments.

Nature-based Solutions, when thoughtfully designed and effectively implemented, provide a promising platform for integrating biodiversity and climate goals. Despite the growing recognition of the need to intensify and accelerate these initiatives, there are two major problems: First, Nature Based Solutions are still largely underfunded, with combined public and private financial support amounting to around 154 billion US dollars annually. This figure is in stark contrast to the 500 billion to 1 trillion US dollars spent annually on environmentally harmful subsidies in the agricultural, fisheries and fossil fuel sectors, which far exceeds the collective investment in Nature-based Solutions⁴.

Secondly, evidence from across the world is showing that poorly designed Nature Based Solutions can be harmful to biodiversity, local ecosystems, communities, and, in the long-term, climate itself⁵. To avoid these unintended consequences, a stronger alignment between biodiversity and climate policies is needed, building on the recognition of the interlinkages and feedback loops between the two. In this short brief, we present seven key points to consider for climate change mitigation that aim to reduce trade-offs and maximize synergies between biodiversity and climate action.

How are Climate and Biodiversity interlinked?

Climate conditions, such as temperature and precipitation, influence biodiversity⁶. More favorable, stable climates support greater species diversity.

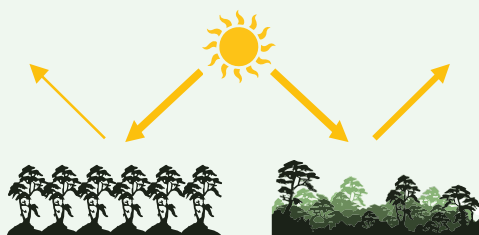
Conversely, biodiversity, through the functions carried out by plant species, plays a crucial role in climate regulation. These functions include influencing land and atmosphere exchanges, such as solar radiation reflection and water supply to the atmosphere – crucial components of climate regulation⁷. This intricate interplay establishes a feedback loop between climate and biodiversity.

Although the impacts (which can be both negative and positive) of climate on biodiversity are relatively well known, the reciprocal role of biodiversity in climate regulation is not as widely acknowledged.

Some of key mechanisms through which biodiversity affects climate are:

1. Land Surface Parameters:

Biodiversity exerts a significant influence on the characteristics of Earth's surface⁸. Different plant species not only impact the amount of carbon captured but also play a crucial role in shaping other parameters vital to climate regulation, such as sunlight reflection (albedo) and water evaporation⁸. Biodiversity broadens the spectrum of these responses, thereby influencing and extending the range of climate processes.

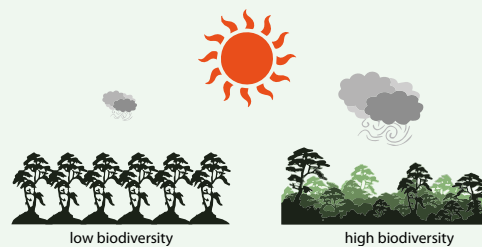
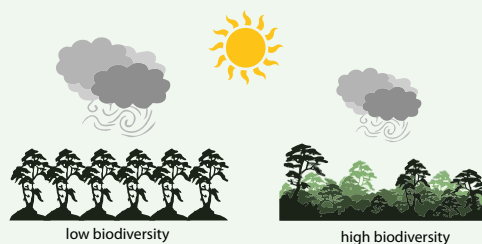


2. Resilience and risk spreading through response diversity:

Biodiversity serves as a source of resilience that contributes to mitigate and adapt to the impacts of climate change, particular in the face of extreme weather events such as prolonged droughts, floods, heatwaves, or wildfires^{7,9}. Different species respond to specific climate disturbances in distinct ways and therefore a higher number of species allows for a wider variety of climate responses¹⁰. In particular, greater biodiversity allows for species contributing to the same

functions and Nature Contributions to People, to compensate for each other in the event of a disturbance, ensuring that critical functions are maintained. This is called response diversity, and it is a critical property of resilience.

Response diversity is essential if ecosystems are to cope with changing environmental conditions, and make a significant contribution to essential climate-related functions, such as carbon uptake and evapotranspiration^{11,12}.



Forests that harbor a diverse set of species are more resilient to climate change than monocultures^{14,15}. Considering that forest plantations for carbon sequestration are significant long-term investments that are expected to withstand disturbances over a period of at least 20 to 30 years, the resilience biodiversity provides becomes critical. Monocultures may have faster growth rates and sequester more carbon in the short term, but they are susceptible to sudden die-offs from factors like pests and wildfires¹⁶. This vulnerability impairs their ability to regulate climate in the long run.

Therefore, investing in carbon sequestration through monocultures, especially those with fast-growing species, not only harms local biodiversity and Nature Contributions to People, but also carries high risks. Monocultures have the potential to rapidly evolve from carbon sink to a carbon source, exacerbating the challenges associated with climate change mitigation. Given the prevailing trend of planting trees as a quick cure for climate change, it is imperative to consider the adherent risks of this approach^{17,18}.

Seven Points to consider for climate change mitigation:

1. The design of climate solutions must consider biodiversity impacts

When designing climate mitigation solutions, such as those involving renewable energy and carbon capture, it is crucial to consider how they impact biodiversity, as potential trade-offs may emerge¹⁹. Policies in the past, like bioenergy initiatives, have had unintended consequences such as heightened food prices, increased pesticide usage, diminished natural land, and increased deforestation. Learning from these experiences is vital to prevent similar outcomes in future policies with respect to biodiversity²⁰. To address these challenges, measures such as utilizing a diverse set of native species in tree planting for carbon capture, or refraining from converting biodiversity rich areas into alternative land uses, like biofuel crop plantations, can be implemented. A balanced and integrated approach is essential to ensure the effectiveness of climate mitigation solutions without compromising biodiversity.

2. Accounting for trade-offs and unintended consequences is crucial but should not lead to inertia

While it's important to acknowledge the potential risks and unintended consequences of climate change mitigation strategies on biodiversity, it is imperative not to allow uncertainty to prevent necessary action. Delays in addressing climate change now can result in substantial harm to biodiversity and Nature Contributions to People. Employing a resilience and systems lens can be a powerful tool for navigating uncertainty, facilitating the identification of potential risks and tipping points that are relevant for the planning and design of climate solutions.

3. Climate change impacts biodiversity and we cannot rely on protected areas as “safe zones”.

Climate affects biodiversity, with more favorable conditions supporting more species. Although biodiversity rich areas, such as protected areas, are more resilient to disturbances, it is crucial to recognize that climate change impacts extend across all types of ecosystems. Consequently, protected areas cannot be considered unequivocally as “safe zones”. There is a pressing need to reconsider approaches to the planning and protection of biodiversity hotspots, incorporating potential climatic refuges and habitats that can survive changing climate conditions²¹. Furthermore, we need to foster ecological network infrastructures to enhance migration of species under changing conditions.

4. Biodiversity loss affects climate and needs to be prevented at all scales

Biodiversity influences climate through processes like carbon and water exchange and reflection of solar radiation⁸. These intricate processes hinge on factors like plant productivity and vegetation density. Biodiversity loss, whether spurred by climate change or human activities, can instigate feedback effects on the climate system. For instance, forest degradation induced by heat and drought has the potential to exacerbate climate anomalies, triggering either more intense heat and drought (amplifying feedback) or cooler, more humid conditions (dampening feedback)²². To avert these negative impacts, biodiversity loss needs to be prevented at various scales, from large landscapes to small areas.

5. Biodiversity serves as a Climate Insurance, preventing Loss & Damage

Biodiversity underpins a variety of ecosystem functions that help regulate climate and respond to disturbances. It mitigates variability in processes influenced by climate⁸ and enhances ecosystem resilience^{10,23}. Diverse ecosystems exhibit a heightened capacity to respond adeptly to extreme events, such as droughts or heat waves⁷, acting as a safeguard against the loss and damage of critical ecosystem functions and Nature Contributions to People such as food and water provision, and the control of pests and diseases.

6. Potential biodiversity impacts should not be exported to elsewhere.

When formulating national climate strategies and designing climate mitigation solutions, it is imperative to take into account the teleconnected impacts^{24,25}. National plans for climate mitigation have the potential to affect biodiversity through channels such as trade, renewable energy initiatives, and carbon offsets. We need to look beyond just local effects and consider how action (or inaction) can impact biodiversity elsewhere.

7. Native Species and Ecosystems need to be prioritized in climate and biodiversity policies

Climate mitigation solutions should rely on native species and ecosystems²⁶. Native species have adapted over millions of years to local conditions and to a highly complex network of biological interactions. The introduction of non-native species carries inherent risks, particularly in the long term amid changing climate conditions, as they may disrupt ecological links that have evolved over long periods of time. Prioritizing native local biodiversity for solutions provides a more robust insurance against ecological disruptions compared to an emphasis on non-native alternatives.

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Author contributions

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