Connecting the Dots 2: Calling for a work programme to establish priorities for synergistic climate and biodiversity action

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Introduction

All three Rio Conventions recognize the need to protect and restore biodiversity and the ecological integrity of ecosystems (i.e., ecosystem integrity) [1]. The Kunming-Montreal Global Biodiversity Framework (K-M GBF) also emphasises the importance of retaining high integrity ecosystems while the Paris Agreement recognises the importance of conserving and enhancing ecosystem carbon reservoirs and of protecting and restoring biodiversity and ecosystem integrity. The UN Convention to Combat Desertification (UNCCD) further recognizes the linkages between ecosystem degradation, loss of biodiversity and resource degradation. The UNCCD also explicitly encourages co-ordination with the UN Framework Convention on Climate Change (UNFCCC) and the UN Convention on Biological Diversity (CBD) in order to derive maximum benefit from activities under each agreement and encourages the development of joint programmes (UNCCD Article 8) [2].

These key elements of the Rio Conventions and especially the UNFCCC and UNCBD, have been reinforced by recent decisions calling for synergistic climate and biodiversity action. For example, several UNFCCC decisions have called for synergistic and/or integrated climate and biodiversity action3 - most recently at COP28 where the decision on the Global Stocktake in CMA 5 para 33 emphasised:

> *"the importance of conserving, protecting and restoring nature and ecosystems towards achieving the Paris Agreement temperature goal, including through enhanced efforts towards halting and reversing deforestation and forest degradation by 2030, and other terrestrial and marine ecosystems acting as sinks and reservoirs of greenhouse gasses and by conserving biodiversity, while ensuring social and environmental safeguards in line with the Kunming-Montreal Global Biodiversity Framework;"*

Scientific pressure to maximize synergistic actions to solve the existential threats arising from global heating and biodiversity loss is increasing4. The challenge for each Convention is to respond to the entwined climate and biodiversity crises by reversing the mutually reinforcing spiral of ecological decline and escalating GHG emissions. The warning issued at the IPBES/IPCC workshop that 'if we fail to solve one crisis we will fail on both'5 must be heeded.

At UNCBD COP 16 (2024) the CBD adopted strong language reiterating the fundamental importance of biodiversity and ecosystem integrity in climate mitigation and calling for joint technical work between the CBD and UNFCCC. In particular, the decision on Biodiversity and climate change emphasized in its preamble "that biodiversity and ecosystem integrity plays an important role in combating climate change". The preamble further recognized "the essential functional role of biodiversity in underpinning the integrity of ecosystems and ecosystem services" and that "protecting and restoring ecological integrity contributes to addressing both climate change and biodiversity loss, and its impacts".

The operational text of the COP 16 Biodiversity and Climate Change decision went a step further, urging parties to "identify and maximize potential synergies between biodiversity and climate actions, including by prioritizing the protection, restoration and management of ecosystems and species important for the full carbon cycle and contributing to climate change adaptation. Finally, the decision also called on Parties "to submit views by May 2025 on options for enhanced policy coherence, including a potential joint work programme of the Rio conventions "for consideration by the Subsidiary Body on Scientific, Technical and Technological Advice at a meeting held before the seventeenth meeting of the Conference of the Parties."

We must achieve two objectives at the same time (1) the protection and restoration of the integrity of ecosystems to maximise their capacity to sequester carbon dioxide and retain and minimize risks to their carbon stocks; and (2) the rapid phase out of fossil fuels. The risks to forests from the interaction between rapidly accelerating global warming and past industrial damage illustrates the imperative to develop policy approaches that incentivize, prioritize and enable retaining and recovering the integrity of carbon dense natural ecosystems and in particular of primary, old growth and all other natural forests [6]. The failure of current climate and biodiversity policies and mechanisms to prevent deforestation and degradation of Earth's primary and old growth forests, in all forest biomes, or to foster recovery of existing natural forests ahead of planting more trees, illustrates the depth of policy failure.

Gaps in policy instruments

The operational frameworks adopted by each convention have been developed in isolation, mostly ignoring opportunities for positive synergies, and blind to the perverse outcomes of actions that fulfil the goals of one Convention but undermine the goals of another.

There is a clear gap in guiding synergistic action under each of the Rio Conventions. However, the problem is particularly acute in the UNFCCC where Nature is under increasing pressure to help solve the climate crisis, but where current rules and Intergovernmental Panel on Climate Change guidelines are not designed to foster long-term protection and restoration of GHG ecosystem reservoirs as called for under the Paris Agreement. Ecosystem reservoirs are at increasing risk of loss because of the interaction between past industrial damage and climate change [7].

In the CBD, indicators of ecosystem integrity need further development and there is an increasing body of literature that could assist with iterative refinement. However, when it comes to natural forests, one of the most critical ecosystems for biodiversity and climate mitigation and adaptation, current indicators are inadequate. Fortunately, this deficiency is readily rectified. The technical capacity exists to distinguish between (a) primary including old growth forests; (b) regenerating secondary natural forests; (c) naturally regenerating forests managed for commodity production, (d) agro-forestry and (e) planted forests including monoculture tree plantations. This broad classification of forests covers the spectrum of forest ecosystem integrity and can be used in helping guide policy, practice and investment decisions to where they can generate the highest level of biodiversity and mitigation benefits at the lowest risk. An explanation and illustration of this approach is provided in Attachment A.

In the UNFCCC a major problem stems from LULUCF accounting rules that encourage reporting of net changes in annual fluxes of greenhouse gas. This short-term, net accounting approach is blind to the importance of ecosystem integrity for the long-term accumulation and retention of forest carbon stocks. The integrity of ecosystems, especially forests, is critically important for their capacity to continue to sequester and store carbon at the lowest possible risk over the long term.
It took until IPCC AR 6 WG11 in 2021 for any definition of ecosystem integrity to emerge in the climate space, viz: "Ecosystem integrity refers to the ability of ecosystems to maintain key ecological processes, recover from disturbance, and adapt to new conditions".

And while the calls in UNFCCC decisions for synergistic climate and biodiversity action are welcome, there is a way to go before climate decision makers understand the functional role of biodiversity in underpinning the integrity of ecosystems and therefore why biodiversity matters for both climate mitigation (retaining carbon) and climate adaptation (resilience). The relationship between biodiversity and ecosystem integrity on the one hand and between ecological integrity and climate mitigation and adaptation, need further elaboration.

Filling this gap in the UNFCCC, and addressing problems with perverse outcomes generated by existing rules and guidelines, requires a work program, involving experts from both the climate and ecological arenas to articulate these functional relationships and the differing risk profiles of climate action in the Land Sector to inform and guide synergistic climate and biodiversity action which maximizes benefits for both.

The need to do so is implicit in Article 5 of the Paris Agreement but the past narrow focus on developing rules that favour production forests and landscapes has left a significant gap. A work programme is needed to focus on and reveal the importance of ecosystem integrity for retaining and recovering ecosystem carbon reservoirs (stocks). Doing so would complete the work needed to operationalize the ecosystem reservoir provisions of Article 5 of the Paris Agreement.

Understanding ecosystem integrity

Ecosystem integrity refers to an ecosystem's capacity to maintain its characteristic composition, structure, functioning and self-organisation over time within a range of natural variability. It is underpinned by its natural patterns of biodiversity including diversity at the genetic, species and community levels [9]. High-integrity ecosystems have greater stability, resilience, capacity to adapt, and provide higher quality ecosystem assets and services that contribute to human wellbeing. Compared to young regrowth, plantation and degraded forests, high-integrity ecosystems, such as primary forests and natural wetlands, are more resistant to threats, have more stable long-lived carbon stocks, and have greater resilience to disturbances compared to those damaged by modern industrial activities. The functional roles in an ecosystem of biodiversity at all levels (genetic, species and community) is the product of natural selection that yields the characteristic species and community assemblages best suited to prevailing environmental conditions, including fluctuating resource inputs, extreme events, periods of stress and natural disturbances and thus underpins ecological integrity [8].

There is approximately two and half times more carbon in ecosystems than there is currently in the atmosphere. It will therefore not be possible to achieve the Paris Agreement temperature goal unless we minimize the risks to carbon stored in ecosystems. Damage to ecosystem integrity, and loss of biodiversity, undermines the capacity of ecosystems to withstand threats that are increasing with climate change, particularly severe drought and fire. Low levels of ecological integrity heighten the risk of reaching critical tipping points, where thresholds are crossed that lead to ecosystem change and/or collapse.

The importance of Article 5 of the Paris Agreement

The UNFCCC defines 'reservoir' as a 'component or components of the climate system where a Greenhouse gas or a precursor of a greenhouse gas is stored', while a 'sink' is any process, activity or mechanism which removes greenhouse gas from the atmosphere…'.Article 5 of the Paris Agreement reflects Article 4.1(d) of the Convention8, where the importance of reservoirs and sinks are given equal weight [10]. During negotiation of the Paris Agreement the importance of ensuring human rights, the rights of indigenous peoples and biodiversity and ecosystem integrity were emphasized by civil society and when adopted as overarching considerations in the preamble, became applicable to all climate actions. They were and still are, of particular relevance to Article 5 [11]. There is a strong emphasis in Article 5 on forests and much work has been done in the UNFCCC in an effort to reduce emissions from forests and foster increased sequestration. However, the status of and risks to ecosystem reservoirs, including forest ecosystems, have been poorly considered. Improving the operation of Article 5 of the Paris Agreement will require a shift in focus within the UNFCCC towards understanding the factors that help ecosystems retain their greenhouse gas reservoirs and minimise current and future risk of loss.

Encouraging the protection and recovery of high integrity ecosystems is essential for minimizing the loss of ecosystem carbon to the atmosphere and preventing tipping points, especially in carbon dense primary and old growth forests. A work program would reveal that biodiversity in all its complexity - not just at the species level but also the ecological complexes of which they are part, including the diversity within species, between species and of ecosystems - is critically important for the ongoing ability of ecosystems to sequester and retain carbon at relatively lower risk over the long term.

The imperative to retain and recover ecological integrity should frame a work program for improving the operation of Article 5 of the Paris Agreement by identifying:

- How past damage to carbon dense ecosystems, including forests, interacts with and amplifies threats that are increasing with climate change;
- Actions that would reduce the risk of losing ecosystem carbon reservoirs to the atmosphere and prevent or delay tipping points;
- Priority ecosystems and areas where protection needs to be significantly increased and conservation management greatly improved;
- Management approaches that would help recover high integrity, high density carbon reservoirs as quickly and effectively as possible;
- Goals and actions to address ecosystem decline and guide restoration efforts;
- Climate actions that have perverse consequences for biodiversity and ecological integrity;
- How to utilize the K-M GBF to help deliver synergistic climate and biodiversity outcomes in both NDC's and NBSAP's.

Mechanisms for undertaking a work program

A joint UNFCCC/CBD (and possibly UNCCD) Ad Hoc Technical Advisory Group would be a timely first step that could lay the groundwork for a joint SBSTA work plan. Failing that an UNFCCC Ad Hoc Technical Advisory Group that includes ecological experts, could be established through a UNFCCC CMA decision building on the Global Stocktake outcomes to establish the importance of ecosystem integrity for the protection and recovery of ecosystem carbon reservoirs, including forests, under Article 5 of the Paris Agreement. The findings of a TAG could then inform a joint SBSTA work programme.

A TAG could provide advice to SBSTA on:

1. Indicators, approaches and tools on how to assess and monitor the ecological integrity of sinks and reservoirs of GHGs and to guide national planning to minimize the risk of losing ecosystem reservoir and sink capacity;
2. Opportunities to align ecosystem integrity assessment and monitoring under Article 5 with existing processes and frameworks, both within and beyond the UNFCCC. This could include the Global Goal on Adaptation framework and its targets and indicators, the KM-GBF Monitoring Framework, the UN Statistical Commission System of Environmental Economic Accounting (SEEA), the FAO Global Forest Resource Assessments (FRA), finance provided by the GCF and GEF (e.g. the GEF's Critical Forest Biomes Integrated Program, as well as human rights monitoring frameworks, to enhance coherence, and streamline efforts to avoid duplicative work;
3. Gaps, barriers and needs for capacity building, technology transfer and financing to enable Parties to fully implement ecosystem integrity assessments and develop comprehensive carbon accounting approaches in the LULUCF sector;
4. Opportunities for increasing international cooperation, exchanging knowledge and best practices among Parties and non-Party stakeholders to enhance collective efforts to support the protection of high integrity, carbon dense ecosystems and foster recovery of degraded ecosystems while supporting the rights and livelihoods of Indigenous peoples
5. The scale of funding to secure the multiple benefits from holistic and synergistic climate and biodiversity action.

References

[1 & 3]."Connecting the Dots: Achieving synergistic action for global biodiversity and climate goals utilising the Kunming-Montreal Global Biodiversity Framework IUCN WCPA and IUCN CCC TecCOP28.

[2] UNFCCC COP 25 called for integrated climate and biodiversity action (1/CP 25 para. 1). At COP 27; the preamble of the cover decision (CMA.4) reaffirmed the Glasgow/Paris Agreement language on the importance of ensuring the integrity of all ecosystems, including in forests, and the protection of biodiversity. And the decision on mitigation, CMA.

[4] para 1, underlined "the urgent need to address, in a comprehensive and synergistic manner, the interlinked global crises of climate change and biodiversity loss in the broader context of achieving the United Nations Sustainable Development Goals (SDGs)...".

[4] October 2024 letter from 201 global science leaders to the Presidents of CBD COP 16 and UNFCCC COP 29

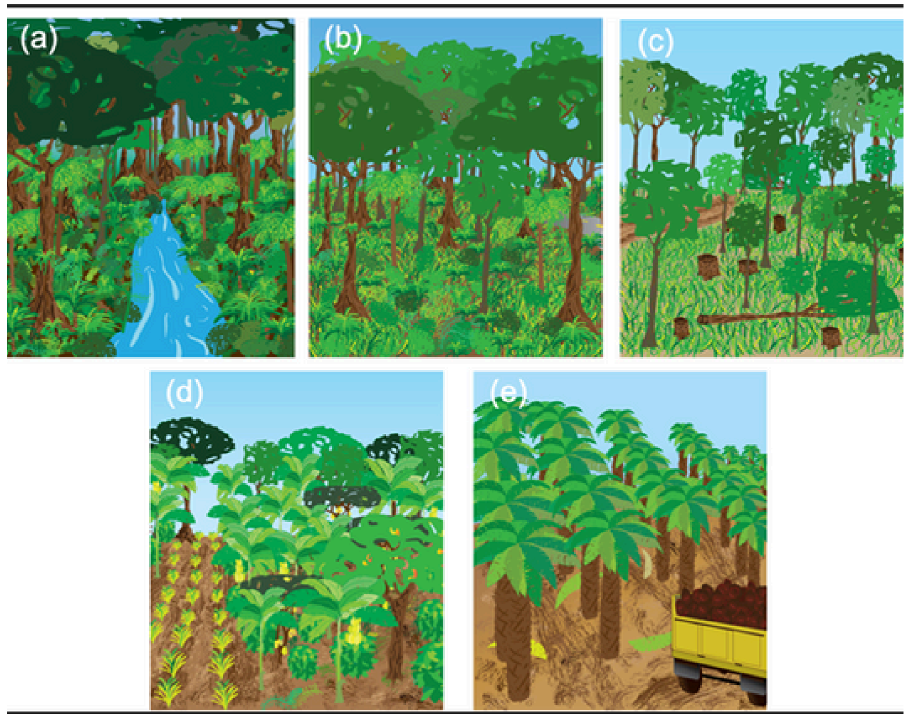
[5] IPBES/IPCC 2021 Co-Sponsored Workshop on Biodiversity and Climate Change, Workshop Report, DOI: ID.5281/zendos.4782538 and IPBES media release 10 June, 2021

[6, 7, 8 & 9] Brendan M Rogers, Brendan G Mackey, Tatiana A Shestakova, Heather Keith, Virginia Young, Kormos, Dominick A Dellasala, Richard Birdsey, Glen Bush, Richard Houghton, William R Moomaw(2022) Using ecosystem integrity to maximize climate mitigation and minimize risk in international forest policy, Frontiers in Forests and Global Change (2022)

[**10 & 11]** The Paris Agreement on Climate Change, Analysis and Commentary, edited by Daniel Klein, Maria Pia Carazo, Meinhard Doelle, Jane Bulmer and Andrew Higham, Oxford University press, 2017

Attachment A: The significance of ecosystem integrity for carbon storage in Forests

Not all forests are equal in terms of their level of ecosystem integrity, carbon storage value, and how they are impacted by climate and other risks. **The figure illustrates these differences for five categories of forests:** *(a) primary forest; (b) secondary forest; (c) production forest; (d) agro-forestry; and (e) commercial plantation.* Higher integrity results in forests having more dense carbon stocks and greater stability, resilience and adaptive capacity in the face of escalating external pressures. The first table provides an overview of how these forest types differ in terms of their ecosystem integrity and the second table provides further details on the three key factors (structure, processes, stability).



Forest Type	Definition	Relative level of ecosystem integrity
(a) Primary Forest	Naturally regenerated forest of native tree species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed	High levels for all three factors
(b) Secondary Forest	Natural forests recovering from prior human land use impacts. Canopies dominated by pioneer and secondary growth tree species	Moderate depending on time since disturbance
(c) Production Forest	The consequence of conventional forest management for commodity production (e.g., timber, pulp). Forest predominantly composed of trees established through natural regeneration, but management favours commercially valuable canopy tree species	Low to moderate depending on intensity of logging regimes and biodiversity loss
(d) Agro-forestry	Some level of natural tree species is maintained with subsistence food or commercial crops grown (e.g., shade coffee). Swidden subsistence farming commonly used by traditional communities. Utilizes a mix of natural and assisted regeneration	Low to moderate given sufficient management inputs
(e) Commercial Plantations	Forest predominantly composed of trees established through planting and/or seeding and intensely managed for commodity production (timber, pulp, plant oil)	Low

Primary forest

- Naturally regenerated forest of native tree species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed
- Likely to have never been commercially logged or intensely managed
- At a landscape level, can comprise early successional (seral) stage following natural disturbances
- More likely to contain full complement of evolved natural biodiversity
- Often the customary territories of Indigenous Peoples

Dissipative structures	• *Ecosystem processes*	• *Stability and risk profiles*	• *Ecosystem integrity level*
• Canopy trees dominated by large, old trees • In wet tropics, closed canopies • Dense soil organic stocks • Typically significant quantities of dead biomass	• Fully self-generating (autopoiesis) • In temperate and boreal forests, includes seral stages following natural disturbances • Tight nutrient cycling with minimal leakage and/or erosion • Clean water supply	• Highly resistant and/or resilient to extreme weather events • In boreal and temperate biomes, fire-adapted plant species • Rich biodiversity provides functional and phenotypic adaptive capacity	• High levels for all three factors

Secondary forest

- Natural forests recovering from prior human land use impacts
- Canopies dominated by pioneer and secondary growth tree species
- If not subsequently disturbed by human land use, can continue to develop additional primary forest attributes over time

• *Dissipative structures*	• *Ecosystem processes*	• *Stability and risk profiles*	*Ecosystem integrity level*
• In wet tropics, canopy closure can occur within 1–2 decades • Aboveground living significantly less than primary forests • Some dead biomass may remain	• Fully self-regenerating so long as primary propagules/seed stock are available • Soil carbon and nutrients stocks can be depleted due to past erosion and biomass removal	• In temperate and boreal forests, increased exposure to wildfire and drought impacts due to more open canopy and drier forest interior • Reduced biodiversity impairs some key processes (e.g., pollination, top-down tropic control)	• Moderate depending on time since disturbance

Production forest

- The consequence of conventional forest management for commodity production (e.g., timber, pulp)
- Forest predominantly composed of trees established through natural regeneration, but management favors commercially valuable canopy tree species

• *Dissipative structures*	• *Ecosystem processes*	• *Stability and risk profiles*	*Ecosystem integrity level*
• Logging regimes maintain a predominantly even-aged, younger age structure (~20–60 years) • Simplified vertical vegetation structure	• Canopy tree species natural regenerated but some level of assisted regeneration common • Ongoing soil loss	• More flammable forest conditions • Greater exposure to invasive species	• Low to moderate depending on intensity of logging regimes and biodiversity loss

Agro-forestry (commercial, subsistence)

- Some level of natural tree species is maintained with subsistence food or commercial crops grown (e.g., shade coffee).
- Swidden subsistence farming commonly used by traditional communities
- Utilizes a mix of natural and assisted regeneration

Dissipative structures	*Ecosystem processes*	*Stability and risk profiles*	*Ecosystem integrity level*
• A curated canopy of trees, often remnant from primary forest or planted from local stock • Little if any understory • Ground cover are food crops	• In tradition swidden system, closed nutrient cycle through use of natural regeneration • Canopy trees buffer food crops from extreme weather and help maintain soil moisture	• Intensive small-scale management and modest level of biodiversity provides assisted resilience and adaptive capacity	• Low to moderate given sufficient management inputs

Source:

Rogers B.M., Mackey B., Shestakova T.A., Keith H., Young V., Kormos C.F., DellaSala D.A., Dean J., Birdsey R., Bush G., Houghton R.A. and Moomaw W.R. (2022) Using ecosystem integrity to maximize climate mitigation and minimize risk in international forest policy. Front. For. Glob. Change, Sec. Forest Management. https://doi.org/10.3389/ffgc.2022.929281