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From pledges to places: action agendas need spatial data to integrate climate and biodiversity action

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As COP30 approaches, policymakers must ensure that the integration of climate and biodiversity action by non-state and subnational actors is anchored in spatial data. Otherwise, we cannot see where change is happening, how effective it is, or who bears costs and benefits. The UNFCCC Global Climate Action and CBD Action Agenda Portals should lead by requiring spatial details on implementation, enabling more credible and participatory monitoring, analysis, and collaboration.

Climate change and biodiversity loss are intrinsically linked[1,2]. Yet, global climate and biodiversity governance usually operate in silos, with limited alignment between the strategies and goals formulated by the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), and the UN Convention to Combat Desertification (UNCCD)[1]. This may result in unintentional goal-conflict or missed opportunities for effective actions. Governing climate and biodiversity conjointly, while advancing resilience and justice for people located in project areas, requires aligning goals, strategies, and actions to harness synergies and mitigate trade-offs[3–5].

Doing so necessitates the involvement of governmental ('Party') and increasingly also non-Party actors. Indeed, cities, companies, Indigenous peoples, and civil society organisations continue to make pledges, even when governments often fall behind on theirs. Consistent with this, Brazil, the host of the 30th UNFCCC Conference of the Parties (COP30), is emphasising the potential of non-Party actors through its Action Agenda - activities that are "functionally and programmatically linked" and aimed at mobilising non-state and subnational actors[6]. One of its main themes, 'Stewarding Forests, Oceans, and Biodiversity', puts nature conservation at the centre of the climate Action Agenda (see *Aranha Correa do Lago* 2025 – Fourth Letter from the Presidency). Given this political momentum, the data and tools that enable alignment of climate and biodiversity goals need attention. Spatial data, geographically referenced information that can be mapped to specific locations, is a pre-requisite for successful climate–biodiversity integration. In climate and biodiversity action, they show where environmental changes and human activities occur, helping identify interactions and guide effective interventions. They are crucial not only for tracking non-Party action where data are scarce, but also for capturing the complexity of socio-ecological systems linking people and ecosystems, and identifying the risks these systems face. We highlight four main reasons for integrating spatial data in the tracking of climate and biodiversity action:

Spatial data enables analysis and monitoring based on multi-dimensional outcomes and impacts

While climate mitigation is often seen as the pursuit of a single global goal, reducing greenhouse gas emissions to limit warming, mitigation efforts still depend on location, as emission sources, technological options, and socio-economic contexts vary widely across regions. This is even more so for climate adaptation and biodiversity protection efforts, where local contextual factors, such as environmental conditions, livelihoods, and governance, play a decisive role, requiring careful consideration of the multidimensional nature of both their immediate outcomes and their longer-term effects on ecosystems and human societies. Hence, climate and biodiversity action require assessment in localized, context-specific settings, to capture socio-ecological systems and the complexity of climatic, biodiversity and human well-being interlinkages[7]. Data collection efforts on non-Party climate and biodiversity action have grown over the past 15 years, but these have focused largely on non-spatial data and the potential impacts of such action. While this yields important insights into describing the expanding universe of non-Party action, there remains a dire lack of spatial data connected to the realised outcomes from these initiatives. This does not mean that the data is nonexistent. Instead, data-collection efforts on non-Party action need to be complemented with spatial data to provide information on the impacts of such action. Collecting data on where exactly implementation is happening is a necessary first step, opening doors for combinations with other spatially explicit information and for supporting monitoring and methodological developments. Without such data, discussions of climate-biodiversity integration will continue to focus on goals, pledges, and *potential* impacts rather than substantive progress in terms of achieving desired changes in behavioural outcomes and ecological and social impacts[8]. The lack of spatial data ultimately raises credibility issues, as claims about on-the-ground impacts cannot be validated without knowledge of implementation locations. Moreover, limited spatial data make it difficult to identify synergies, like soil protection from carbon-fixing reforestation, and to prevent trade-offs such as the spread of invasive species through the same interventions[9,10]. While spatial data and methods cannot always establish causal relationships or capture every aspect of change, they can provide practical and systematic means to monitor progress and support climate–biodiversity action agenda integration.

Spatial data allows for comparison and learning across contexts and scales

Spatial data provides a foundation for standardised continuous measurements and metrics, for example through satellite remote sensing[11]. Additionally, it enables factoring in contextual differences by making it possible to link to spatially explicit data on land use, benefits from ecosystem services across scales[12], as well as other data related to socio-economic, environmental, and disaster risk conditions. By linking different types of data, spatialisation is a pathway to identify, characterize, and manage climate-biodiversity interlinkages across terrestrial, inland water, coastal, or marine ecosystems, spanning all geographic, political, and temporal scales and contexts.

Spatial data can enable more just and inclusive outcomes and impacts through participatory production and use

Spatial data anchors non-Party initiatives in the local geographies they target. In so doing, it connects the initiatives to the realities of communities and interdependencies with ecosystem services and biodiversity, revealing intersections with vulnerable species populations, ecologically sensitive areas, or Indigenous and community-managed territories. This creates opportunities for, and makes fundamental, the inclusion of locally affected peoples in spatial data collection, usage and governance, avoiding adverse outcomes of technological solutions and governance failures of the past and present[13,14]. If managed via participatory processes, spatial data can play a role in efforts to advance environmental justice[15], by informing, for instance, the design of community and landscape responses, and the fair distribution of benefits, harms or finance.

Spatialisation fosters collaboration and learning across disciplines and communities to better understand and address complex climate-biodiversity interlinkages

Spatial data connects processes that are usually the subject matter of different disciplines and policy realms, creating room for multi- and interdisciplinary collaboration and discussion[16]. Collaboration, however, should not be restricted to scientific disciplines. It should but also be cross-sectoral. For instance, spatial data can enable policymakers, practitioners, and affected communities to co-design responses that integrate multiple sectors, operate across scales, and ensure that resources and capacities are effectively deployed to advance multiple sustainability goals. Moreover, spatial data can facilitate improved visualizations, which communication experts can use to make climate-biodiversity linkages more accessible and help translate of research into action.

What's next? As UNFCCC COP30 approaches, efforts to integrate climate and biodiversity action through the Action Agenda must include calls for more and better use of spatial data. Policymakers must lead the charge to institutionalize spatial data in action tracking. The UNFCCC's (https://unfccc.int/climate-action/tracking-and-recognition/global-climate-action-portal) NAZCA platform, also known as Global Climate Action Portal, the Action Agenda Portal under the CBD (https://www.cbd.int/portals/action-agenda/), and any emerging counterpart under the UNCCD, should move decisively toward facilitating, coordinating and requiring spatially explicit reporting from non-Party actors. To begin, such information does not need to be complex. Even basic GPS coordinates or georeferenced project polygons, describing where implementation is occurring, combined with readily available socioeconomic and environmental spatial data and advances in Geographic Information Systems (GIS) and data processing, would already create significant opportunities for more effective monitoring, analysis and collaboration.

A substantial increase in environmental data availability, progress in techniques and algorithms to process spatially-explicit information (such as those collected by satellites) and recent AI development[17,18] all open opportunities to assess the impacts of specific biodiversity and climate action globally, and derive key insights and lessons to drive progress in the implementation of integrated biodiversity-climate actions. Barriers to such steps are however, real: data accessibility remains uneven, technical capacities differ widely across regions[19], information supply of climate services is often not user-demand-driven[20], and in some cases actors are reluctant to disclose location-specific information[21]. Additionally, collecting and sharing spatial data entails financial, technical, and human resource costs for non-Party actors. That is why capacity-building efforts on the collection of spatial data and its wide use, clear guidelines on its submission, and incentives for sharing it are all essential. Affected communities must be central in these processes. Pilot programmes and assessment bodies, including both researchers and impacted or engaged communities, are needed to monitor and make recommendations on ethical and just governance of spatial data gathering and usage.

Researchers, practitioners, and affected communities are well-positioned to support these processes. Many have experience with collecting or applying spatial data, whether in the context of Reducing Emissions from Deforestation and Forest Degradation (REDD+), research on urban action[22], nature-based solutions[23], or cooperative climate initiatives[24], even if limited to national-level data. Online databases like Restor (https://www.restor.eco/), along with some certification initiatives (https://registry.verra.org/), collect or disclose spatial data. IUCN is already overlaying conservation and restoration project areas with biodiversity and climate change data (https://www.iucncontributionsfornature.org/). Some communities bring more spatial expertise, others stronger governance insights; inter- and transdisciplinary collaboration and learning is therefore vital to successfully support spatial integration.

With this support, the UNFCCC Action Agenda has a timely opportunity to integrate spatial data not merely as a technical enhancement, but as core infrastructure for delivering, evaluating, and communicating climate-biodiversity integration.

Data availability

No datasets were generated or analysed during the current study.

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Competing interests

The authors declare no competing interests.

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