



Commission for the Upper Cauca River Basin Recovery, Collaborative Governance for Sustainability and Water Security

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Rivers are essential for life, there is an indissoluble relationship between the natural system and the human system. Aquatic ecosystems guarantee ecosystem services to the human system, on the other hand, the human system makes use of these services and as a result of this generates effects on the natural system. However, an over use of these services could adversely impact the natural system. Therefore, the recovery of rivers is a priority for the planet. This work describes the progress of the Commission for the recovery of the upper Cauca river basin as a collaborative governance for sustainability and water security in the region. The upper basin is between the Colombian massif in the department of Cauca and the municipality of Cartago in Valle del Cauca. It is an important natural, cultural, social, and economic resource of Colombia, but it presents a continuous deterioration of water availability, both in quantity and quality, limiting its use for human consumption and a reduction in biodiversity. This work shows that the Commission for the upper Cauca river basin recovery is a process in development. The Commission is an instance made up of public and private entities, which arises from the failure of the current model of water resource management in Colombia. The central problem is how to transcend short-term planning in administrations to long-term planning based on a shared vision. Collaborative governance is proposed as a recovery of the Cauca river based on the concept of bioculturality and the rights of nature, due to the deep relationship of unity between nature and the human species. The need to achieve a shared vision is highlighted, to act under the watershed vision with all the actors involved. In addition, minimal and conclusive indicators must be defined that society recognizes and that motivates it to advance in the recovery. The aquatic ecosystems recovery is a priority, understanding that the investments required for achieving this goal can also significantly contribute to sustainability and water security for the region.

Keywords: river recovery, governance, water security, sustainability, upper Cauca river basin

INTRODUCTION

Maintaining and recovering a hydrographic basin is a requirement in order to have a multifunctional water system that generates environmental services for society and ecosystem conservation.

To do this, it is necessary to understand the interdependence of the different capacities of action of the living beings in the natural environment and the human system, joined with integrated approaches to reach the desired goals. Hydrographic basins are composed of dynamic, diverse, and complex ecosystems, which have been historically intervened and affected by humans, and their water sources have been degraded seriously due to the increase of multiple planetary activities (England and Wilkes, 2018). They provide the physical environment where different species live, reproduce and die; additionally, hydrographic basins generate ecosystem services that benefit people (Kaiser et al., 2020). The environments that the biological populations occupy to perpetuate their existence are diverse: the river bodies, the alluvial soils, the riverbanks, the wetlands, the alluvial plains, and the aquifers (FISRWG, 1998). The riverbanks act communally with the course of the river, establishing the capacity for sustaining life within the system (Naiman et al., 2005). What is more, taking into account the challenges imposed by climate change in terms of mitigation and adaptation, and at the same time, the urgent need for development in still growing economies countries (Baloch et al., 2019; Tauseef Hassan et al., 2020), to sustain hydrological services in a basin scale demands novel governance paradigms.

Rivers have been significant for many cultures. For instance, the notion of the “mother river” is included in Chinese, Indian, Thai, and Russian cultures and was considered the key for sustaining life and fertility (McCully, 2002). The effort toward improving the quality of life, the population increase, the urbanization of cities, as well as the increase of the demand for water resources and soil has caused a decreased ability of species to survive in many river systems, making these aquatic ecosystems the most threatened in the world (Dudgeon et al., 2005). The various forms of pollution have negative effects on the processes that take place in an ecosystem by affecting the biodiversity and the derived ecosystem services, such as water availability for human consumption, irrigation, industry, and ecological sustainability. Apart from pollution, climate change also affects crop production in hydrological basin scales, making the planning exercise exigent and requiring the design and implementation of innovative sustainable policies (Singh and Dhadse, 2021). However, river basins can be recovered, but they require a variety of measures to restore the processes that living beings are part of, thereby, guaranteeing species conservation that was affected negatively due to human intervention (Speed et al., 2016). Some reports show concerns regarding the efficacy of these measures due to the improbability that the ecological recovery desired will be reached in every river basin (Palmer et al., 2010; Bernhardt and

Palmer, 2011; Wohl et al., 2015). The potential of ecological recovery depends on the scale of analysis and the study evaluation time horizon (Verdonschot et al., 2013; Schmutz et al., 2014; Morandi et al., 2017). The experiences of recovery show positive results in hydro morphological degradation, changes in soil use, riverbed reconfiguration, and riparian buffer zones (Lu et al., 2019). Economic benefits in terms of ecotourism have also been reported from river basins recovery as a result of the implementation of multi-criteria spatial decision-making techniques for regional planning (Omarzadeh et al., 2021). In Europe, environmental, social, and economic orientations were directed to the integral management of the rivers with greater multifunctionality and was not considered optimal to be used for only one purpose, disregarding the ecosystems and their ecosystemic services (Nijland and Cals, 2000).

The upper Cauca river basin has been progressively deteriorating, which has affected its quality. There have been several recovering attempts and began with the formulation of the agreement 014 of 1976 by the Regional Autonomous Corporation of Valle del Cauca (CVC) regarding the competence area. In this agreement, the control of the punctual pollution was the main focus, which was initially oriented to promote the constructions of wastewater treatment plants within the industrial sector and the last decades, in the municipalities. Nonetheless, despite the expensive investments made, this strategy has not given the expected results, while the water quality of the Cauca river has continued to deteriorate.

The failure in the recovery efforts of the upper basin of the Cauca river is because the structural issues have not been effectively addressed with a lack of an integral vision of the problem, and because the basin has not been used as the analysis unit for planning of integrated water resources management in the region.

In Colombia, the dominant water management scheme is based on the administrative political division, with weak interinstitutional coordination, limited leadership and teamwork, and in some cases with insufficient information. Planning is carried out for the short term, with little emphasis on products and results that show effective improvements in the river. Some interventions have incurred cost overruns due to errors in the selection of technology and irregularities in hiring processes. Additionally, there has been a lack of a governance model that addresses the problem with innovative solutions and with a shared long term, which is in harmony with the international agenda of conservation, sustainability, recovery, sustainable use of biodiversity, and improvement of the services and benefits of ecosystems for society (United Nations, 2018).

As a strategy to face the situations previously exposed in a different way and looking for an agreed work path, the need for establishing the Commission for the recovery of the upper Cauca river basin arose. This document presents the advances of the Commission for the recovery of the upper Cauca river basin. It is a process being developed in search for a process of collaborative governance with greater perspective.

THE CAUCA RIVER: IN SEARCH OF A STRATEGY OF WATER RESOURCE MANAGEMENT WITH A BETTER PERSPECTIVE

The Cauca river is 1,204 km long and its basin represents 5% of the national area. About 25% of the Colombian population lives in the watershed, with a total of 183 municipalities throughout the basin. The upper basin is an important region; 61 of the basin's municipalities are in the departments of Cauca and Valle del Cauca, and of the total 89 tributary sub-basins, 59 are between Salvajina (Cauca) and Anacaro (Valle del Cauca). In this region is the city of Cali, the biggest human settlement on the banks of the river, from which more than three-quarters of its population is supplied with drinking water. With its water, important economic sectors are supported; 79% of the superficial water collected is used for agriculture and industries.

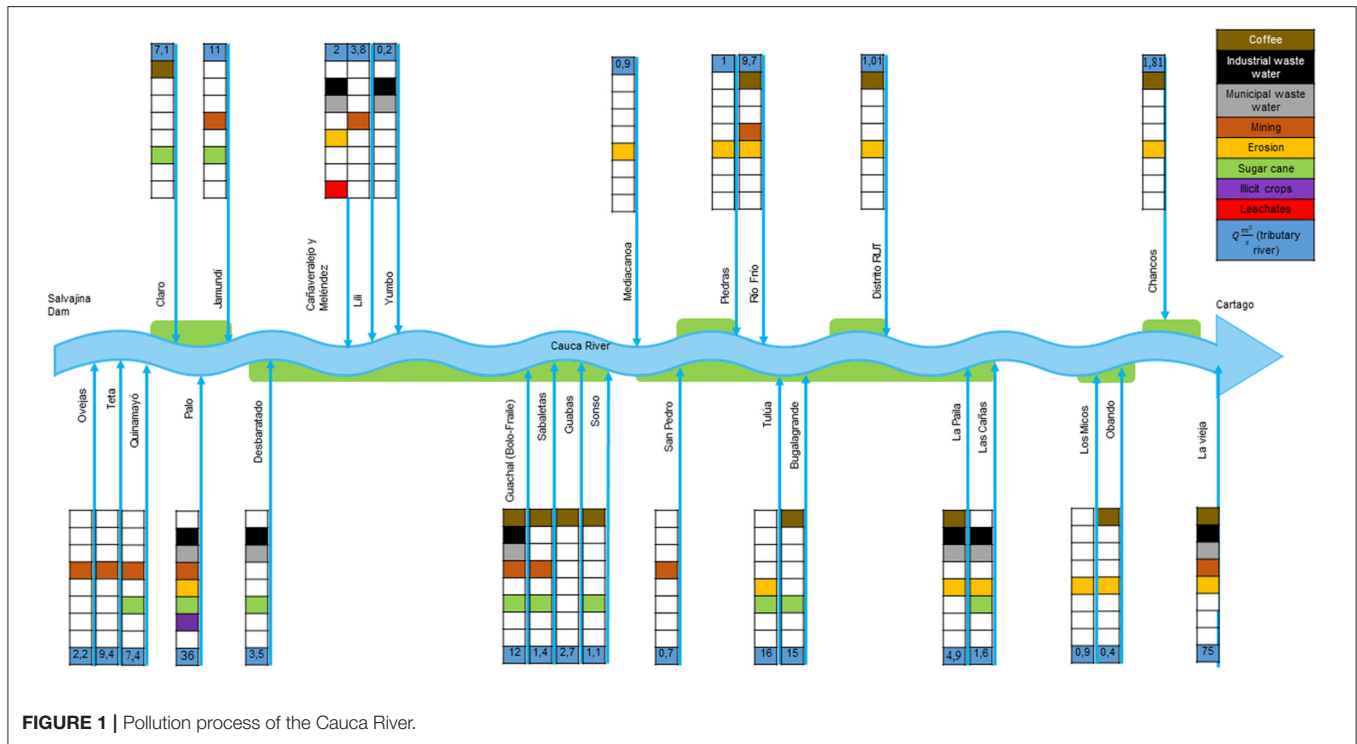
For decades, efforts have been made to preserve the Cauca river, including national, regional, and local legislation, multiple planning tools of the territory, water quality and floods studies, construction works for flow regulation, damage minimization due to floods, and wastewater treatment. However the river show a grave condition: Of 36 hydrographic subzones that make up the Cauca river, for dry year conditions, 25 present a high index due to variability of water offer; 34 subzones have between high and very high pressure for demand and climatic variability; 28 between high and critical pressure on ecosystems; 26 have between high and very high pressure due to contamination; 14 subzones show high to very high water erosion and 31 sub-zones between high and very high transformation of highly flooded areas (IDEAM, 2019). **Figure 1** shows a schematic representation (without scale) of the route of the Cauca river, its tributary and activities that cause pollution in the Cauca river. The water resource management plans WRMP established in the regulation for tributary rivers will offer detailed information by section of the river. There is a great affectation due to the sediment load coming from the El Palo, Desbaratado, and Timba rivers that are located in the north of the Cauca Region. Moreover, due to the sediments transported by the rainwater channels in the city of Cali, there have been temporary closures of water intakes of the Water Supply Treatment Plant from Puerto Mallarino and Cauca river because of the high turbidity and pollutant load. From those channels, between 300 and 400 T/d of sediments, are removed (Galvis et al., 2018). From the El Hormiguero bridge until the La Virginia bridge, the water quality of the river with maximum and minimum flow rates is between the categories 'fair' and 'poor' as a source for human consumption. According to Galvis et al. (2018) the specific amount of pollution discharged in the upper Cauca river basin (La Balsa—Anacaro) estimated for summer was 131.6 T BOD₅/d, where most of the higher discharges were associated with the sub-basins of the El Palo river (8.3 T/d), Zanjón Oscuro (7.5 T/d), Guachal river (7.1 T/d), Yumbo river (4.5 T/d), La Paila river (5.2 T/d) and the municipality of Cali (61.1 T/d), which contains 46.4% of the total of pollutant load to the river. It also includes household and industrial dumping and untreated rainwater drainage that affect the water bodies' quality,

compromising aquatic ecosystems (Vojinovic and Huang, 2014; Samant and Brears, 2017; Schuch et al., 2017).

On its way, the Cauca River receives domestic wastewater from more than 10 million people, starting with a high pollutant load that it receives in the Popayan city (Cauca department), where several rivers and streams bring untreated wastewater from about 400,000 people. Continuing with the tour, in the Salvajina dam the river rests and becomes a little oxygenated, however, later it crosses gold mining sectors, where some of them use mercury in their extraction, as well as sandboxes between artisan and industrialists. After passing through Cali, the river is again affected by high levels of contamination (i.e. organic matter, total solids). Studies by Madera-Parra et al. (2018) show that the presence of diffuse contamination in the Cauca river by compounds such as 10,11-dihydro-10,11-dihydroxycarbamazepine, ibuprofen, gemfibrozil, naproxen, paracetamol, bisphenol A, 4-isonylphenol, estrone and sulfamethoxazole, with the highest concentrations at the wastewater treatment plant of Cali, the southern channel and at the exit of the city of Cali, in concentrations of up to 27,000 ng/L. These compounds have a high threat to the aquatic biota present in the Cauca river.

Water quality research carried out in the Cauca river found a variety of emerging micro-pollutants with endocrine disruption potential, as well as a composition of the river microbiome close to a sewage stream without treatment (RICCLISA, 2018). The quality of the Cauca river has worsened despite all efforts, which include copious regulations, multiple plans, projects, and investments (e.g., many PTAR). The problems of the upper Cauca river basin are reflected in the loss of navigability function, reduction of ecosystem diversity, and critical quality parameters for the different uses (raw water does not meet the defined standards in the national regulations in order to be used as a source for human consumption). Operational effects for increasing the closure of the Cauca river intake for aqueduct service, is an indicator of the increasing pollution that at the same time is a risk indicator for the city water supply, which has been forced to build and put into operation for two reservoirs with a capacity of 180,000 m³ to reduce the suspension of the service to the users. Between 1950 and 1986, 90% of the river wetlands were desiccated or removed by filling them with debris. Flow rates of the tributaries used to supply Cali today are below the expected amount in the design of the water treatment plants. Ingram (2008) claims that institutions responsible for river basins are incapable of providing evidence of improvement in problems that have been in development for many decades, especially when they are ruled by forces beyond their control.

The causes of pollution are complex; they are beyond technical issues, and they must be recognized and addressed to achieve a shared and consistent vision of long term recovery (30 years minimum), which transcends government periods. Also, it is necessary to work in teams, guaranteeing the participation of all actors, recognizing that nobody owns the truth and that nobody can cover all the necessary interventions. The governance model has not been successful and it is mandatory to improve it in order to arrange the recovery. Now it is required to put into practice the



basin approach as an analysis and action unit, and to look at the water integrally considering different uses and users.

Investments must be prioritized according to their impact on the water quality of the river, changing the paradigm of solutions at the end of the pipe, and encouraging the implementation of nature based solutions. In addition, it is essential to move forward systematically with specific strategies such as prevention as the effective option to control the punctual and diffuse pollution as well as the minimization, reuse, and use of the self-purification capability of the river (natural or stimulated) (Galvis et al., 2018; Galvis, 2019). Interventions must consider comprehensive actions aimed at: the strengthening of capacities and effective interventions to the basins that facilitate the follow-up and control (integrating a monitoring network); to evaluate the institutional performance based on the impact of the investment, e.g., how many milligrams of oxygen dissolved per liter will increase in the critical sections; exchange information and experiences—including national and international networks; to promote biocultural approaches and to involve the community taking advantage of the wide variety of communities and ethnic groups existing in the river basin.

The consequences of the degradation of the upper Cauca river basin already present risks to human health, hydric safety, and ecosystems sustainability. It presents an opportunity to guide efforts to improve the conditions of the ecosystem, thus improving the health of people and neighboring communities (Naiman and Dudgeon, 2011). Such is the case of Cali, a city of two and a half million inhabitants, which captures 80% of the water directly from the Cauca river for human consumption. All this implies massive environmental costs that will be transferred to future generations.

SUCCESSFUL BACKGROUND RELATED TO THE RECOVERY OF RIVERS

After several failed attempts to integrally address the recovery of the Cauca river upper basin, the Comptroller General of Santiago de Cali and the Cinara Institute of the Universidad del Valle, promoted a forum for the recovery of the Cauca river in August 2017. This activity included a tour around the river and a meeting with the international invited lecturers and important key actors of the management of the Cauca river. The purpose of the was to provide the region with the learned lessons of successful processes of recovery of rivers around the world. Experiences to recover Elba river (Schütze, 2017), the Rin river (Gangi, 2017), and the Thames river (Oates, 2017) were reviewed. A summary of the experiences of the successful recovery of those rivers is described below:

The Elba River

A basin that is shared by four countries, principally the Czech Republic and Germany, and Poland and Austria with a smaller area. The basin has a length of 1,096 km, an area of 148,268 km², a population of 24.5 million, and an average flow of 870 m³/s at the mouth of the river. It is used as a source of water in cities such as Dresden and Torgau with river bed filtration technology and was the most polluted river in Europe. There were so many chemical industries (acid discharge, oil, photography, and a lot of open lignite mines), that the population normally said “you can print photographs inside the river because of the number of chemicals in it.” Federal states did not agree over the river basin, which made the management more difficult. Between Germany and the Czech Republic in 1990, the International

Commission of the River Protection was established in order to generate action recommendations: a central office of eight people (at Magdeburg); Committees: authorities, scientists, NGOs (120 people in total). The improvement of the water quality was established as a priority, and flood problems were addressed. The establishment of spaces for nature and to promote tourism was emphasized, and today it is Unesco biosphere reserve (Schütze, 2017).

The Rin River

The river basin covers nine countries: the Netherlands, Germany (50%), France, Luxembourg, Belgium, Switzerland, Austria, Liechtenstein, and Italy. With a length of 1,233 km and an area of 200,000 km², it is the third long river in Europe. It has the most important navigation European route (825 km), 60 million people inhabit the basin, and the basin supplies 30 million people. In 1970 the Rin river was considered the European sewer. The chemical and metallurgical industry used the river as transport and there were a lot of disagreements that obstructed the recovery progress. Ambitious goals were set; such as the return of the salmon, which was defined as an indicator of a healthy river. Commissions were appointed and by 1999, a more integral approach was adopted through the sustainable development of the whole ecosystem, creating the “Rin 2020” program, where all countries developed their legislations with the obligation of implementing measures considering the basin unit (Gangi, 2017).

The Thames River

The Thames basin covers an area of ~12,935 km², it has a length of 300 km, with 80 million people settled in its valley (7 million who live in London) and a large industry that generates high demand of human consumption and industrial water, generating too much residual water. One hundred and fifty years ago, during the Industrial Revolution, London had 2 million inhabitants, and the industrial pollution and domestic waste went directly in the river, deteriorating its quality. The Thames river became the most polluted river in the world. Many diseases were spread, and by 1849 Cholera had killed 14,000 people. Meanwhile, nothing lived in the Thames river. The British Government adopted integral management under the following principles: a vision for the river—achieved in an agreement with all sectors; integration—of all policies and sectors in only one plan for the river; scale—to work at the same time in all the scales: basin, tributaries and locally; synchronization—to take action in all problems; participation: of the communities, businessmen and affected people; capacities—for all sectors and this way everyone can contribute; associations—to create accompaniment in public-private sectors in order to plan, finance and execute together; knowledge—to take advantage of the best scientific knowledge to learn continuously if necessary; and implementation strategy—agreed and with the possibility to be changed if necessary. In 2010 the Thames river won the award for the most improved river quality. All parties involved agreed that every cent invested was worth it in terms of health, safety, and economy (Oates, 2017).

The three experiences show that those river systems throughout history were in critical condition and each one had a specific trigger. However, with an organized and

integrated process, the rivers could be recovered with the establishment of a form of organization that facilitated the implementation of an agreed roadmap. The labor took decades and required significant economic resources that were recovered with health achievements for the people, cheaper expenses of treatment, decreasing risks and flood damages, recovering healthy ecosystems for many species, and benefits for the economy and companies. All actors should be linked to the process and their interests should be considered, until a shared vision and a long-term consensual work plan is built. The rivers became pleasant environments that can be also used for recreation. The discussion and analysis of those three experiences with the invited experts contributed to define the organization strategy to approach the recovery of the upper Cauca river's basin through the Commission.

COLLABORATIVE GOVERNANCE TO FACILITATE THE CAUCA RIVER RECOVERY

The recovery of rivers has been a subject of little interest in Colombian society, due to the complexity in the process of making decisions and the lack of clarity regarding the concept of governance. Collaborative governance is important to reach negotiated agreements, interactive planning, and the participation of the public opinion and of all those who are interested. Besides, gaining support and promoting public awareness is equally essential to obtain effective results, given that the structures of social networks relevant to influence ecosystem governance. In addition, certain actors contribute as agents to promote beneficial network structures (Ernstson et al., 2010).

The scientific literature does not have a clear agreement about the concept of governance. The definitions are more associated with the reflection and meaning approach of the place where the problem is analyzed. The recovery of the rivers is a complex problem; that is to say, it is characterized by a lack of clarity in its definition, objectives, and steps to follow, such as relationships between diverse groups involved (local organizations, municipalities, departments, institutions) and the equity criteria, accessibility, and sustainability. Colombia was accepted in 2018 into the Organization for Economic Cooperation and Development OECD; this organization is guided by the definitions of “Governance in Transition” (OECD, 1995). In this context, governance is related to the decentralization of State power and to the emergence of the co-responsibility of different actors facing development and social welfare. The principles of the OECD regarding water governance focus on efficiency, effectiveness, trust, and commitment (Akhmouch and Correia, 2016). According to the Global Water Partnership (Global Water Partnership, 2009), water governance is defined as “the range of political, social, economic, and administrative systems that exist to develop and to manage the hydric resources and the water provision services at different social levels.” According to the Ministerio de Ambiente y Desarrollo Sostenible (MADS) (2013), water governance is a process for its integral management that

promotes the active and inclusive participation of different social actors in the decisions articulating multiple cultures. These definitions contribute to the principles for good water governance, but has a limited reach facing the real complexity of systems. In essence, water governance seen from the perspective of human intervention is looking for changing the water cycles with social or environmental purposes (Bouckaert et al., 2018). The strategy of governance contributes to identifying challenges for implementing policies and recommending reforms, as well as identifying relationships between the programs, regulations, and achieving goals (Jacobson et al., 2013). Ernstson et al. (2010) and Meerow and Newell (2017) emphasize the necessity of establishing an appropriate governance model in order to secure long-term sustainability. In the context of the recovery of hydrographic basins and freshwater systems, the necessity of collaboration between diverse interested people has been identified in order to share visions, objectives, and rules. This facilitates collaborative governance (Imperial, 2005; Baldwin and Ross, 2012; Yeboah-Assiamah et al., 2018) allowing the achievement of the results in consensus and benefits for all the interested parties with better transparency and social commitment (Baldwin and Ross, 2012; Brower, 2016; Greenhalgh and Samarasinghe, 2018). The collaboration is about the degree of connectivity between all the relevant interested parties and their capacity to participate in the governance processes (Bouckaert et al., 2018). Collaborative governance facilitates achieving consensus (Innes and Booher, 1999) and integrating learning (McLoughlin and Thoms, 2015).

The conceptual framework for the collaborative governance strategy must consider that water is not only a human survival element, it is an integral part of society, culture, and nature. Therefore, for Colombia, the incorporation of approaches of bio-cultural and biocultural rights developed in the judgement T626/16 by the constitutional court of Colombia, is perhaps the guiding reference framework for the recovery of rivers, being a framework of relevant work in research and development.

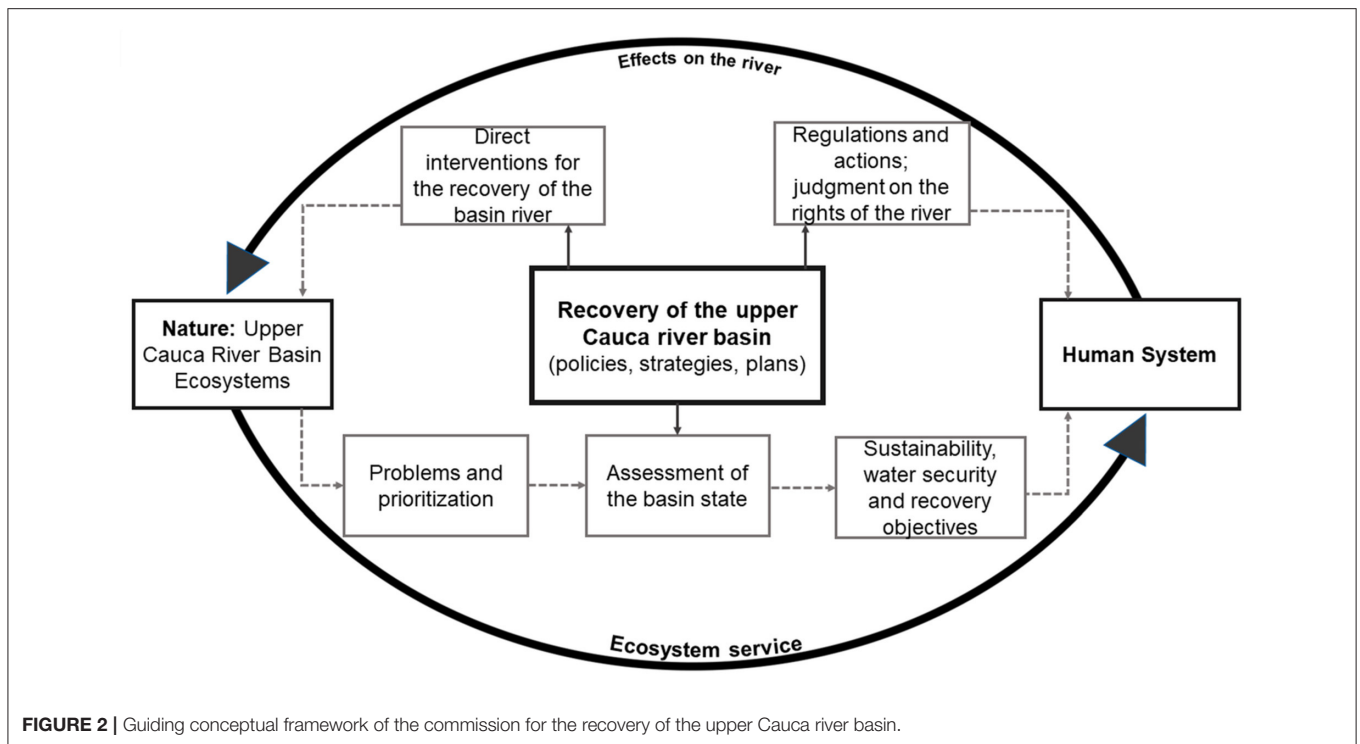
In recent years, individual or collective lawsuits against the Colombian government have been advancing; they are based on the political constitution for the protection of the fundamentals right to life, health, and a healthy environment. It is sought that the State assumes responsibility of the recovery of the Bogotá, Atrato, Cauca rivers, and the Amazonia Region. This shows the citizens' concern for the deterioration of rivers and demonstrates the discontent for the lack of effectiveness, inability, and indolence of the authorities designated by the society for its care. These kinds of processes are derived in a better institutional articulation that, if fulfilled, it would contribute to the optimization of resources and to a better impact; it demands coordination between the different environmental and territorial planning tools and the responsible actors. It also goes beyond the government periods facilitating the long-term planning and the continuity of the actions. These experiences are not yet consolidated, but they become opportunities for strategies like the ones for the upper Cauca river basin Commission because they make the institutions take the search for solutions seriously, as well as act as a positive signal of citizen sensitivity.

The conceptual model of governance for the Cauca river recovery, which is presented in **Figure 2**, is proposed as part

of the postulates of the constitutional court of Colombia that has reviewed different approaches as anthropocentric, biocentric, ecocentric, and bio-culturality. Judgement T626, 2016, considers that “nature is not only conceived as the environment and the human habitat but also as an individual with own rights that has to be protected and guaranteed.” Therefore, this is a new imperative of integral protection and respect by the part of the States and societies, where “only from an attitude of deep respect and humility with nature, its members and its culture, it is possible to start a relationship with them in fair and equitable terms, leaving aside all concepts that are limited or simply utilitarian, economic or efficiency-based.” The central premise where the conception of bio-culturality and biocultural rights are based, is the relationship of the deep connection between nature and human species, where the conditions to preserve the biodiversity are guaranteed in order to keep unfolding its evolutionary potential in a stable and indefinite way [sentence Corte Constitucional de Colombia (2016)]. On the other hand, judgement 38-2019 of the Medellin High Court, declared the Cauca river as a subject of rights and it implies its protection, conservation, maintenance, and recovery (Tribunal Superior de Medellín, 2019). These referents make the Commission promote a collaborative strategy of long-term innovative governance.

COMMISSION FOR THE RECOVERY OF THE UPPER CAUCA RIVER BASIN. ALTERNATIVE CONSTRUCTION PROCESS OF COLLABORATIVE GOVERNANCE

Several articulation initiatives have been proposed to improve the quality of the Cauca river upper basin, but have had little significance. In 2001 the “Pact for the Cauca river recovery” was signed. In 2009 the document of the National Council of Economic and Social Policies was elaborated, CONPES 3624, DNP and MAVDT (2009), named “Program for the Sanitation, Management and Environmental Recovery of the Cauca river upper basin” which was updated in 2014. In 2015 the Regional Environmental Management Plan (REMP) was formulated with a horizon of 21 years (2015–2036) [Corporación Autónoma Regional del Valle del Cauca (CVC), 2015]. In the Cauca department, a REMP with a horizon of 10 years (2013–2023) was also elaborated [Corporación Autónoma Regional del Cauca (CRC), 2014], and by 2018 the CONPES 3915-2018 document that established “Policy and Strategies Guidelines for the Sustainable Regional Development of the Colombian Massif,” Departamento Nacional de Planeación (DNP) (2018a) was developed. These initiatives have been characterized by having a conventional approach to delimit the problem, a weak articulation between departments, limited participation of the civil society which focuses on the actors with high economic and political influence, a lack of political will aggravated by the changes between governments, a weak control over the institutions' development, and weak social and media participation. The limitations in the indicators for the follow-up on the recovery of the river's quality are also evident, and this includes at least one that is socially recognizable.



The Commission arose due to the crisis of the water resource management model within the region. The first steps were given in 2017 when dialogue was established. It was facilitated by the Comptroller General of Cali together with the Universidad del Valle-Instituto Cinara as a result of the forum about rivers recovery with the participation of the international guests' representatives of the Commissions for the recovery of the Elba, Rin, and Thames rivers. In Latin America, México has a national water Commission with 26 basin councils around the country, and 215 subsidiary bodies with 36 basin Commissions that work at the sub-basin level [Comisión Nacional del Agua (CONAGUA), 2021].

The Commission for the upper Cauca river basin was established initially by representatives of: Comptroller of Santiago de Cali, DAGMA, CVC, EMCALI, Camara Colombiana de la Infraestructura (Colombian Chamber of Infrastructure), Univalle-Instituto Cinara, Universidad Autónoma de Occidente, ACODAL Occidente, independent consultants and advisers, Fundación Empresarial para el Desarrollo de Yumbo (Business Foundation for Yumbo Development)—Comité empresarial (Business Committee) and Citizenship. A Technical Secretariat of the Commission was agreed; it would be made up of the following institutions: ACODAL, Univalle- Instituto Cinara, EMCALI and the Santiago de Cali Comptroller General. In the future, the participation of more institutions from Valle del Cauca and from the Cauca departments has to be included. The Cauca river upper basin was prioritized in the first phase of the process, beginning with the city of Cali's impact the river into the framework of a basin vision. In order to start the process, different aspects and challenges of the Commission were considered to facilitate and

guide the recovery of the river in the next 30 years, which are presented below.

- It started by recognizing that it is a long-term process, that requires patience where it is necessary to understand and analyze the problem.
- The people involved agreed to lead a process with a shared vision, and with the implementation of actions.
- Many institutions and organizations carried out actions oriented to the recovery of the Cauca river, but they felt frustrated because the actions were not articulated and did not achieve significant environmental impacts on the river.
- It was agreed to define common goals and measurements to value them with the involved actors.
- One formal group work with the stakeholders was defined. It can be extended in an agreed way if it is considered necessary and relevant.
- The development of the Commission with a technical voluntary secretariat, started the work.
- It was established to advance prioritizing integral management plan for the upper Cauca river basin, integrating the upper basin actors (for the Cauca department and Valle del Cauca) looking for immediate or short-term results.
- This was done through consulting to integrate the Environmental and Sustainable Development Ministry, as they lead the sector.
- It was agreed that the Commission doesn't require technical groups in each municipality. Through the Ministry of the Environment of each department, it is possible to ensure that the guidelines are implemented with a hydrographic basin approach instead of a political-administrative division.

The sustainability possibilities of the strategy are defined by the capacity of teamwork between all the actors considering their interests in a long-term horizon, construction of a shared vision over the basin, and an agreed agenda based on the trust generation and common goals. The risks of the initiative would be structured by the ineffectiveness to approach problems, lack of citizen participation, lack of well-structured projects, reduced budget, and political will for the integral work and the integrity of the processes.

On April 18, 2018, the Technical Secretary of the Commission had a meeting with the Environmental and Sustainable Development Minister to discuss the initiative. In the meeting delegates of the environmental authority of Cauca department (CRC), and the public services company from Popayán (Cauca) also participated. The minister proposed setting up a macro-basin council for the Cauca river, articulated with the Magdalena river to develop its distinct dynamic that facilitates the coordination of national, regional, and local actors, through a Pact for the Recovery of the Cauca river.

On June 18, 2018, a memorandum of understanding was signed by the legal representatives of each member of the Commission and the Environmental and Sustainable Development Ministry. The aim of the agreement is to develop the following strategies: sustainability and resilience of ecosystem services within the main basin of the Cauca river and its tributaries; alternatives to improve the quantity and quality for the different users and uses (including human and domestic consumption, agricultural, livestock, recreational, aesthetic, industrial, fishing, aquaculture, navigation, and power generation); identify the financial arrangement mechanisms through which the river can be managed; recover the water sources in the Cauca river basin and the management of the urban and rural drainage, contributing to the strengthening of the economy, productivity, risk mitigation, sanity improvement and life quality of the communities, to generate better conditions for the prosperity of the territory and its social fabric.

The memorandum of understanding was a useful tool to start the articulated work (locally, regional and national) of the Commission around the construction of a work agenda for the next 30 years. On that basis, several analysis and discussion meetings were established with the perspective of prioritizing short-term direct actions for improving the Cauca river upper basin. A synthesis of that analysis showed that the Cauca river pollution has changed and the strategies have focused on “solutions at the end of pipe,” neglecting aspects as point- source and diffuse pollution both at the rural and urban level. The difficulty lies in making coherent the large number of plans that develop in different aspects and territories associated with the political-administrative divisions was identified, not considering the hydrographic basin as an analysis unit. The necessity of having a shared vision with short, medium, and long-term strategies and the necessity of teamwork, was evidenced. It was also clear the lack of participation of the indigenous, afro, and peasant communities located in the upper basin.

Some short-term priority actions do not necessarily have to do with the construction of new infrastructure, for instance: (i) to avoid the progressive deterioration of the basins (deforestation,

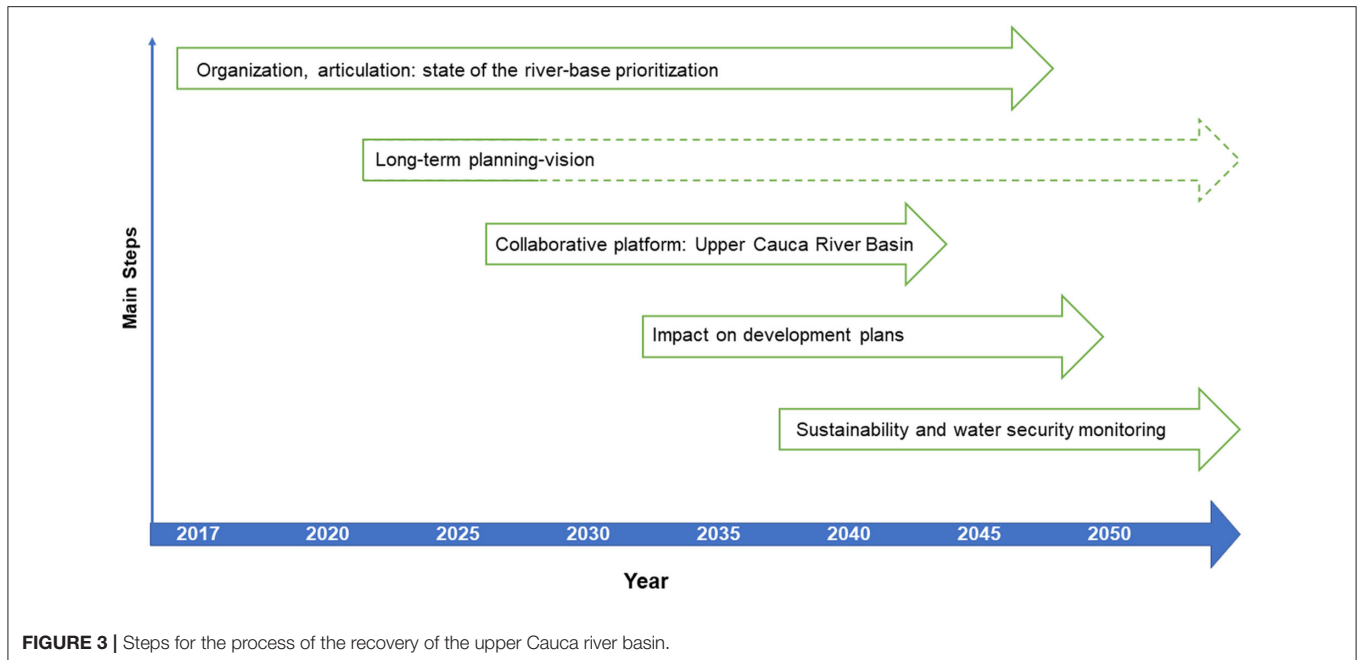
illegal mining, informal settlements, etc.), (ii) to avoid continuous losing of buffer strip of the river banks (main channel and tributaries), and (iii) to rethink inadequate decisions related to land use. Additionally, several efforts have been made, but the river quality has not recovered for the required uses. In that sense, it is key to focus on the river's condition, taking into account the vision of rivers as subjects of rights, which implies improving the understanding of a river in terms of dynamic behavior, to check its routes and its spaces, the self-purification, and the kind of pollution that affects it the most in order to sustain its ecology.

The beginning of the Commission's work implied understanding diagnostics, programs, and plans of the institutions with an emphasis on the basin. On that basis, team groups discussed and agreed on the first priorities as guiding to the responsible institutions of its planning and execution: (a) to improve the conditions of environmental sanity of the south sewer system of the city of Cali, as its discharge affects the ecosystem and the water quality collected for human consumption; (b) strategies for improving the discharge of sewage water of the city of Cali for the second phase of the wastewater treatment plant of Cañaveralejo; (c) to prioritize in the regional environmental management plan for the recovery of the Guachal river basin; and (d) to implement jointly with the Cauca department a strategy for controlling the impacts upon the Cauca river brought about by the discharges of El Palo and El Desbaratado rivers, which have high suspended solids concentrations.

The Commission established the steps for the Cauca river recovery process as presented in **Figure 3**. This was made by the technical secretariat as coordinator, articulator, and facilitator group of the policies and decisions adopted, guaranteeing the coherence and compliance of the established roadmap. The mission: to position the recovery of the upper Cauca river basin as a regional and national priority, influencing the materialization of urgent initiatives while articulating strategic actors; 2020 vision: in 2020, with the leadership of the Commission and in the framework of a Regional Pact (collaborative platform), it was agreed to elaborate an integral strategic plan for the recovery of the upper Cauca river basin from the Colombian massif to Cartago (Valle del Cauca); 2025 vision: in 2025, with the leadership of the Commission, the integral strategic plan for the recovery of the upper Cauca river basin, it looks for having prioritized projects for execution; 2050 vision: in 2050, the recovery of the upper Cauca river basin will be a successful case at a national level, for being an initiative of efficient management achieved by the government, private institutions and the community, with the leadership and coordination of the Commission.

Commission Activities Between 2019 and 2020

During this period the following objectives were proposed: to develop in a collective way the conceptual framework of the recovery of the Cauca river upper basin; to formulate the strategic plan of the Commission and to formulate the integral strategic plan for the recovery of the Cauca river upper basin; to identify



the committed initiatives and resources for the different public and private institutions for its recovery; prioritization of the projects; interinstitutional formulation of the project of the south drainage system; to manage the structuring and the strategy of financing the reduction of the specific and diffuse pollution project in the Cauca river (CARMAC-MADS); to incorporate the recovery of the Cauca river upper basin in the national, regional and municipal agendas. To check possible projects in the framework of the National Development Plan 2018–2022, departmental and municipal development plans 2020–2023, the CVC 2020–2024 action Plan, and the revision and adjustment of the 2015–2036 PGAR. It was also proposed the key actors sign the Regional Pact of the recovery of the Cauca river upper basin, which derived in the conformation of the collaborative platform for the recovery of the Cauca river upper basin that is described below.

Collaborative Platform for the Recovery of the Upper Cauca River Basin

The collaborative platforms are initiatives promoted by the National Government of Colombia within the framework of the National Plan of Development, to establish guidelines of politics, strategies, goals, and indicators for the country's development. The Ministry of Environment and Sustainable Development established for the 2018–2022 period the formation of eight Collaborative Platforms [Departamento Nacional de Planeación (DNP), 2018b]. These initiatives are understood as a governance strategy of the public sector that promote the collective action of public and private actors, oriented to the restoration and recovery of degraded ecosystems, especially on basins where instrumentalization processes of the water integral management are being carried out, articulating technical, economic and administrative efforts [Ministerio de Ambiente y Desarrollo

Sostenible (MADS), 2020]. In that sense, the work carried out by the Commission of the upper Cauca river basin is addressed to the national strategy, becoming the second Collaborative Platform of the country.

Through a concurrence of wills in 2020, the collaborative platform for the recovery of the upper Cauca river basin was established, made up of 28 actors of the Cauca and Valle del Cauca departments that belonged to the productive sector, the community and territorial entities, the academy and public services companies. This type of initiatives contributes to facilitating the collaborative governance according to Imperial (2005), Baldwin and Ross (2012), and Yeboah-Assiamah et al. (2018). In this way, it seeks to establish guidelines to improve the basin in terms of its ecosystem condition and to perform articulated actions oriented to the identification of funding sources and the impulse of strategic projects backed by the national and regional government.

As a result of this exercise of interinstitutional and intersectoral articulation, initially coordinated by the Environmental and Sustainable Development Ministry (as guardian in the legal representation of the Cauca river, Judgement T-038 of 2019), the action plan that consolidates the projects took into account the different instruments of planning grouped in four main topics was constructed: quality, offer, demand and governance. Each one of the topics was led by members of the collaborative platform, who promoted environments of dialogue to define the main lines of work in the prioritized aspects, as well as an initial proposal of indicators for the respective follow-up, which are presented in **Table 1**.

Even though the action plan of the collaborative platform does not define all the actions and projects that are required to achieve definitely the integral recovery of the Cauca river upper basin, it is an initiative that will allow setting strong, concrete,

TABLE 1 | Topics, work strategic axes, and follow-up indicators of the action plan of the collaborative platform for the recovery of the upper Cauca river basin.

Topic	Strategic axis	Follow-up indicator
Quality	Monitoring water quality	Number of seasons or monitoring points of water quality operating or characterized/Number of seasons or monitoring points of water quality available (%)
	Formulation and execution of management instruments, management and planning.	Number of tools or formulated rules and in execution/Number of tools or projected rules (%)
	Pollution and sanity management	Number of actions* executed for the reduction of pollutant load discharge in the Cauca river/Number of actions* projected for the reduction of the pollutant load discharge to the Cauca river (%).
Demand	Characterization and quantification of the water demand.	Water use index
	Incorporation of the GIRH in the principal productive services of the water users.	Quantity of water demanded by the system/quantity of water in the source (%)
	Water efficient use and sustainable.	Efficiency index in the water use.
Offer	Restoration, rehabilitation and reforestation.	Ecosystem hectares in restoration, rehabilitation and reforestation.
	Payment for ecosystem services	Areas under schemes of payment for ecosystem services and conservation incentives, for each basin.
	Management instruments, management and planning.	Planning tools implemented/planning tools formulated (%)
Governance	Protected areas	Hectares of protected areas/total hectares (%)
	Citizen participation	Number of basin councils implemented Number of the organization of the civil society strengthen in environmental topics.
	Water culture	Number of municipal CIDEA* working. Number of actions in environmental education and cultural citizen. Number of municipal councils in rural development currently working.
	Conflicts management	Number of PRAES** formulated and in execution. Number of conflicts socio-environmental strategically and technically intervened

* *Interinstitutional technical committees for environmental education.*

** *Environmental and educational proposals.*

and measurable goals in the medium and long term, so that the subsequent exercises will have a referent for strategic planning.

In addition to the action plan, a collaborative governance scheme was projected that will allow the definition of mechanisms of participation and interaction between the different actors, which improves the connectivity of all the parties interested (Bouckaert et al., 2018). Thereby, the follow-up, articulation, and monitoring of established activities in the collective action plan of this instance. Although the collaborative platform depends on the will of the national government in power with a short-term horizon, this initiative will be very useful in the formulation of future plans of development to the national, department, and municipal level facilitating the identification of strategic projects and of significant impact for the Cauca river upper basin.

This is the first time that a governance and government exercise is developed facilitating a scenario of articulated work between all the competent actors of the Cauca river upper basin, identifying those committed initiatives and resources for the different public and private institutions, as a starting point for the process of short-term recovery (2020–2023 period). In this way, it becomes a scenario for the strengthening of the long-term objectives and vision of the upper Cauca river basin Commission, as well as, a starting point for the construction of collective planning, in a basin that demands the integrality as a base for the solution of the structural problems.

Balance of the Developed Activities

- Knowledge integration and socialization: Institutional meetings to socialize and learn about what each one has done in the basin.
- Articulation of learned lessons of the different actors: Definition of problems and priorities in teamwork with institutions.
- Memorandum of understanding signed with the Environmental and Sustainable Development Ministry: Signing of a cooperation agreement between the different institutions interested in the Cauca river recovery. The Ministry of Environment and Sustainable Development coordinates the agreement and further developments.
- Integration of the Commission with the CARMAC-MADS: The Ministry of the Environment and Sustainable Development integrates the Commission with the Regional Environmental Council of the Macrobasin.
- Strategic planning: Collaborative work between institutions to develop the strategic plan: central problem definition, prioritization, mission and vision, resources and schedule.
- Prioritization of the actions to start the roadmap highlighting: south drainage system, Guachal river basin; agreement and understanding meetings of the strategies for the sewage water discharge of the city of Cali; encounters with Cauca department to check strategies related to the problem of high discharge of solids by the Palo and Desbaratado river.

- Inclusion of projects in the National Plan of Development 2018–2022: Negotiation with the National Planning Department in order to include prioritized projects in the National Development Plan.
- Regional projects: To implement environmental sanity plan of the Cauca river and the Pacific watershed.
- Environmental recovery and intervention in water and sanity in hydrographic basins from Valle del Cauca: It was agreed to begin with actions in the sub-basins of the greatest impact on the Cauca river: Guachal river, Yumbo river, Jamundi river, Melendez river, Lili river and Cañaveralejo river.
- Through the Housing, City, and Territory Ministry, to look for funding for the construction of WWTPs, that contribute to the reduction of the specific and diffuse pollution of the Cauca river, especially in the Cali Municipality.

With the Environmental and Sustainable Development Ministry:

- It was discussed that the recovery of the upper Cauca river basin is significant for everyone, and should be a national priority, with support requested in order to materialize the prioritized initiatives and the articulation of strategic actors of all the macro-basin.
- It was requested to reactivate the Regional Environmental Council of the Magdalena—Cauca macro-basin (CARMAC) and to update the strategic plan.
- Formation and management of the collaborative platform.
- We participated in the formulation of an action plan approaching structural topics of the progressive deterioration of the river's upper basin with the relevant actors of the region for prioritization in the CARMAC.
- It was requested to reactivate the Water National Council conformed by the Ministries of Environmental, Housing, Mining, Agricultural, Health, DNP, and the IDEAM.

CONCLUSIONS

The Commission for the recovery of the upper Cauca river basin is a process in development that arose due to the limitations of the current model of hydric resource management in Colombia. The main issue has been transcending the short-term planning of the local and regional administrations to a long-term planning in function of a shared vision. The background shows that rivers can be recovered; that all of the studied rivers were at the time in deficient conditions of quality, but the process of recovering took several decades.

The recovery of the upper Cauca River basin is a long-term process which requires overcoming several limitations through the following actions and initiatives: (a) defining

the participation of the basin communities that are representative and recognized; (b) define the indicators that allow monitoring the evolution of the state of the river, in harmony with the investments and actions carried out; (c) greater investment by the state in the basin and (d) guarantee the commitment of the productive sectors that intervene and significantly impact the basin. The near future scope of this huge task considers firstly establishing the agreed action plan for the short term with financial resources and secondly adopting the agreed roadmap for achieving the long term goals.

The conceptual model of collaborative governance proposed for the recovery of the upper Cauca river basin, is grounded in the conception of the bio-cultural and the rights of nature due to the indissoluble relationship between nature and humans. This proposal has facilitated a better understanding between the problem and prioritization of consensus actions with a better connectivity between the stakeholders through the collaborative platform. It is imperative to achieve a shared vision, to act under the vision of basin with all the involved actors, of proposing minimum and convincing recovery indexes including at least one that would be a symbol that the society recognizes and motivates it to advance in the recovery. It is key that the recovery of aquatic ecosystems and the investment that requires the process can be carried out, with the guarantee of sustainability and water security for the benefit of the biodiversity and the society as a whole.

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LS finalized the paper edition. All authors drafted, revised the paper, and agreed to the submitted form.

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