Primary Forests, Ecosystem Integrity & Climate Change

Technical Brief | UNFCCC COP 28
November 2023

Prepared by the World Commission on Protected Areas (WCPA) of the International Union for the Conservation of Nature (IUCN)

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A Rapidly Accelerating Climate Crisis

The global impacts from the 1.1°C of global warming we are currently experiencing are already devastating, including fire disasters, widespread flooding, droughts, and massive coral die-offs. Allowing global warming to increase beyond 1.5°C of warming will result in far greater impacts, and risks of irreversible loss and damage.

Unfortunately, the response to global warming to date has been far from sufficient. The Global Stocktake report concluded that much more ambitious targets are needed in NDCs to reduce global GHG emissions by 43% by 2030, and by 60% by 2035 compared with 2019 levels, and to reach net zero CO2 emissions by 2050 globally. The report concluded that based on current NDCs, the gap to emissions levels consistent with limiting warming to 1.5 °C in 2030 is estimated to be 20.3–23.9 Gt CO2 eq. In the meantime, our remaining global atmospheric carbon budget is around 400 GtCO2e or only about seven years of emissions at current emissions levels.

Achieving these targets means that we must now phase out fossil fuels and generate urgent and drastic emissions reductions across all sectors. [IPCC 2022, UNEP 2022].

Primary Forests and Climate Change

The world's forests store massive amounts of carbon: at least 862 GtC [Pan et al. 2011], which is more carbon than in known oil and coal reserves combined, and more than is currently in the atmosphere. Releasing about 110 GtC through deforestation and degradation this century, or roughly 8% of this global forest carbon stock, is enough to exhaust our global carbon budget, and push us over the 1.5°C threshold.

Unfortunately, we are releasing significant amounts of forest carbon every year. Between 2010 and 2019 the Agriculture, Forests and Land Use sector has been responsible for about a quarter of gross anthropogenic greenhouse gas emissions [IPCC 2022] and annual emissions from deforestation and degradation are about 8.1 Gt CO2. Nonetheless, it has been estimated that over 2001-2019, global forests were a net carbon sink of −7.6 Gt CO2e per year, reflecting the net balance between gross carbon removals of −15.6 Gt CO2e per year, and gross emissions from deforestation and other disturbances of 8.1 Gt CO2e. [Harris et al. 2021]. Ending emissions from deforestation and degradation would therefore provide a potential 8.1 Gt CO2 net mitigation benefit per year, which if coupled with deep cuts in fossil fuel emissions would put the world community on track to limit warming in line with the Paris Agreement target of 1.5 °C. Forests are therefore an appropriate and important focus of global mitigation efforts.

However, not all forests have equal value in terms of climate mitigation: primary forests are disproportionately important, and their protection should be the top priority for mitigation efforts for several reasons.

- **Primary forests are exceptionally carbon dense.** Primary forests store significantly more carbon per hectare than degraded forests or plantations. A tropical forest that has been logged once stores about 35% less carbon than a tropical primary forest; the difference is even greater in temperate forests where a logged forest may store 70% less than primary forest [Keith et al. 2009; Mackey et al. 2020, Mackey et al. 2014; Mayer et al. 2020].

- **Primary forests represent a globally significant carbon stock.** There is more than enough carbon in primary tropical forests alone (~150 GtC) to push us beyond 1.5°C of warming if emitted this century, without counting the massive primary forest carbon stocks in boreal and temperate forests [Mackey et al. 2020]. Although there is a misperception that old forests release as much carbon as they absorb, in fact primary forests, and in particular the largest, oldest trees in primary forests, continue to sequester carbon at globally significant rates [Luyssaert et al. 2008, Lewis 2009, Stephenson et al. 2014].

- **Primary forests are more stable, and therefore their carbon stocks are at much lower risk of loss from natural disturbance.** Primary forests are more resistant to natural disturbance than degraded forests of plantations, and more resilient when disturbance occurs. This increased stability means that they are better able to resist pressures such as droughts, fire, insect outbreaks, disease etc., and also better able to bounce back from these pressures, which in turn means that their carbon stocks are at lower risk of being lost. [Rogers et al. 2022, Kormos et al. 2017].

- **Primary forest carbon is irrecoverable on any timeframe that is meaningful to preventing catastrophic climate change.** Industrial extractive activity, including commercial logging with best practices, is not sustainable in primary forests, and the time it takes for a forest to recover its carbon and biodiversity after industrial disturbance far exceeds climate mitigation targets for staying below 1.5°C of warming and meeting the Kunming-Montreal Global Biodiversity Framework targets. [Goldstein et al. 2020; IPCC 2022].

- **The ecosystem integrity of primary forests allows them to persist over the very long term.** A primary forest can regenerate itself for many thousands of years – even millions of years in some cases. This means that the carbon stocks in primary forests are also the longest-lived of any forest. Longevity is critical: carbon must be stored for a century or more to have a climate impact. Short term carbon fluxes over decades will not prevent dangerous warming.

Thus, primary forests store the most carbon per hectare and enormous carbon stocks globally (while continuing to draw down even more carbon dioxide), their carbon stocks are at lower risk of being emitted than degraded forests or plantations, they store carbon for the longest period of time, and their carbon is irrecoverable. Protecting these ecosystems from conversion or degradation is therefore of the highest priority.

It also follows that the next highest priority for forests from a mitigation standpoint over the next few decades (i.e. to mid-century) is to allow a degraded forest to mature (a process often referred to as "proforestation"). [Moomaw et al. 2019, Mo et al. 2023]. Ecological restoration of degraded forests generates far more carbon and biodiversity benefits than planting trees over the next few critical decades, and allows degraded forests to begin to recover their ecosystem integrity. It is by far the highest priority mitigation action after protection primary forests and other high ecosystem integrity carbon reservoirs.

Climate-Biodiversity Synergies: biodiversity underpins forest mitigation

Primary forests have superior mitigation benefits precisely because they have not been disturbed by industrial activity and still have high ecosystem integrity, i.e. they still have all of their biodiversity, healthy species populations, and their original vegetation structure. Their biodiversity is what enables them to adapt over time to maximize biomass and ensure their ability to resist and bounce back from natural disturbance. **Thus, ecosystem integrity fundamentally underpins a forest's ability to provide superior mitigation benefits: it is essential to a primary forest's ability to maximize carbon stocks, as well as to the stability and longevity of those carbon stocks.**

Primary forests not only maximize mitigation benefits, they also protect the most species of any terrestrial ecosystem and far more species than degraded forests. Estimates of forest biodiversity vary, but many studies suggest that tropical forests alone may hold two thirds of Earth's terrestrial species. Studies also show that primary forests protect many more species than degraded forests of the same type, and that many primary forest species do not survive in degraded forests [Gibson et al. 2011, Barlow 2007]. We cannot solve the biodiversity crisis without primary forests.

Primary Forests are critically important in many additional respects. They are very often the lands of Indigenous Peoples, and essential to the ability of Indigenous communities to maintain their traditional cultures and livelihoods. Many primary forests have survived precisely because they are the traditional lands of Indigenous Peoples and remain under their customary guardianship.

Primary forests also provide critically important freshwater benefits. Water flowing from watersheds covered by primary forest is clean and free of excess sediments [Furniss et al. 2010]. Forests also help regulate regional rainfall through globally scaled teleconnections: for example, deforestation in the Amazon can impact rainfall patterns as far away as California [Sheil 2014].

An ecosystem integrity mandate

The good news is that both the **Convention on Biological Diversity** and the **United Nations Framework Convention on Climate Change** increasingly **recognize the importance of primary forests and ecosystem integrity** and the key **linkages between climate and biodiversity.**

- The joint IPBES-IPCC report in 2021 and U.N. Framework Convention on Climate Change decisions 1/CP.25, 1/CP.26 and 1/CP.27 in 2020, 2021 and 2022 all emphasize the fundamental importance of ecosystem integrity and integrated climate-biodiversity solutions to resolving the climate crisis.

- The Glasgow Declaration on Forests and Land Use, signed by over 140 countries in 2021 commits signatories to "halt and reverse forest loss and land degradation by 2030" and affirms the importance of Indigenous and locally led forest stewardship.

- The IPCC's 6th Assessment Report (Working Group III, Mitigation) notes that "avoiding the conversion of carbon-rich primary peatlands, coastal wetlands and forests is particularly important as most carbon lost from those ecosystems are irrecoverable through restoration by the 2050 timeline of achieving net zero carbon emissions" and that "the protection of high biodiversity ecosystems such as primary forests deliver high synergies with GHG abatement.

- The Kunming-Montreal Global Biodiversity Framework recognizes the importance of ecosystem integrity in Goal A and Targets 1, 2 and 12.

In addition, the International Union for Conservation of Nature has also adopted a policy recognizing the irreplaceability of primary forests and intact forest landscapes [IUCN 2020] and the Global Environment Facility just created a new Integrated Program on the Amazon, Congo and Critical Forest Biomes, with a strong primary forest focus.

Conclusions and Recommendations

Despite the fact that primary forests are irreplaceable, essential to resolving both the climate and the biodiversity crises, and provide many other critical social and ecosystem service values, **degradation, fragmentation, and loss of primary forests continues at very high rates** [Morales-Hidalgo et al. 2015, Haddad et al. 2015]. As recognized in the Glasgow Leaders' Declaration on Forests and Land Use (goal 6), **protecting primary forests will require deep changes in national and international forest policies, and in the way funding for forest stewardship is mobilized and allocated**. In particular, far **more resources must be allocated to Indigenous Peoples, local communities, and protected areas**, as these are the only forest management approaches with proven capacity to protect primary forests and their many essential ecosystem services. In addition, currently under 3% of climate finance is directed to forests of any condition, let alone to primary forest protections [CPI 2021], even though ecosystems could provide thirty percent or more of the mitigation needed to avoid catastrophic warming. On the other hand, we spend trillions of dollars annually subsidizing extractive industries and industrial agriculture, with devastating impacts on forests and their biodiversity – and trillions more attempting to mitigate climate change, pandemics and other crises resulting from environmental destruction.

We therefore recommend that:

- **Nature-Based Solutions standards should clearly emphasize the crucial importance of primary forests** (and other primary forest ecosystems) and prioritize their protection.
- **Climate and biodiversity finance**, including reallocation of destructive subsidies called for under the Kunming-Montreal Global Biodiversity Framework and elsewhere, **should prioritize primary forest protection** as a matter of urgency.
- **Carbon accounting must be adjusted so that it can differentiate between stable, long-lived carbon dense ecosystems with high ecosystem integrity, and degraded ecosystems and tree plantations with low ecosystem integrity.** A ton of carbon stored in a primary forest is in no way equivalent to a ton of carbon stored in a plantation because a plantation is far more vulnerable and in many cases unlikely to persist more than a few decades. Further adoption of the UNSEEA-EA standard would facilitate new accounting methodologies recognizing the superior biodiversity and mitigation and adaptation value of primary forests and ecological restoration of degraded forests.

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