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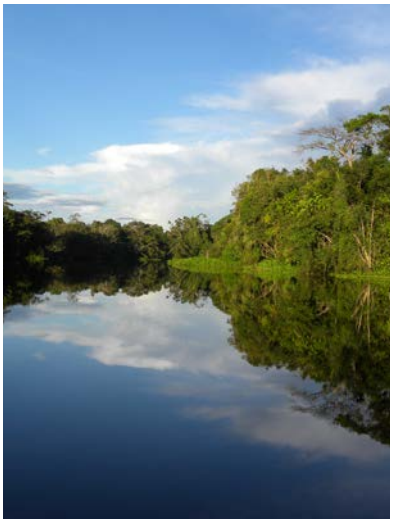
Aquatic Ecosystem Connectivity in the Amazon is essential to ensure Climate Change Mitigation, Adaptation, and Resilience

Key Actions to Sustain Aquatic Connectivity and Climate Resilience in the Amazon

- Adopt an integrated watershed approach to safeguard the Amazon's hydrological integrity. Aquatic ecosystem connectivity is central to climate change mitigation, adaptation, and resilience in the Amazon. Ensuring the free flow of water, sediments, and life across the basin is essential for maintaining the Amazon's role as a global climate regulator.
- Maintain at least 80% of Amazonian freshwater wetland, including free-flowing rivers, lakes, and flooded forests and grasslands, under effective conservation and management.
  - Sustain fishing efforts at 2022 levels and promote co-designed fluvial reserves with local communities to maintain natural river dynamics and fish migration routes.
  - Strengthen participatory environmental governance and support Indigenous territories and local stewardship efforts to ensure lasting forest and freshwater resilience.
- Advance basin-wide knowledge exchange and effective cooperation to adapt to climate change through nature-based solutions.
  - Foster transboundary collaboration on fisheries management, habitat restoration, and water security to enhance adaptation and resilience for Amazonian peoples.



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Extended Policy Brief

This policy brief compiles recent scientific information on the urgent need of maintaining the integrity and connectivity of the Amazon's freshwater systems for climate change mitigation, adaptation, and resilience. The document integrates findings from scientific literature, field research, and policy analyses, aiming to inform decision-makers and key stakeholders at the COP about the critical need to protect rivers, wetlands, and strategic freshwater habitats.

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Underlying the world's largest tropical megaforest is the water that supports it—a complex freshwater system consisting of streams and rivers that rush, meander, and diverge across a varied topography, including waters from alpine glaciers, high-elevation grasslands, montane cloud forests, and lowland rainforests.[1] As a fundamental element of the Amazon forest, the freshwater system regulates global climate[2] and supports biocultures that facilitate climate resilience.[3] Thankfully, aquatic connectivity is, for the most part, still maintained in the Amazon basin.[4] Ensuring the continued integrity of the freshwater system is a priority for ensuring climate change mitigation, adaptation, and resilience.

1. CLIMATE CHANGE MITIGATION

Climate change is a compounding process: The fact that we have already lost so much makes a place like the Amazon even more important for minimizing the effects of climate change. While the exact impact of the Amazon river's aquatic connectivity over global climate is an area of active research, scientific research suggests that a drier Amazon could result in more intense and more frequent hurricanes over the North Atlantic Ocean and the Caribbean Sea.[5] Further, many of the Amazon's freshwater habitats are carbon sinks, such as the peatlands that hold over a high amount of carbon for the amount of land- with more frequent droughts, the carbon stored by these peatlands will be released[6].

2. CLIMATE CHANGE ADAPTATION

Given predictions that climate change will make the Amazon drier, it is more important than ever to adapt our human behaviors so that we can withstand some of the consequences like extreme heat, droughts, wildfire, and floods. In particular, making room for rivers by protecting floodplains helps water move through a landscape in a way that does not cause human damage[7] and potentially acts as a barrier for wildfires by keeping the environment humid, especially if it is not deforested[8].

3. CLIMATE CHANGE RESILIENCE

To withstand climate shocks, we need strong relations with each other and our surroundings[9]. For example, severing aquatic connectivity via activities such as mining or infrastructure such as dams has impacts on fish lifecycles, particularly on those that migrate, which then impacts human nutrition[10] and livelihoods[11]. Losing the fisheries that humans depend on today can lead to overreliance on industrial agriculture and livestock, which is more vulnerable to disease and extreme weather events, both exacerbated by climate change[12].

It is imperative for any effort that addresses climate change in the Amazon to prioritize aquatic ecosystem connectivity. To do this, we must:

- Maintain 80% of Amazonian freshwater wetlands with effective conservation and management measures, like protection for free flowing rivers, maintaining fishing effort to 2022 levels, and implementing an integrated watershed perspective when selecting conservation areas.

Since the ecosystem integrity of the Amazon depends on aquatic connectivity, key freshwater habitats across the basin need to be maintained. Freshwater habitats in the Amazon include rivers and lakes, as well as meadows and marshes, tidal wetlands, floodplains and flooded forests, and peatlands[1]. These habitats are diverse and maintained by the flow of water between them, facilitated not only by rivers and streams, but also by aerial rivers and groundwater which provide water from the atmosphere and from underwater[13].

Thus, what happens in one freshwater habitat is affected by the other, and adaptations of traditional conservation and natural resource

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management plans can support maintaining connectivity between them. For example, legislation that has been used to protect terrestrial environments can be mimicked to protect rivers. Since 1968, eight countries have created conservation systems like those that establish National Parks focusing on rivers[14]. Fisheries management plans can also be developed from an integrated watershed perspective, looking beyond the area of incidence to how they are influenced and influence the system at large to adjust fishing effort accordingly[15]. Even the creation of protected terrestrial areas can be done with freshwater systems in mind. When terrestrial protected areas are designed with aquatic connectivity in mind, freshwater benefits can be increased by 600% for a 1% reduction in terrestrial benefits[16].

- Strengthen care for the environment through participatory governance to totally eliminate deforestation, degradation and criminal-provoked fires before 2030.

Deforestation, degradation, and criminal-provoked fires are a threat not only to Amazon forests, but to its freshwater systems. Certain flooded forests, such as Mauritia flexuosa palm stands in the Western Amazon, are both a source of commercially valuable palm fruits and a critical carbon sink (peatlands), which require community-based sustainable management and governance regimes. Also, a healthy forest along rivers prevents erosion and maintains evapotranspiration and precipitation patterns, maintaining flow across the landscape[17]. Without vegetation holding on to soil, water becomes stagnant– we have seen this throughout the basin as a consequence of deforestation for mining and agriculture[18]. The loss of flow prevents sediments, nutrients, and water to flow downstream where they not only support the humans and wildlife that lives there, but also empty out into the Atlantic ocean supporting a key part of the hydroclimate cycle[1].

Ensuring the elimination of deforestation, degradation, and criminal-provoked fires requires a commitment to environmental stewardship in the long-term. Successful environmental stewardship, that is stewardship that results in healthy forests and rivers, requires collaboration across sectors, particularly those that center local relations[19]. Already, protected areas and Indigenous territories in the Amazon make up 50% of the Amazon basin and hold 58% of the

aboveground carbon stock[20]. The effectiveness of these is clear with demarcated Indigenous territories having significantly less deforestation than non-Indigenous territories[21]. Their expansion and participatory governance must be strengthened by formalizing and upholding Indigenous and local land rights, sustainable livelihoods, and intergenerational and intercultural education initiatives[20],[21].

- Ensure development investments and economic activities have net positive effects on freshwater connectivity and implement a moratorium on dams.

Development investments and economic activities are often a source of obstruction in freshwater connectivity. Dams outright control the flow of rivers from upstream to downstream[18], while channelization controls the rivers ability to move laterally in the floodplain[22]. Hydroways can also be an obstruction in freshwater connectivity as dredging the river can change sediment dynamics as well as physically make the river deeper, changing the speed at which the river flows and the area that is seasonally flooded by the river[23]. Economic activities like mining (both large- and small-scale) and agriculture not only change the sediment and flow dynamics, but they also contaminate water, which directly affects animal and human health and requires advanced, expensive technologies to clean[24]. Even those that do not directly affect rivers can have an effect on water systems: roads in the basin beget more roads, mining, agriculture, and deforestation, which leads to more erosion, chemical run-off, and physical changes in the freshwater system[25].

Sound development investments, economic enterprises, and urbanization processes are necessary and can be planned in a way that prevents degradation and even positively affects freshwater connectivity. In the Amazon, there is a real opportunity to preserve the freshwater connectivity that exists: some rivers could be

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designated fluvial reserves to maintain freshwater integrity. These can be co-designed with riparian human communities to guarantee fish movement, protect the seasonal variability of river flows and recognize the role of freshwaters as integrators and influencers of social-ecological systems throughout the Amazon Basin[4]. It is more cost-effective to prevent the effects of poorly planned investments and activities than to have to fix them later[24]. For this reason, the Amazon Waters Alliance also calls for a moratorium on dams.

Business-as-usual climate change models predict extreme drought and extreme flooding in the Amazon, making inhabitants of the basin deeply vulnerable. As we work to mitigate the strength of the change to our global climate system, we must also work to adapt to that change so that the effects are not as dire. Two aquatic connectivity axes by which Amazon inhabitants will need to adapt to are fisheries and water potability. Extreme drought and flooding will create mismatches between the new flow regimes of rivers and fish biology. Where fish could once be relatively reliant on a rhythm that allowed them to access spawning grounds via periodic flooding, extreme drought may create a barrier and lower fish populations. This same change in flow regime could affect the availability of water overall and the quality of the water that is available for humans.

To adapt to these effects of climate change, there needs to be dialogue and coordination across a

large scale around nature-based solutions. Nature-based solutions include the protection and restoration of critical habitats and sustainable practices, including those outlined in the calls to action above, and thus reduce climate change risks. Many of the important fisheries in the Amazon depend on migratory fishes that span administrative boundaries[11]. Thus, knowledge exchanges that bring together people across the basin can keep people apprised of changes across the basin, allowing them to learn best practices and prepare for any fishery changes. Similarly, because water moves across space, having safe, potable water requires similar knowledge exchanges for systems that respond across geographic scales.

Implementing nature-based solutions while facilitating local community leadership and knowledge exchanges can pave the way for recognizing systemic injustices, responding to socioeconomic and sociopolitical realities, and promoting justice, equity, and community resilience[24].

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