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Essays and Perspectives

# Connectivity and policy confluences: a multi-scalar conservation approach for protecting Amazon riverine ecosystems

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## HIGHLIGHTS

- The Amazon basin is approaching a tipping point, and is therefore of paramount concern for biodiversity conservation.
- While attention is paid to the protection of terrestrial ecosystems, freshwater efforts lag behind, despite rising threats.
- Basin-wide conservation policy development, implementation, and enforcement requires commitments across all scales.
- Stakeholder's participation in the system could be facilitated by supporting cross-border and cross-scalar capacity-building.

## GRAPHICAL ABSTRACT


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## ABSTRACT

The world is calling for ambitious conservation targets for the Amazon, the world's largest hydrographic basin, with an aim to protect 80% of the biome by 2025. With less than two years to reach this target, it is time to bridge scientific, management, and policy divides in understanding and safekeeping the Amazon. A collaborative, concerted effort is required for developing policy strategies toward the integration of riverine biocultural diversity and connectivity to conserve the basin. Building on policy analysis and interviews with diverse stakeholders, this paper identifies key elements that can support the creation of an Amazon basin-wide riverine conservation system's approach, focusing on public policies and institutional arrangements. The proposed system concentrates on coordinated protection of riverine connectivity and ecosystem services across this transboundary basin. It builds on existing policies, institutions, and governance arrangements to instantly include rivers currently under some form of protection, while providing a platform for investigating other rivers for subsequent inclusion. Fostering transdisciplinary dialogues, addressing power imbalances, and promoting capacity building across scales would facilitate meaningful participation of key stakeholders in the system's governance. Building on local strengths, enforcement would happen at the regional and national levels.



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## Introduction

The Amazon is one of few remaining basins with large contiguous river networks of extensive connectivity (Grill et al., 2019) (Fig. 1). Its rivers directly support 47 million people, with 2.2 million self-identifying as Indigenous (Athayde et al., 2021). The Basin hosts 10% of the world's biodiversity (SPA, 2021), including 13% of known freshwater fishes, of which roughly 7% are potadromous species that migrate through the basin's rivers (Duponchelle et al., 2021), therefore relying on the integrity of the system's connectivity. Integrated Amazonian rivers and forests are climate regulators at regional and global scales, including the Amazon flying rivers that affect much of South America (van der Ent et al., 2010).

Despite its global cultural and ecological significance, the basin is troubled by compounding threats. Dam development, terrestrial and aquatic highways, mining, agribusiness, and rampant fires for forest clearing all disturb and obstruct riverine corridors, in unique and compounding ways, limiting the river's capacity to supply its full extent of ecosystem services (e.g., Latrubesse et al., 2017; Anderson et al., 2018; Diele-Viegas et al., 2020; Ferrante et al., 2020; Rajão et al., 2020). Due to these destructive activities, exacerbated by climate change, the Amazon rainforest is close to a tipping point of moving from forests to savanna-based ecosystems (Lovejoy and Nobre, 2018). Recognizing this reality, in 2020, the International Union for Conservation of Nature (IUCN) called for protecting 80% of the Amazon by 2025 (WCC 2020 Res 129) (IUCN, 2020). However, the resolution primarily focuses on forests, failing to include river protection. This omission highlights a conservation bias towards terrestrial systems (Abell and Harrison, 2020; Leal et al., 2020), despite growing awareness of the need to maintain vulnerable riverine connectivity (Castello et al., 2013; Latrubesse et al., 2017; Anderson et al., 2018). Arguably this terrestrial focus fails to recognize the interconnectedness of the forest and rivers, a deficit for conservation planning.

To secure adequate protection and management of freshwater systems that optimize sustained benefits of ecosystem services, a social-ecological systems approach accounting for biocultural diversity is necessary (Kingsford and Biggs, 2012). Conceptually, biocultural diversity provides an opportunity for enhanced understanding of the interconnectedness of biological and cultural diversity, and their mutual reciprocal influences. These relationships have resulted in a range of Indigenous and local knowledge (ILK) practices and beliefs that have contributed to the conservation and sustainable use of biodiversity in the Amazon over many years (Athayde et al., 2021). Connectivity throughout the Amazon implies that actions taken in one area can significantly impact other areas upstream, downstream, laterally, or temporally. Thus, conservation strategies for Amazonian river networks must also address the challenges of scale posed by this enormous ecologically and socio-economically complex basin.

Managing common resources, particularly transboundary ones like water, is typically addressed within supranational or regional governance frameworks (Miller, 2021), while also requiring different levels of governance and interventions at different scales. Multi-scalar strategies not only must address the intricacies of transboundary environmental governance but also engage the complex social dynamics involved (Cooke et al., 2024). These transboundary commons encompassing diverse spaces and species require a form of hybrid governance involving collaborative activities that bring together different stakeholders, including governmental bodies, private entities, and societal actors (Miller et al., 2020). No 'one-size-fits-all' template for catchment management exists (Flitcroft et al., 2018). Therefore, if a watershed is to be protected and managed effectively, it must deal with the specific social-ecological features, economic and political complexities, and actors involved (Vollmer et al., 2023). To ensure protections and sustainable use of riverine ecosystems are effectively integrated and socially equitable, a fully participatory process of stakeholder engagement is vital. Albeit challenging, such a process is necessary and requires human and financial capacity.

Cid et al. (2022) argue that understanding the links between ecosystem functions across river networks, and, hence, the management of these rivers and their services to improve social-ecological connectivity, requires a meta-system level approach at the regional scale that moves beyond decision-making at the local watershed scale. Against that backdrop, we provide an approach for developing a basin-wide conservation strategy to protect riverine connectivity in the Amazon, designed to be highly adaptable to local nuances and stakeholder needs, while integrating them into national, regional, and global conservation priorities. Our study draws on existing policy platforms that can be used for riverine ecosystem conservation in the Amazon basin, and facets of policies from other parts of the world.

## Methods

Our approach is informed by 28 semi-structured interviews, recruited by snowball sampling, and conducted with persons from academic institutions (46%), non-profit organizations (32%), government agencies (3%), environmental agencies (11%), water resources managers (4%), and fisher associations (4%) associated with the Amazon basin. G̈rounded theoryẅas applied to organize the data gleaned from the interviews (Glaser and Strauss, 1967). Results were coded and separated into categories to reveal emerging themes and their relationships to one another (ibid). The "Constitute" database (constituteproject.org, 2019) was searched for any references to freshwater ecosystems in the Constitution of each Amazonian country. In addition, policies at the national and basin-level related to water resources and environmental governance that were mentioned during the interviews, as well as others encountered during an extensive literature review, were analyzed for their potential use in developing a conservation approach (Supplementary Material).

### Taking lessons from basin-wide conservation approaches

To create a basin-wide conservation approach for the Amazon, lessons can be learned from existing large-scale strategies around the world. First, the Integrated Water Resources Management (IWRM) framework was conceived to strike a balance in the interrelated economic, social, and environmental aspects of watershed governance. Grounded in IWRM principles, the Wild and Scenic Rivers Act of 1968 (WSRA) in the United States (US) protects free-flowing rivers or stretches of river, and their ecosystem services, that are of regional and national significance (Perry, 2017; 2021). In so doing, it is intended to establish a compromise between the conservation and development of rivers. Because these protected rivers fall within various jurisdictions of land and water management, an interagency council was formed to make management practices uniform across agencies. Moreover, non-profit organizations (e.g., American Rivers) and coalitions of grassroots groups such as the Wild and Scenic Rivers Coalition hold those management agencies accountable for fulfilling existing protections and advancing new protections within the system. This policy framework has since been used as a model in several countries to create similar conservation systems (Perry et al., 2021). Adopting a comparable model in the Amazon might include establishing

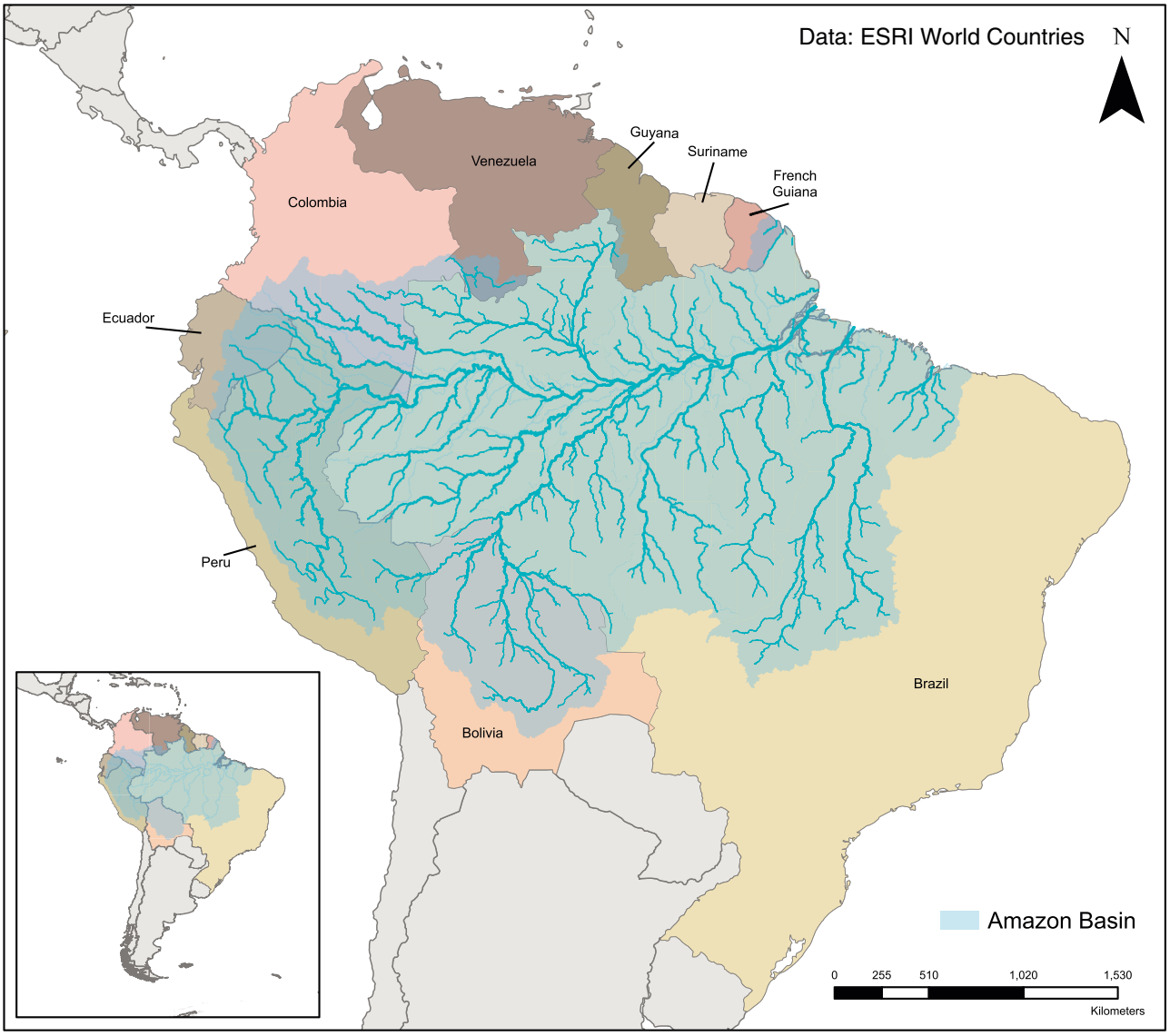


**Fig. 1.** Amazon Basin countries and main tributaries.

such a council grounded in the Ministry of Environments from each country and a coalition of grassroots groups and Indigenous communities from across the basin.

Unlike the WSRA, the European Water Framework Directive (EWFD) is an international model of IWRM practices. Generally regarded as a successful policy, the EWFD is enforceable by the EU governing body and is implemented at the State level by national environmental agencies (Aubin and Varone, 2004). Yet, the policy has been criticized for the lack of explicit protection of riverine connectivity (Schäfer, 2021) and as a top-down approach trying to force a generalized policy onto more nuanced regional issues (Voulvoulis et al., 2017; van Rees et al., 2021). Despite its shortcomings, the EWFD provides a model for multinational governance of rivers.

The UN Watercourses Convention (UNWC) provides a framework for the collaborative management of transboundary basins and to ensure equitable use of resources between countries. The Convention provides guidelines for countries sharing watercourses to cooperate in their management, use, and protection. As such, by ratifying the UNWC, Amazonian countries can demonstrate their commitment to sustainable river management and collaborate to develop and implement conservation plans for the basin. The UNWC can also help address the challenges posed by the basin's loss of river connectivity. The Convention provides a platform for countries to engage with other international organizations and stakeholders, such as NGOs and Indigenous groups, to ensure that their voices are heard in the decision-making process.

There are several examples of transboundary management iniatives for other large rivers, such as the Mekong River Commission, the Nile Basin Agreement, and the Niger Basin Authority. These are designed to support the sustainable use of the rivers and their resources, while ensuring their conservation, and to enhance cooperation between the riparian states. Many of these examples highlight the complexities of transboundary agreements and provide important guidance and lessons-learned for application to the Amazon.

## Building a conservation system from the ground up

It is essential to consider the dynamic nature of rivers at different levels in policy-making. We draw upon the recommendation by Cid et al. (2022) that suggests that to enhance the protection of river connectivity, efforts must move beyond the scope of local strategies alone and instead adopt those that take into consideration the entire watershed scale dynamics and feedbacks. We recognize the complexity scale presents for managing from a basin-wide

perspective, given that distinct ecosystems are connected across thousands of miles. Thus, we offer a trans-scalar approach with practical elements that Amazonian countries can expand upon to protect riverine connectivity and associated ecosystem services. According to one interview participant, "*the local populations have an awareness, but at the regional, national, and international level, there is a lack of understanding that a conservation system is a priority that has to be made*" (IV A). Thus, we aim to raise awareness, of not only the need, but of how such a system could be formed from the ground up.

Our approach identifies a nested system of policies, institutions, and governance arrangements and how they can be extended across the basin. The existing elements in each of these strategies could facilitate cross-border dialogues, expedite the protection of certain rivers, and encompass inclusion of additional rivers in the future. In our discussions below, we first describe mechanisms and initiatives from the local to the global level that could be coordinated across the Amazon. The processes and policies presented are not exhaustive, but instead provide examples to inspire basin-wide approaches for riverine conservation.

First, at the local scale, we recognize existing governance arrangements and initiatives that already aim to enhance the protection of riverine ecosystems and biocultural diversity. Moving to the national scale, we highlight organizations and legal protections enforced by the State. Then, we consider regional conservation initiatives spanning across borders that, when taken together, can form a transboundary basin-wide riverine conservation system. Next, we identify global agreements and guidelines that influence riverine conservation efforts. Finally, we underscore several challenges and opportunities to consider for implementing this approach.

## Local scale

Indigenous peoples, and local and urban communities in the Amazon play a critical role in the governance, management, and conservation of rivers and aquatic ecosystems. Rivers and river connectivity also support livelihoods and other important relationships between cultural and biological diversity in the region (the biocultural diversity). Biocultural approaches to conservation have the potential to challenge prevalent views and practices, and to place issues such as power, rights, and place-based worldviews central in conservation decision-making (Zanotti, 2018). Nevertheless, local people have been given limited options for participation in planning, policy development, and decision-making processes related to aquatic resources, including fisheries-related and water policies, infrastructure implementation, and transboundary coordination (Athayde et al., 2019). The disconnect between local governance arrangements, customary laws, management, and formal regulations and policies coming from state-level to national jurisdictions creates conflicts, confusion, and negative implications for conserving rivers and freshwater ecosystems, especially in transboundary areas (Doria et al., 2020).

Research and practice show the importance of local arrangements, rights-based approaches, and community-based co-management initiatives in protecting social-ecological connectivity and promoting the conservation of freshwater biocultural diversity (Campos-Silva and Peres, 2016; Zanotti, 2018., Athayde et al., 2021; Campos-Silva et al., 2021). For example, consultation protocols have been developed by Indigenous peoples and local communities to protect their right to Free, Prior, and Informed Consent (FPIC) for projects or policies that might threaten their territories, livelihoods, or cultural expressions (RCA, 2018). Some of these protocols have been used to halt or question development projects that threaten the connectivity and integrity of rivers. For example, the International Hydropower Association's San José Declaration on Sustainable Hydropower recommends that all project-affected communities, including Indigenous Peoples and vulnerable groups, should be identified and engaged in the issues important to them during the development of hydropower projects (IHA, 2021). Meanwhile, formal and informal fisheries agreements, such as the Várzea Project, regulate the access and use of fisheries resources in community-controlled aquatic ecosystems across the Amazon (Almeida et al., 2009; Campos-Silva and Peres, 2016; WWF, n.d.). Citizen/Community science and participatory monitoring initiatives, which involve local participation in collecting data about fisheries, water quality, and other topics, are fundamental in filling data gaps as well as knowledge across broader scales (Zuanon et al., 2019; Doria, 2022). However, while certain studies propose that local stakeholders wield considerable influence over state actions, especially in the realm of transboundary water (e.g., Offutt, 2022), contrasting perspectives suggest that the upsurge in local water governance initiatives has not translated into a noteworthy augmentation of decision-making authority at the local level (e.g., Norman and Bakker, 2009). It is of utmost importance to build capacity at the local level, empowering communities to actively participate, and contribute their knowledge and expertise from the beginning of water governance processes. Thus, we propose that local and Indigenous communities be involved in the shaping of river conservation strategies and that their knowledge be included in the development of management plans.

## National scale

Amazonian countries have established different types of Protected Areas (PAs) (e.g., National Parks, Refuges, Nature Reserves, Indigenous Territories). Although PAs are considered some of the most effective safeguards against degrading development activities, rivers are often not well protected despite being part of PAs, and especially when they form the boundaries of PAs (Thieme et al., 2012; Hermoso et al., 2016). As one interviewed participant noted, "*if you look at the existing conservation polygons in Bolivia's map, it looks like a Protected Area, but when you zoom in, there are empty 'gaps.' These gaps are rivers, these gaps are borders of Protected Areas. There is no level of protection*" (IV B). A river and its riparian area need explicit protections throughout the corridor, not just to rely on terrestrial protections around the watershed, given that terrestrial protections do not expressly set out to protect riverine connectivity, biodiversity, or associated ecosystem services. The adoption of freshwater protected areas (FPAs) where the conservation focus is on aquatic ecosystems (Piczak et al., 2023) can help scale-up the strategy.

The Mamirauá Sustainable Development Reserve in the state of Amazonas, Brazil stands as a noteworthy model of PAs (Lopes et al., 2021). Established by government decree, its primary objective is to harmonize the conservation of biodiversity with the well-being of residents, recognizing their deep connection with the river and its dynamics. Projects aimed at enhancing socio-ecological systems, such as fisheries management, forest agrosystems, and community-based tourism, are conducted in the reserve. They not only contribute to the preservation of freshwater environments, but also empower local residents by involving them in decision-making processes. This sustainable reserve exemplifies how supporting socio-ecological systems also protects freshwaters. Such models could be used elsewhere in the basin for similar purposes.

The Ramsar Convention also stands for freshwater protection. While it is an international Convention, its actions, such as the designation of wetlands of international importance ('Ramsar sites'), are implemented at the national level. The Ramsar Convention can be an important FPA mechanism, especially because the Conven-

tion addresses both biodiversity conservation and 'wise use' of these wetland resources. Ramsar sites should lead to improved management of the rivers that flow through them (Piczak et al., 2023) and of Amazonian wetlands within them, although this is not always the case.

A relatively new development of a legal process for granting rivers legal standing in courts, or 'Rights for Rivers' is a rapidly expanding set of actions designed to hold accountable entities that would cause harm through degrading development activities such as dam building. Thus far, three Amazonian countries (Colombia, Ecuador, and Peru) have implemented Rights of Rivers (Perry et al., 2021). While it is still unclear how some countries will enforce these policies, bestowing these rights on additional rivers, especially those that border PAs, could add much needed layers of protection on rivers of conservation concern.

We suggest implementing a comprehensive strategy that integrates terrestrial PAs, and inland aquatic PAs, Ramsar sites, and other governance measures. By combining the strengths of these different approaches, especially in areas where local arrangements, fisheries agreements and citizen science already exist, the scope of management can be expanded to include the riverine realm, thereby contributing to the achievement of freshwater biodiversity conservation goals.

An example of such a multi-scalar approach of national and international policies employed to regulate, safeguard, and enhance the governance of freshwater ecosystems is in the Tarapoto Lake system of Colombia. Here, the implementation of local community fishing agreements paved the way for the formalization of Resolution 1225/2017 by National Fishing Authorities, also supported by NGOs. The lake, that is part of a complex of lakes, rivers, and wetlands, is the first Ramsar site in the Colombian Amazon. This hybrid governance model not only safeguards fish populations but also extends its protective umbrella over wetlands and freshwater mammals such as the pink river dolphins. As a Ramsar site, it bears an international šealẗhat facilitates the coordination of diverse actors and perspectives across multiple scales. The establishment of the Planes de Ordenación y Manejo de Cuencas Hidrográficos in the Loretoyacu area (Decree 1640/2012 and Resolution 2019 for Loretoyacu) marks a significant step in expanding the management to a broader region encompassing Tarapoto. This national legislation for integrated basin management prioritizes social participation to craft the diagnoses, plans, and proposals for the sub-basin. The efficacy of these management plans hinges on the active involvement of relevant actors in their construction and execution. Moreover, at a broader scale, the recognition of the Colombian Amazon as a subject of rights of nature (Macpherson et al., 2020) introduces an additional layer of protection. Although it is necessary to have more financial support to improve livelihoods, the aim is that an Amazon approach as an intricate web of governance structure could support communities and help freshwater ecosystem to flourish, as each layer contributes to the overall capacity building and resilience of the region.

To help in the management and governance of the Amazon approach, there are some entities already tasked with environmental protections in each country, such as the Ministries of Environment and Environmental Agencies. In their capacity to create, implement, and/or enforce policy in each country, these entities must work collaboratively among themselves, with legislators, NGOs, and different sectors of society to craft policies to advance protections of riverine connectivity, biocultural diversity, and ecosystem services. One option for doing so is to form committees or working groups tasked with advancing such policies. In Brazil, river basin committees may facilitate discussions related to water management issues. Protection entities could coordinate with these committees to incentivize the incorporation of ecosystem protections into water resource management strategies. However, it is important to highlight that Brazilian river basin committees have limited decision-making authority, and their representation has weakened in recent years.

Additionally, coordinating standard procedures for implementation and enforcement of the conservation policies, in co-design efforts and with the inclusion of Indigenous peoples (e.g., Fundação Nacional dos Povos Indígenas in Brazil and Confederación de Nacionalidades Indígenas del Ecuador) and local communities is imperative. Coordination among national organizations and policies in turn could strengthen riverine governance at different levels. Aside from meeting the Amazon specific targets, these proposed actions can simultaneously advance national efforts to achieve the global $30 \times 30$ targets to protect 30% of inland waters by 2030, creating a win-win scenario across scales (WWF, 2023).

## Regional scale

Effective conservation efforts require more than just successful implementation of local-scale practices. Conservation actions can be compromised if local efforts are not strategically connected to another related area and regional dynamics. This underscores the importance of multi-scalar approaches to conservation (Cid et al., 2022). Whenever possible, initiatives must be scaled-up as suitable for the Amazon basin. In this respect, harmonization of environmental policies between countries will play an important role. Drawing on the Escazú Agreement (2018) and Leticia Pact (2019), efforts should be made to enhance public participation in the environmental decision-making process, support the conservation and resource management efforts of Indigenous peoples, and promote connectivity of priority ecosystems. First, for these instruments to be effective, it is crucial that all countries within the basin become signatories and facilitate meaningful, inclusive, and equitable participation of key stakeholders in decision-making processes, such as Indigenous and local communities and NGOs. By working together under one singular legal framework, there is a unique opportunity to develop a cohesive plan for the region.

The Amazon Waters Alliance provides an example of such efforts that recognizes the significance of integrated management at the basin scale, and how sub-basins are connected. It focuses on implementing conservation strategies across the region using hydrographic basins as the management units and applies an üpstream-downstreamšpatial framework of Integrated River Basin Management (IRBM) (Amazon Waters Alliance, n.d.). Their system is designed to be scalable, working from very small to large sub-basins within the Amazon, and including the entire Amazon region. Additionally, the World Wildlife Foundation Living Amazon Initiative strives for a balanced and environmentally sound Amazon biome, preserving its ecological and cultural significance for local communities, countries, and the global community.

In another example, protection mechanisms of inland water systems link across river networks, taking account of their connectivity and the specific rights, uses, and needs throughout the basin. The governments of Brazil, Colombia, Ecuador, and Peru, supported by Global Environmental Facilities (GEF) and World Bank, are currently working together under this framework to manage the transboundary freshwater resources in the Putumayo-Içá watershed, aiming to improve governance and increase capacity for inclusive decision-making (Cuenca Putumayo-Içá, n.d.). Their involvement contributes to strengthening local organizations, improving the management of fisheries resources, and enhancing the sustainable management of non-timber forest resources. Scaling up the IRBM approach in the Putumayo-Içá, and applying it over larger areas, can help control and monitor the spread of cumulative impacts on freshwaters, which can otherwise travel across many miles and different geopolitical borders. Other mechanisms

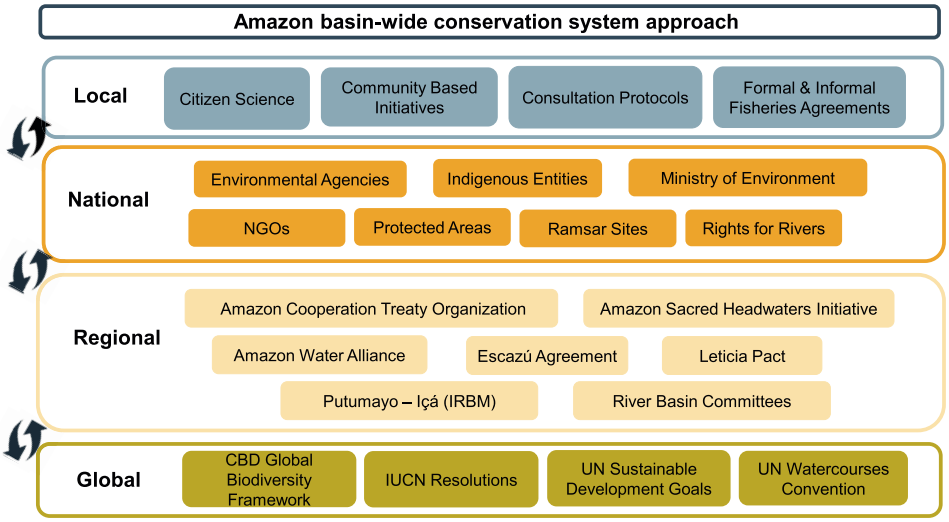


**Fig. 2.** Examples of Amazonian policies and institutions across scales. Examples of key existing policies, organizations, and actions that may be used in the approach for the basin-wide riverine conservation system. Not all Amazonian countries are signatories to all of them or have all of the institutions in place. Some of these examples may transcend scales, e.g., NGOs can act both nationally and internationally. The Sustainable Development Goals and Convention on Biological Diversity (CBD) are applied at the national scale, but note that directives and outcomes are of international relevance. CBD's Global Biodiversity Framework is also implemented at the national scale via National Biodiversity Strategies and Action Plans, but with an objective to meet international goals and targets.

of holistic transboundary coordination and multi-sectoral partnerships for conservation of specific ecosystems may focus on sacred landscapes, such as the Amazon Sacred Headwaters Initiative that seeks protection of headwaters of important Amazonian tributaries - namely the Napo, Pastaza, and Marañón (Amazon Sacred Headwaters Initiative, 2021).

To create, implement, and enforce policies at the regional scale, there is need of a supranational entity to do so. The extant Amazon Cooperation Treaty Organization (ACTO) may serve that purpose with some modification. At present it facilitates knowledge and dialogue but does not specifically focus on water. The ACTO faces criticism from scholars who believe that it could take a stronger role in the conservation of the Amazon *per se* (Newton, 2013). Additionally, one interview participant pointed out that "*ACTO depends on who is in charge, who is the executive secretary and what policies they are implementing [in each country]*"(IV C). Although ACTO has no decision-making power and faces difficulties with conflicting jurisdictions, the governance structure already exists and promotes a regional integration vision, well-positioning it to support cross-border cooperation and improve the management and monitoring of riverine ecosystems. If strengthened, the organization can support actions for economic activities and command and control agencies, always based on collaboration at the regional level, exchange of information between countries, and release of reports on riverine ecosystem status. As described, "*if ACTO works more on the issue of water cooperation, the region will benefit.*" (IV D). Should the countries agree to create a basin-wide river conservation approach, the ACTO could be used as the governing body to enforce it, provided that the organization is strengthened, fostering research and deep collaboration with different actors in the region. To that end, the UNWC, with its focus on sustainable management of transboundary basins, together with other strategies, can help address areas that the ACTO still does not cover, such as guidance on water resource stewardship, providing dispute resolution mechanisms, principles for fair and reasonable utilization of water, and obligation to do no harm (Newton, 2013).

## Global scale

After placing the Amazon in the global context as a key-player for climate change mitigation (Heinrich et al., 2021), scientists, policy-makers and civil society have created the momentum to protect its freshwater resources (Fig. 2). Alongside the resolution to protect 80% of the Amazon, another resolution raised the importance of maintaining the Marañón, Ucayali, Huallaga, and Amazonas as free-flowing (WCC-2020-Res-111-EN) (IUCN, 2020). This resolution is in recognition that these key tributaries connect landscapes and peoples across boundaries and are under severe developmental threat (Latrubesse et al., 2017). Although resolutions are not enforceable, Amazonian countries are signatories of the IUCN; thus, they should be taken seriously and applied towards ever increasing efforts to protect free-flowing riverine integrity.

Furthermore, at the Convention on Biological Diversity's 15th Conference of Parties meeting in 2022, the text proposed for Target 3 of the Global Biodiversity Framework (GBF) called for protection of "at least 30 per cent of terrestrial and inland water areas, and of marine and coastal areas" by 2030. The specific inclusion of inland waters in Target 3 provides the opportunity for including inland waters in the National Biodiversity Strategy and Action Plans of the GBF. Meanwhile, discussions surrounding freshwater at the 2023 UN Water Conference underscored the importance of meeting the Sustainable Development Goals focused on water and freshwater ecosystems (SDG 6 and 15) (UN, 2023). Taken together, these policy goals and targets may provide a platform of policy recommendations for the development and management of a conservation system that is fairer, more inclusive, and sustainable.

## Basin-wide challenges and opportunities

While freshwater management and protection mechanisms exist at various scales, they are not evenly distributed and present management gaps. Furthermore, to create a basin-wide conservation system, significant regional obstacles must be addressed including different social contexts, limited access to remote areas, difficulties collecting data, lack of knowledge about the territory, absence of State and command and control agencies, and enduring communication among basin countries. Country-level socio-economic and environmental priorities also dictate how such policies take shape. Competing priorities within and between countries may pose a challenge. Agendas ultimately depend on who is in charge and whether their goals move towards development or conservation. Pressures and incentives from external markets also play important roles.

Despite these challenges, opportunities for immediate action to protect rivers exist. Those already with some level of conservation status, such as Ramsar sites, those inside or bordering PAs, or granted personhood, could be instantly added to the system essentially forming the baseline upon which the system would build. Additionally, freshwater connectivity corridors identified as vital for certain aquatic species or biocultural connections should be included (Caldas et al., 2023). In addition, areas with existing management frameworks (e.g., Putumayo-Içá IRBM) could be added and expanded on as models for neighboring sub-basins to extend their effective coverage.

To identify other areas of high conservation priority, it is necessary to draw on existing studies and conduct further investigations into the biophysical and socio-cultural realms of the rivers. As cooperation and exchange of knowledge and resources among governments, communities, and scientific institutions is facilitated, and as more rivers are included in the conservation system, the system would eventually become more comprehensive and effective. Ultimately, the system would comprise of an interconnected network of protected rivers, with different strategies and organizations working together to ensure long-term riverine conservation.

## Conclusion

The Amazon river and basin, with its network of over 1000 tributaries, has enormous biocultural significance. Many of these tributaries are free-flowing and otherwise relatively ecologically unimpaired. Amazonian geographies, rivers, forests, cities, and flooded habitats are all interconnected, as are the human populations and communities that depend on them. Moreover, several of these tributaries are transboundary; hence, the importance of cross-border connectivity in the Amazon cannot be overstated. Despite this integration, many policies and initiatives governing the region lack the same level of coordination. These challenges have been identified and supported by various stakeholders' perspectives. Therefore, it is crucial to take urgent actions that integrate across a basin-wide scale to conserve the Amazon riverine ecosystems as completely as possible. The strategies discussed here highlight not only the relevance of coordination across scales, but, importantly, the need to support and scale up, when possible, local initiatives, innovations, and efforts for the conservation of rivers and associated biocultural diversity in the Amazon. Recognizing and respecting human and territorial rights, addressing power imbalances, and providing opportunities for greater participation of Indigenous peoples and local Amazonian residents are paramount elements of a basin-wide system for protecting rivers in the Amazon.

As existing protections can be expanded and layered to achieve riverine-related goals across scales if political will exists, it can also be applied to other basins around the globe. The success of this initiative could inspire other countries and regions facing similar challenges to prioritize the conservation of their natural resources and work towards a shared vision of healthy watershed management (Vollmer et al., 2023) that includes transboundary basins. Taking lessons from strategies both in the basin (e.g., ACTO) and abroad (e.g., UNWC and WSRA), these mechanisms can be strengthened and serve in the creation, application, and enforcement of coordinated protection strategies. This is an opportunity for the Amazon to lead by example in the global conservation effort of connected standing forests and free-flowing rivers.

## Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.pecon.2024.02.002.

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