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Early view

Building a collective identity of the river: lessons learned from transdisciplinary research in the Caoní River basin, Ecuador

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Governing the Revolution: A Foucauldian Critique of Passive Revolution in Bolivia

Abstract: The Caoní River watershed, located within the Pichincha Chocó Andino Biosphere Reserve in northwestern Ecuador, is a territory affected by deforestation dynamics and water pollution. In response, citizen groups have mobilized to protect the river as a living entity through the creation of the Salvemos el Caoní initiative, supported by NGOs and academia. This article explores how transdisciplinary research tools implemented within the framework of an international cooperation project have contributed to building and strengthening a shared identity around the river as a common good in a context of ecosystem and human social fragmentation. The methodology integrates three transdisciplinary research tools under the umbrella of an embodied learning approach: community river monitoring, the co-construction of environmental narratives, and participatory mapping. The objective is to identify both the benefits and challenges of these tools in mapping sources of pollution, assessing species at risk, and collectively designing a watershed conservation mechanism within a context of local tensions among multiple interests and actors surrounding the river. Finally, the article analyzes how, on the one hand, the process strengthened local capacities and fostered trust and cooperation among municipalities, community organizations, private stakeholders, and academia. On the other hand, it examines both the progress and tensions involved in strengthening collective identity and action around the river as a necessary prior step toward

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defending the river as a rights-bearing subject under Ecuador's constitutional framework of the Rights of Nature.

Keywords: Collective identity, Participatory conservation, Rights of Nature, Caoní River, Transdisciplinary research

Resumen: La cuenca del río Caoní, ubicada en la Reserva de Biósfera del Chocó Andino de Pichincha, en el noroccidente del Ecuador, es un territorio afectado por dinámicas de deforestación y contaminación del agua. Frente a esta situación, grupos ciudadanos se han movilizado para proteger el río como un ente vivo y han conformado la iniciativa Salvemos el Caoní, con apoyo de ONGs y la academia. El artículo explora como las herramientas de investigación transdisciplinaria implementadas en el marco de un proyecto de cooperación internacional han contribuido a construir y fortalecer una identidad compartida en torno al río como bien común en un entorno de fragmentación del ecosistema y de las sociedades humanas. La metodología articula tres herramientas de investigación transdisciplinaria bajo el paraguas del enfoque de aprendizaje encarnado: los monitoreos comunitarios del río, los procesos de co-construcción de narrativas ambientales y los mapeos participativos. El objetivo es identificar tanto los beneficios como los retos de estos instrumentos para mapear fuentes de contaminación, evaluar especies en riesgo y diseñar un mecanismo de conservación de la cuenca en un contexto de tensiones locales entre múltiples intereses y actores en torno al río. Finalmente, se analiza como, por un lado, el proceso ha fortalecido capacidades locales y ha promovido confianza y cooperación entre municipios, organizaciones comunitarias, empresarios privados y academia. Por otro lado, se analiza tanto los avances como las tensiones en el fortalecimiento de la identidad y acción colectiva en torno al río como paso previo para la defensa del río como sujeto de derechos bajo el marco de los Derechos de la Naturaleza en el país.

Palabras clave: Identidad colectiva, Conservación participativa, Derechos de la Naturaleza, Río Caoní, Investigación transdisciplinaria

Introduction

In recent decades, various legal systems around the world have begun to recognize rivers as subjects of rights, transforming traditional understandings of the relationship between society and nature (O'Donnell & Talbot-Jones, 2018). From the Atrato River in Colombia to the Whanganui River in New Zealand, these cases reflect a shift toward biocentric and relational approaches that seek to guarantee the

protection, restoration, and governance of river ecosystems in the face of increasing extractive and climate threats. This legal recognition not only redefines the legal status of nature but also opens new debates on environmental justice and community participation.

However, several authors emphasize the need to consider potential power dynamics and tensions in the processes of defending, recognizing, and guaranteeing the rights of rivers, moving beyond a purely biocentric approach (Boelens et al., 2024). A key aspect to consider is the process prior to the potential recognition of a river as a subject of rights, in order to highlight its complexities, limitations, and the factors that contribute to possible stagnation.

In this context, this article presents an analysis of a transdisciplinary research process developed in the Caoní River basin, in the Chocó Andino region, located in the northwest of the province of Pichincha, Ecuador. This territory faces multiple socio-environmental threats such as deforestation, mining, hydroelectric projects, pollution, and the impacts of climate change. In response to this situation, a group of community members and local businesspeople have mobilized through the Save the Caoní initiative to protect the river as a living entity, based on the recognition of the Rights of Nature in the 2008 Ecuadorian Constitution.

Several rivers have been recognized as subjects of rights in the country within the context of widespread pollution from human and extractive activities, as is the case with the Machángara and Monjas rivers in Quito. Other cases of the Rights of Nature involve the rulings concerning the Los Cedros Protected Forest and the Intag Valley in the north of the country, which have successfully reversed mining concessions granted to foreign multinational corporations. However, these judicial decisions do not guarantee effective restoration or reparation of the damage suffered by the ecosystem, primarily due to a lack of concrete implementation by those convicted. In the Ecuadorian case, a lack of political commitment to judicial decisions is evident, as illustrated by the failure to comply with the two popular referendums of 2023 that validated the citizens' decision to prohibit oil exploitation in Yasuní and mining in the Chocó Andino region.

In the case of the Caoní River, the collective's willingness to initiate legal action to protect the river as a subject of rights is limited by the lack of coordination among local actors and a fragmented social fabric along the river, resulting in a loss of connectivity between the natural and human ecosystem. This reality may complicate

the aspirations of certain local actors to defend the river as a living entity through a legal process of protection, as in the cases mentioned previously.

This article explores how transdisciplinary research tools contribute to strengthening identity and collective action around the river's commons, and what their practical limitations are. Methodologically, the article critically analyzes three transdisciplinary research tools: the co-construction of environmental narratives, community-based river monitoring, and participatory mapping to identify pollution sources, assess endangered species, and collectively design a conservation mechanism for the Caoní River. These three tools are interconnected, as they are part of the same embodied learning process toward the collective construction of the river's identity and the validation of a potential community-based conservation mechanism.

On the one hand, the study demonstrates that the transdisciplinary research process has strengthened local capacities and fostered dialogue and collective action among municipalities, community organizations, and academic partners. It analyzes how the Save the Caoní citizen movement contributes to revitalizing, recovering, and restoring the river for the benefit of the humans and non-humans who depend on the ecosystem. This experience highlights the transformative potential of community-based conservation to reconnect people with the river, reconfigure water as a common good, and integrate biodiversity protection into the struggles for territorial and environmental justice.

On the other hand, the difficulties and limitations in the transdisciplinary research process are analyzed, which manifest tensions among various groups of local actors, a lack of community leadership, and dependence on political decisions. Several challenges of transdisciplinary research in practice are also highlighted, such as the relationships between academia and the community, which are often marked by historical asymmetries, divergent expectations, and communication difficulties that can hinder the co-production of knowledge. Furthermore, there is a need to adapt international cooperation frameworks to the local, cultural, and political realities of each territory, so that interventions respond to community priorities and not exclusively to global agendas.

The emergence of the Save the Caoní collective as a movement to defend the river in a fragmented environment

The Caoní River basin, covering 49,351 hectares, is located in the northwest of the province of Pichincha and a large part of its territory lies within the Chocó Andino Biosphere Reserve of Pichincha (Figure 1). Within the basin is a Key

Biodiversity Area (ECU54), which, according to the Critical Ecosystem Partnership Fund (CEPF) Ecosystem Profile, covers 9,101.37 hectares. In terms of political and administrative divisions, the Caoní River originates in the canton of San Miguel de los Bancos, flows through the canton of Pedro Vicente Maldonado, and empties into the canton of Puerto Quito, where it joins the Blanco River.

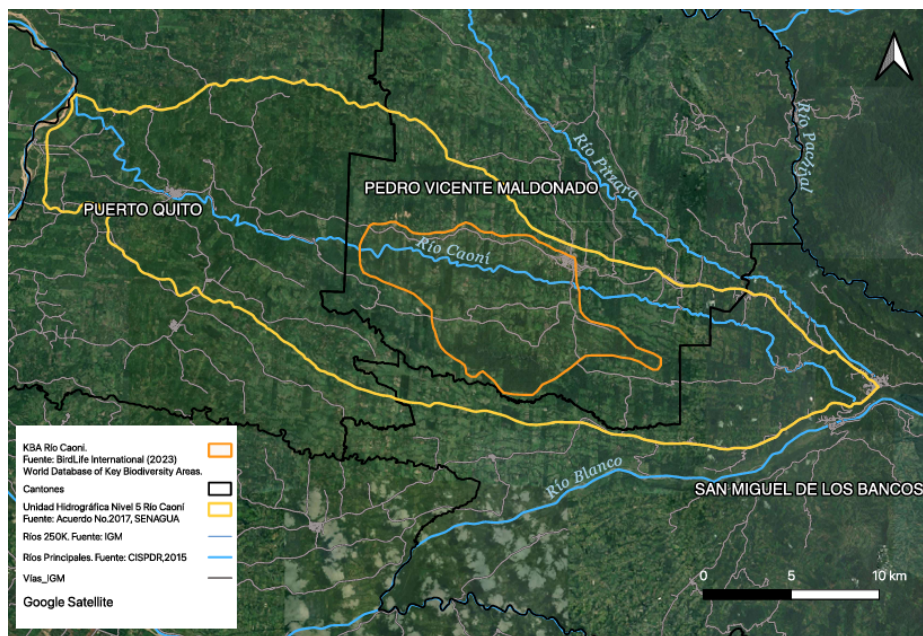


Fig. 1: Map of the Caoní River basin and KBA (Source: Sebastián Arostegui)

The Chocó Andino Biosphere Reserve of Pichincha is a highly biodiverse area of over 287,000 hectares, declared by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2018. Located within the Metropolitan District of Quito (DMQ), it encompasses cloud forests and páramo grasslands, home to endangered species such as the Andean bear and the Chocó toucan, and provides water to 30% of Quito's population. The Biosphere Reserve promotes a balanced

model between community development and nature conservation through sustainable tourism and agroecological activities.

The situation of the rivers in the Chocó Andino Biosphere Reserve is marked by a growing tension between ecological conservation and extractive pressure, especially from mining. Rivers in the territory, such as the Pachijal, Mashpi, and Alambí rivers, constitute some of the last relatively clean water sources that supply water to rural communities and urban areas of Quito (Villalba Lascano, 2024).

Several environmental organizations have warned of growing threats stemming from mining concessions, illegal mining, deforestation, and the expansion of extractive activities in the micro-watersheds of northwestern Pichincha (Acción Ecológica, 2024). Potential contamination from heavy metals, sediments, and acid mine drainage represents one of the main risks to the ecological integrity of the rivers and to the water security of hundreds of thousands of people.

The Caoní River faces similar pressures, being one of the Tropical Andes Key Water Areas (KBAs) with more than 75% of its surface area affected by agricultural activities (CEPF, 2021). Local research has documented the deterioration of water sources and soil due to productive activities and population growth (Jaramillo, 2016; Celi et al., 2020; Cueva and Eras, 2021).

Monitoring conducted in the Caoní River basin as part of the project revealed moderate levels of biological, chemical, and physical contamination, primarily associated with domestic wastewater, agricultural activities, and erosion. Among the main contaminants identified were fecal coliforms and *Escherichia coli*, as well as nutrients such as nitrates, sulfates, and chlorides linked to wastewater and agricultural fertilizers, especially in the upper reaches of the basin. Additionally, sedimentation and erosion processes associated with changes in land use and the extraction of rock material were recorded. These results highlight the need to implement differentiated management and restoration strategies adapted to the various sources of contamination present in the basin.

The infographic (Figure 2) provides a territorial and integrated understanding of the main sources of pollution in the Caoní River, identifying urban, agricultural, and land-use pressures that affect water quality and the ecological integrity of the watershed. Through a spatial representation of activities such as wastewater discharges, urban sprawl, intensive farming, and slaughterhouses near the river, the material allows for linking the results of biophysical monitoring with local socio-environmental dynamics. It also highlights the role of diffuse pollution and landscape

transformations in the progressive degradation of the river ecosystem, contributing to strengthening the analysis of environmental governance and participatory watershed management.

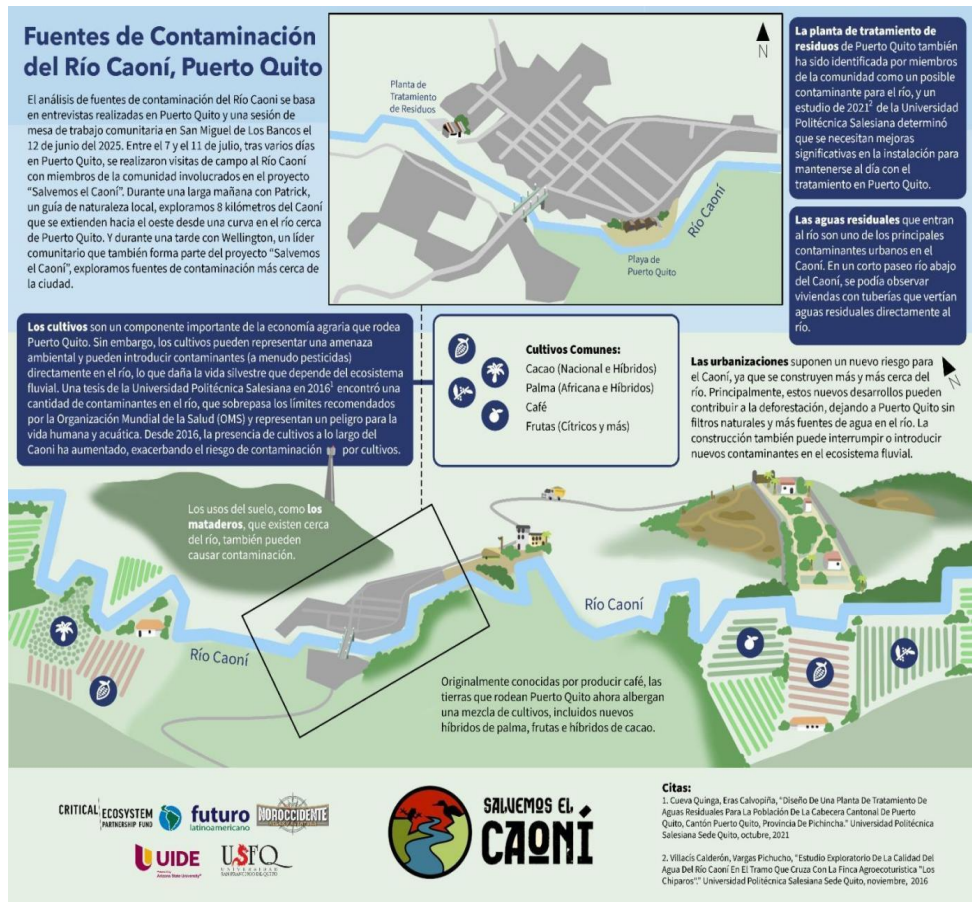


Fig. 2: Sources of pollution affecting the Caoní River within the Puerto Quito canton (Source: Cameron Howland)

The Save the Caoní initiative began in 2023 thanks to the concerns expressed by a group of tourism entrepreneurs and residents along the banks of the Caoní River in the Puerto Quito canton. Coordinated and supported by the digital magazine

Noroccidente Relax y Aventura, they voiced their worries about the state of the river and its ecosystems. The initiative has since expanded and now comprises approximately 60 members throughout the river basin, representing civil society, tourism businesses, communities, environmental NGOs, local public authorities, local media outlets, and academia.

In the case of the Caoní River, socio-environmental conflict does not revolve around a large-scale extractive or infrastructure megaproject, but rather around multiple everyday practices of pollution and environmental degradation dispersed at the local level. The basin has undergone historical processes of land acquisition for agricultural activities, urban expansion, and the arrival of populations not historically linked to the territory, progressively transforming the social and ecological dynamics of the river landscape. Added to this is the coexistence with Afro-descendant communities in the lower part of the basin and a high diversity of local actors (producers, tourism operators, urban residents, local governments, and community organizations) which complicates the construction of a shared territorial identity. This social heterogeneity hinders the articulation of sustained collective action for the defense and care of the river, highlighting the challenges of building participatory environmental governance processes in territories marked by historical trajectories, diverse interests, and differentiated relationships with the river ecosystem.

Theoretical framework: a dialogue between the river commons and transdisciplinary research

The role of identity and collective action in the processes of the river commons

From the field of political ecology, literature studies rivers as common goods, taking into account approaches to environmental and territorial justice. The concept of “river justice” addresses rivers as key spaces of coexistence and struggle. Rivers face multiple forms of domestication, enclosure, disposal, and pollution on an unprecedented planetary scale (Boelens et al., 2022). From this perspective, differential access to water, asymmetries in rights, and unequal levels of protection and influence in decision-making are inevitably shaped by class, gender, ethnicity, and human/non-human identity.

Despite their recognition as subjects of rights, in countries like Ecuador, rivers are subject to the commodification of nature. From this perspective, rivers are conceived as a useful economic resource for development purposes, or even as “cheap nature,” and their flows are restricted by large-scale hydraulic projects aimed at providing clean energy, water security, and flood protection for expanding cities and

agribusinesses. The notion of “cheap nature” is developed by authors such as Moore (2016), who analyze the root of the ecological and climate crisis in the capitalist model of globalized development. Capital accumulation depends on the strategy of reducing the cost of four essential elements: labor, food, energy, and raw materials. This productive approach to rivers is often linked to bureaucratic administrations and capitalist imaginaries, also known as “hydrocracies” (Molle et al., 2009).

These narratives often ignore alternative and local riverine knowledge and relationships (Boelens et al., 2019). These plans affect riparian human and ecological communities, including river-related life, livelihoods, and cultural activities of largely vulnerable groups, such as fishers, small-scale farmers, and human and non-human riverine communities (Hoogesteger et al., 2023). In response to these challenges, new water justice movements have emerged, engaging in radical collective practices of territory and community building. As movements that revitalize rivers, they contribute to recovering and restoring rivers and their ecosystems for the benefit of the humans who depend on them.

The management, care, and collective protection of rivers have received increasing attention within academia, recognizing the large number of everyday practices, grassroots initiatives, collectives, and movements that involve diverse forms of individual and collective action for the defense of rivers, riparian landscapes, and related livelihoods (Hommes et al., 2022). We conceptualize common-use river initiatives as “collective practices of creating territories and communities, which free rivers from the influences that confine, commodify, or pollute them” (Boelens et al., 2022, p. 3).

A central element for encouraging or restoring river stewardship is building a shared identity around the river, as a key preliminary step for fostering collective action. In this regard, Boelens et al. (2022) propose the concept of “riverhood,” which refers to recognizing a river as a subject with its own identity, rights, and even legal personality, rather than considering it solely as an exploitable natural resource. This approach proposes understanding the river as a living, relational, and ecologically interdependent entity, with the right to exist, flow, regenerate, and remain healthy.

A key element that requires further exploration is understanding how river defense movements emerge, consolidate, or face challenges. Several authors analyze how the creation and mobilization of alternative knowledge is central to the constitution, identity, and strategies of river defense movements (Duarte-Abadía et al. 2019). In

the case of the Caoní River basin, local actors are primarily private landowners who lack a strong management logic and community identity. It is therefore important to understand the motivations of these private local actors to reclaim and reconnect with the river, as a first step toward the emergence of a more consolidated river defense movement and the recognition of the river as a living entity.

The effective management of common-pool resources through collective action depends on users' ability to build a shared identity around the resource (Mosimane et al. 2012). Common interests connect those who use the resource, and the stronger their identification with and collective commitment to it, the more robust the collective action will be. Thus, the sustainable use of common-pool resources depends on the interaction between identity and collective action. However, this identity is dynamic and can change over time, affecting user behavior. This article proposes a theoretical framework based on collective identity to analyze how identification with the river and affective commitment influence the governance and resilience of socio-ecological systems associated with common-pool resources.

Other authors analyze the role of the meanings that local communities attribute to the Niobrara River in Nebraska (United States) and their perceptions of the river landscape. They identify a “river meanings network” that integrates ecological, cultural, emotional, and social dimensions associated with the territory. The results show how these meanings influence perceptions of landscape changes and, especially, of conflicts related to the river's development and management (Davenport & Anderson, 2005). The study expands on the concepts of sense of place and attachment to territory and proposes a useful framework for understanding environmental disputes and strengthening local planning and governance processes.

Mickelsson et al. (2024) investigate how collective river management practices, or commoning, emerge through knowledge co-creation processes to address human, animal, and environmental health challenges in the upper uMngeni River basin (South Africa), supported by citizen science tools. They explain how commoning becomes an expansive and potentially transformative learning process, in which people work together to build collective practices and activities in response to socio-ecological challenges. Commons are thus considered an activity and a process that reflects social relationships inseparable from relationships with nature. From this perspective, commoning is useful for analyzing how river stewardship practices emerge through collective learning processes and the contextualization of the meanings of river health, as people interact with river waters in their local communities.

Transdisciplinarity as a tool for analyzing collective action and identity around the river

Transdisciplinary research has become established in recent years as a central approach to expanding the impact of academia on society. Transdisciplinary research is a knowledge production approach that integrates academic and non-academic knowledge to address complex real-world problems, especially those related to socio-ecological systems, sustainability, and environmental governance (Nicolescu, 2014). Unlike multidisciplinary or interdisciplinarity, transdisciplinarity not only articulates scientific disciplines but also incorporates local, indigenous, community, and practical knowledge in collaborative processes of knowledge co-creation (Hadorn et al., 2008).

Transdisciplinary research is based on dialogue among multiple disciplines, actors, and ways of knowing to address complex problems from integrated and contextualized perspectives (Vilsmaier, 2025). In this sense, the principle of dialogue is central to transdisciplinarity, allowing for the articulation of diverse perspectives without homogenizing them, and promoting collaborative processes of knowledge co-production among science, communities, and other social actors.

From the perspective of collaborative and situated research, knowledge production must be built upon the active participation of communities as actors who possess their own knowledge, experiences, and capacities (Hensler et al., 2024). Along these lines, collaborative research that embraces diversity proposes generating processes of dialogue, reflection, and collective action that recognize local voices and prevent the imposition of external logics on territories. Furthermore, this approach emphasizes that the relevance and sustainability of actions depend on their joint construction with communities, strengthening sociopolitical ties, processes of belonging, and contextualized forms of knowledge oriented toward social and environmental transformation.

This approach is also related to the concept of embodied learning, which posits that learning emerges not only from cognitive processes but also from the bodily, emotional, and territorial experiences of individuals interacting with their environment (Stolz, 2015). From this perspective, knowledge is constructed through

lived experiences, territorial journeys, affective relationships, and sensory experiences with ecosystems, strengthening contextualized and transformative forms of learning oriented toward collective action and socio-ecological sustainability.

The concept of embodied learning also allows us to understand how sensory, emotional, and bodily experiences with rivers contribute to the construction of an ecological and relational identity within the riverine territory. In their Environmental Education study on a child's explorations of a nearby river, Humphreys and Blenkinsop (2018) show that direct contact, play, observation, and daily interaction with the river strengthen affective bonds, ecological empathy, and a sense of belonging to the river ecosystem. These lived experiences allow the river to cease being perceived solely as a resource and become a space for learning, connection, and ecological identity. From this perspective, the construction of a "river identity" emerges through experiential and embodied practices that connect emotions, memory, care, and environmental awareness, fostering processes of commitment and collective action around the protection of river ecosystems.

Embodied learning within feminist political ecology (FPE) is an approach that places people's lived and embodied experiences—particularly those of women and marginalized groups—at the center of analysis to understand and challenge unequal power dynamics related to access to, control of, and degradation of environmental resources (Ravera et al., 2023). This approach shifts the focus from purely abstract, top-down, or technocratic environmental analyses toward forms of “situated knowledge,” where bodily sensations, emotions, and everyday and local practices (such as care work or resource gathering) are recognized as valid forms of evidence and pedagogical tools.

Transdisciplinary research allows us to understand the commons, understood in this article as the processes of collective action in defense of the river, from a broad perspective that recognizes historically marginalized voices, memories, and knowledge (Streck, 2021; Zonta et al., 2023). From this approach, mutual learning, trust-building, and the active participation of communities are central pillars for strengthening co-management of the river and promoting just and sustainable collective action. In this perspective, it is not only important to reflect on river defense movements, but also to act and implement community-based solutions to address the problems that inhabitants face daily, affecting their livelihoods (Andrade et al., 2025).

Methodological framework

This article is part of the project “Participatory Conservation of the Caoní River and its Threatened Species,” funded by the Critical Ecosystem Partnership Fund (CEPF) and its partner in Ecuador, the Latin American Future Foundation (FFLA). The project was implemented by the San Francisco de Quito University (USFQ) and the International University of Ecuador (UIDE), with support from the digital magazine *Noroccidente Relax y Aventura*. It was formally executed from February 2025 to March 2026. The project aimed to strengthen the conservation of the river and its endangered amphibian species through participatory governance, comprehensive monitoring of the river ecosystem, and strategic alliances with local governments and academia.

This article draws on the project's empirical findings to offer a critical reflection on the transdisciplinary research process and its concrete impacts on protecting the river as a common good. Therefore, the broader objective of the article is to evaluate the efficiency and validity of transdisciplinary research tools in real life, taking as a basis for reflection the implementation of an international cooperation project that involves academia in alliance with actors in the territory.

This section explains how the transdisciplinary approach was implemented throughout the project. Therefore, the research was developed using a participatory and collaborative approach in all its phases, and the authors were active participants in these processes. Within the framework of the project, three transdisciplinary tools were used to involve local stakeholders (Table 1) in the different phases of the research, to understand the river from the perspective of its inhabitants and defenders, and to implement concrete actions for its protection (Merçon, 2021; Reed et al., 2023).

In the project developed in the Caoní River basin, community monitoring was applied as the first transdisciplinary research tool in the participatory design of river sampling points. This involved collaboration with 15 local stakeholders in conducting the monitoring, and connecting the collected scientific data with local knowledge about the river when analyzing the results through three multi-stakeholder working groups in the area. This refers to a collaborative process in which local communities, institutional actors, scientists, and other stakeholders with their specialized knowledge work together to observe, evaluate, and understand the ecological, social, and cultural state of a river (Dupuits et al., 2024).

The methodology for monitoring the water quality of the Caoní River combined physicochemical and biological analyses at nine points in the basin during the rainy and dry seasons of 2025. The study included the analysis of parameters such as fecal coliforms, nutrients, COD and BOD, as well as the use of aquatic macroinvertebrates as bioindicators through the EPT and BMWP-Col indices, allowing an integrated evaluation of ecological alterations and variations in water quality associated with anthropogenic pressures in the basin.

Table 1. Groups of actors involved in transdisciplinary spaces (Source: Sebastián Arostegui).

Actors category	Description
Representatives of the local government	Officials who work in municipal offices related to the environment, planning, or public services. They develop and implement policies and manage infrastructure.
Residents of the community	People who live in the watershed and use the river daily, understanding how environmental changes affect their lives.
Tour operators	Lodge owners, guides, and other stakeholders in ecotourism, balancing economic benefits and environmental impacts.
Agricultural sector	Farmers and ranchers whose land use practices directly affect water quality and the landscape.
Civil society organizations	NGOs and community groups focused on conservation and education, which often connect communities with government initiatives.
Educational institutions	Students, teachers, and parents from educational institutions in the territory.
Technical/scientific experts	Specialists in environmental science, conservation and related areas who provide technical support and specialized knowledge.

The second participatory mapping methodology for the Caoní River basin was based on two community workshops on social cartography and participatory mapping, held in June and August 2025 in San Miguel de los Bancos and Puerto Quito. These workshops aimed to integrate local knowledge, territorial perceptions, and everyday experiences related to the river. Through participatory activities, local stakeholders identified, using colored stickers and collective discussions on printed maps, the main

sources of pollution, land uses compatible and incompatible with conservation, priority biodiversity zones, and areas of socio-environmental conflict. This methodology facilitated the development of a collaborative territorial diagnosis of the basin, strengthening the exchange of knowledge, territorial memory, and the understanding of the socio-ecological relationships that shape the river's governance.

The third methodology for constructing environmental narratives was developed through three participatory illustrated story workshops with children and teachers from the Caoní River basin. These workshops combined creative writing, drawing, and collective reflection on the territory and river conservation. Through stories, memories, and visual representations, participants expressed perceptions of pollution, biodiversity, and their emotional connection to the river, allowing for the identification of environmental imaginaries, senses of belonging, and intergenerational visions of the territory. This methodology facilitated the integration of emotional, cultural, and ecological dimensions into the processes of environmental education and participatory conservation.

The construction of environmental narratives allows for the teaching and practice of an ethic of care surrounding rivers, based on the everyday knowledge of the inhabitants and the shared responsibility of the actors throughout the watershed, such as communities, users, producers, and local authorities (Haraway, 2013; Lewsley et al., 2025). From the feminist perspective of the ethic of care, rivers can be interpreted through stories and narratives that allow for the restoration of an emotional and creative connection with the ecosystem beyond the destruction, pollution, and extraction promoted from a technical perspective (Li, 2024).

Analyzing the construction of a river identity in the Caoní River from a transdisciplinary perspective

Community monitoring of the river

Community-based monitoring to analyze the river's water quality was conducted with 15 actors from civil society, local authorities, and communities, who collaborated in the participatory identification of sampling points. They recognized that monitoring, environmental education, and responsible water resource

Aquatic macroinvertebrates are probably the most widely used organisms as bioindicators of water quality due to several characteristics that make them ideal for detecting changes or alterations in water bodies (Orozco González & Ocasio Torres, 2023). Aquatic macroinvertebrates provide information over time because they reflect changes in the physicochemical parameters of water. This allows scientists and communities to detect problems before major damage occurs in the ecosystem.

Two indices were applied to analyze water quality based on macroinvertebrates: the BMWP/Col (Biological Monitoring Working Group/Colombia) and the EPT index. The higher the percentage of EPT individuals, the better the water quality; low values indicate greater pollution (generally from organic matter, metals, or chemicals) (Tubić et al., 2024). Regarding the BMWP/Col index, each macroinvertebrate family receives a score according to its sensitivity to pollution: Highly sensitive families → high score; Tolerant families → low score. The interpretation is based on the total index score, which is obtained by adding the scores of all families present in the sample (Pérez et al, 2024).

Regarding community monitoring of the river, during the rainy season (May 2025), 70 individuals belonging to 11 orders and 18 families were recorded. The EPT index, which considers the families Ephemeroptera, Plecoptera, and Trichoptera, yielded a value of 44%, indicating MODERATE water quality. While not a low level, it suggests that the diversity or abundance of these groups is affected, possibly by anthropogenic pressures such as changes in land use, alterations in riparian vegetation cover, or diffuse pollution.

The BMWP-Col index obtained a value of 110, indicating good water quality, as it implies the presence of several sensitive families with high scores; such as the Elmidae, Perlidae, and Ptilodactylidae families, found in the analyzed ecosystem, which are usually found in relatively preserved bodies of water.

The discrepancy between the two indices can be explained by their methodological approach. The EPT index is more conservative, focusing on only three orders, while the BMWP/Col index includes a broader range of families, making it more sensitive to quality gradients in tropical water bodies. In this case, the family richness detected by the BMWP/Col index suggests that there are enough sensitive groups to indicate good quality, even though the EPT diversity is not particularly high. Both indices provide complementary information. The average quality reflected by the EPT index suggests certain ecological pressures on particularly sensitive groups, while the

BMWP/Col index indicates that the ecosystem still maintains a favorable overall ecological integrity.

For the dry season (August 2025), 100 individuals were recorded, belonging to 10 orders and 15 families. The EPT index yielded a value of 42%, corresponding to a MODERATE category. This result indicates a moderate decrease in the diversity of sensitive organisms, suggesting some level of environmental disturbance, possibly due to organic discharges, sedimentation, or habitat changes. Furthermore, the BMWP-Col index reached a value within the 61–100 range, classifying it as ACCEPTABLE. This reflects the presence of a relatively diverse biological community and water quality that is slightly impacted but still tolerable for aquatic life.

Overall, the results show that the water body presents an intermediate ecological condition, with good oxygenation and moderate pollution. It is recommended to implement environmental management measures, such as controlling discharges and conserving riparian vegetation, to maintain or improve the quality of the ecosystem.

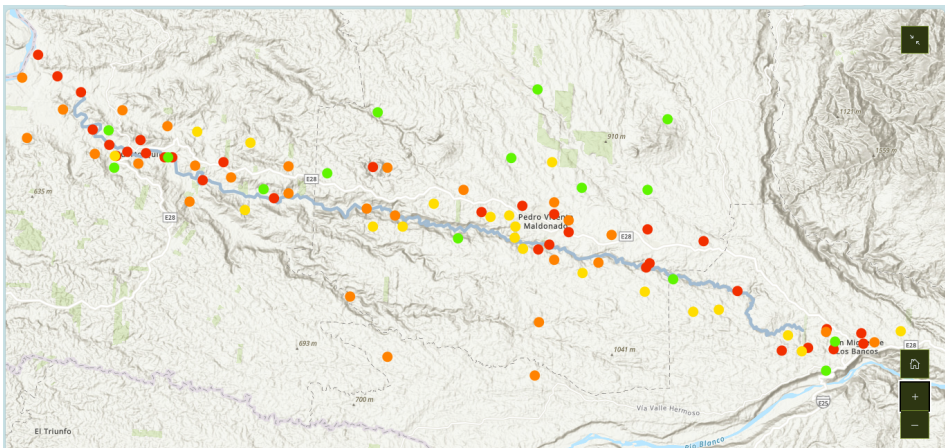
The physicochemical analyses of the Caoní River water show variable water quality depending on the season and sampling site. The highest levels of pollution from nutrients (nitrates, sulfates), chlorides, *E. coli*, and chemical oxygen demand (COD) were recorded in the San Miguel de los Bancos and Pedro Vicente Maldonado sectors, mainly associated with domestic discharges and wastewater. In contrast, the Caoní River shows a significant capacity for dilution and self-purification, maintaining *E. coli* levels within permissible limits for recreation and generally acceptable physicochemical parameters. No heavy metals were detected above acceptable levels, although the presence of barium was identified, possibly linked to agricultural activities. Taken together, the results suggest that the river maintains a relatively favorable ecological condition, although it faces anthropogenic pressures that require continuous monitoring and management actions.

Talking map and participatory diagnosis of the state of the river

The participatory mapping methodology was used to conduct a participatory assessment of the Caoní River watershed and its Key Biodiversity Area (KBA). Participants used colored stickers to locate river pollution points, activities compatible or incompatible with river conservation, and priority conservation areas on the map (Figure 4). Based on dialogue and the exchange of knowledge and experiences, each group responded to one of the following lines of reflection:

1. Human activities and land uses

- a. *What activities help or harm the river and where are they located?*
2. Conservation
 - a. *Where are the most important areas for protecting river life? Which areas are most vulnerable to loss?*
 - b. *Who are the key players in river management?*
3. Water quality
 - a. *Where and how can we monitor and improve water quality?*



- Código de colores para los mapas:
 - **Rojo:** Puntos de contaminación/degradación del río
 - **Naranja:** Usos incompatibles con conservación
 - **Amarillo:** Usos compatibles con conservación
 - **Verde:** Zonas prioritarias de conservación, hábitats críticos, bosques en buen estado

Fig. 4: Talking map of the river's diagnosis and its different uses (Source: Cameron Howland)

The participatory mapping exercise fostered a space for collective reflection among the participants, where they shared their life stories and experiences and identified various strategic actions needed to strengthen the integrated management of the Caoní River. First, the importance of strengthening territorial governance was emphasized, including the legal establishment of a Caoní River consortium and the consolidation of grassroots organizations, in order to bring together the diverse stakeholders present in the region. Likewise, the need to design and adopt a river conservation mechanism was raised, accompanied by systematic awareness-raising processes for the local population, authorities, riverside landowners, and productive stakeholders—key elements for promoting shared responsibility in protecting the watershed. A representative from a local environmental NGO stated: “The most effective strategy for achieving change to restore the river and be heard by the government is protection action, as it compels the authorities to take action”³.

Participants also highlighted the urgent need for increased public investment in water treatment infrastructure, as well as the necessity to advance land-use planning and management processes to address growing pressures on the ecosystem. Among the specific actions discussed were the importance of promoting reforestation projects in critical areas and along riverbanks, strengthening research and monitoring, and more rigorously enforcing environmental regulations aimed at protecting riverbanks and water quality. However, it was acknowledged that budget constraints pose a pervasive challenge to the implementation of any conservation strategy.

Another point of debate was the review and redefinition of territorial boundaries related to river conservation, such as the possible expansion of the Chocó Andino Biosphere Reserve in Pichincha. In the productive sector, problems linked to poor agricultural practices were identified, including the indiscriminate use of agrochemicals, which presents an opportunity to develop campaigns to reduce and replace these inputs. Likewise, the lack of knowledge regarding the volumes of greywater and blackwater discharged by agro-industrial activities and urbanizations was noted, a critical gap for water management. Finally, the potential of Nature-based Solutions—such as riverbank restoration, wetland creation, and river channelization—was highlighted as cost-effective alternatives to impacts such as the high deforestation associated with African palm cultivation. Taken together, these discussions demonstrate that the conservation of the Caoní River requires a

³ Intervention during the first working group meeting on the Caoní River, San Miguel de los Bancos, June 2025.

comprehensive, coordinated, and multi-sectoral approach that responds to both the ecological and socioeconomic dynamics of the territory.

On the other hand, during the second field working session, a collaborative effort began to develop the technical and legal framework for the River Protection Action. In Ecuador, a protection action is a constitutional guarantee used to safeguard the rights of nature and the human right to water when these are violated by pollution, extractive projects, or inaction by authorities. Based on the Constitution (2008), it allows citizens, communities, or groups to demand before a judge the remediation and protection of ecosystems as subjects of rights, compelling full reparation for the damage (GARN, 2024).

As key steps, it is necessary to first clearly identify which rights are believed to have been violated and how to prove it (evidence; scientific data and hard data; maps and visual elements). The example of the lawsuit and ruling concerning the Machángara River in Quito and its violated constitutional rights was discussed, including:

- The rights of nature
 - The river's life cycle: the right to live, to exist, and to flow
 - The structure of the river: the right to maintain its identity and integrity
 - Functions of the Machángara River: right to fulfill its role
 - The systemic principles of nature
- The right to water
- The right to a healthy environment, sanitation and health
- The right to the city

On the other hand, the need to define responsibilities was raised, who will file the lawsuit (whether one person or several), and against whom the lawsuit is filed. Comprehensive reparations must be identified, as in the case of the Machángara River, which was recognized as a subject of rights in a 2024 ruling. Within this framework, the Machángara River was recognized as a strategic axis for the restoration and reconstruction of a Sustainable, Green, and Blue Quito, which implies the need for a public policy for the comprehensive reparation of the Machángara River; the review, reform, and effective application of current regulations for repairing the Machángara River; and the establishment of mechanisms for citizen participation.

Furthermore, it is crucial to define the river's identity and the context of the rights violations. As final steps, a strategy must be developed to determine when to present evidence, utilize the media, and engage experts to act as *amicus curiae*⁴ during the proceedings. Finally, the legal action must be formally filed and submitted to the court (in the canton where the river is located) to pursue the case.

Continuing with the participatory working groups in the field, four working groups were formed using the social mapping methodology (Figure 5), with the objective of mapping, based on local knowledge and the lived experiences of the inhabitants, the visions and realities of the Caoní River. The exercise was carried out in four parts: 1) Drawing the current state of the Caoní River; 2) Identifying which rights and functions of the river have been violated or are at risk; 3) Writing in one sentence how the group would like to see the Caoní River in 10 years; and 4) Indicating the actions that must be implemented to protect the rights of the river and achieve that vision.

The analysis of the social mapping exercise of the Caoní River revealed a profound understanding of the river's ecological rights and functions, highlighting its role in biodiversity, its right to remain free from pollution, to maintain riparian forests, to conserve its flow, and to support responsible human activities. The groups emphasized the need to reconnect the population with the river, recognizing its ecosystem services—such as the provision of quality water and food—and recovering cultural practices associated with the consumption of local fish and productive diversification beyond monocultures, such as palm hearts. Likewise, the need was identified to better connect existing best practices in territories like Puerto Quito through agroecological farming schools, organic cacao training, and environmental workshops in communities and schools, to address the fragmentation problem that exists between the upper and lower basin. Finally, the participants emphasized the importance of strengthening territorial management through the control of urbanizations, the promotion of recreational initiatives such as bike paths along the Caoní River with provincial support, and the effective use of water protection ordinances, all of which constitute a basis for fairer and more sustainable governance of the river.

⁴ An *amicus curiae* (“friend of the court”) is a person or organization that presents arguments or expert information to a court to support decision-making in a case.

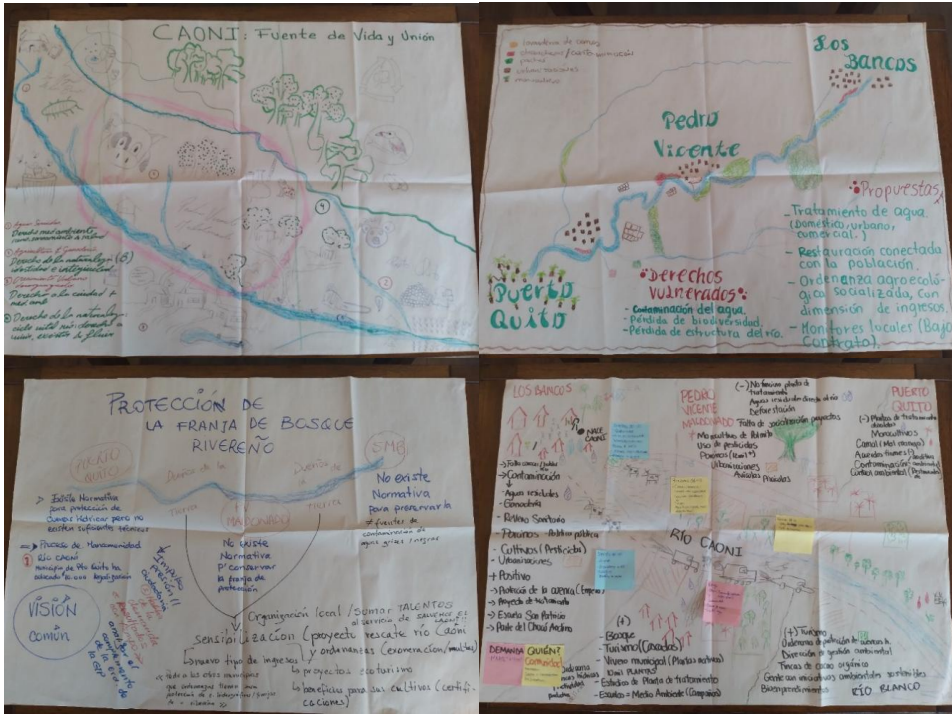


Fig. 5: Social mapping of the Caoní River and its rights (Source: Emilie Dupuits)

Building environmental narratives through the story contest that saves rivers

The first edition of the Illustrated Story Contest “Stories that Save Rivers” (Figure 6) was implemented with students from public, private, and semi-private schools in the cantons of Puerto Quito, Pedro Vicente Maldonado, and San Miguel de los Bancos. The contest not only aimed to encourage children to express themselves through stories and drawings and promote reading, writing, and visual and narrative art, but also to raise awareness about the importance of being guardians of the Caoní River and its biodiversity, connecting rivers, territory, citizens, and generations through illustrated stories.



Fig. 6: Poster for the Short Story Contest that Saves Rivers (Source: V. Delgado)

The dynamics of exchange and work with the children revealed the level of awareness that exists not only among them but also among the parents and teachers of the participating schools. It was evident that the majority of participants are aware of and concerned about the environmental pollution of the Caoní River and its causes. Several teachers and parents shared childhood memories of swimming in the river, demonstrating their personal and intimate connection with nature and their concern about the river's degradation that they have observed over time. A theme of intergenerational justice was also present, with the teachers and parents

demonstrating their commitment to leaving a healthy environment for future generations and recognizing their responsibility as decision-makers in the river's environmental degradation. One mother mentioned that “when I was a child, the connection with the river was much closer; you could swim in it, and there were many animals that lived along its banks. I would like my children to be able to enjoy the river again as I did when I was a child”⁵.

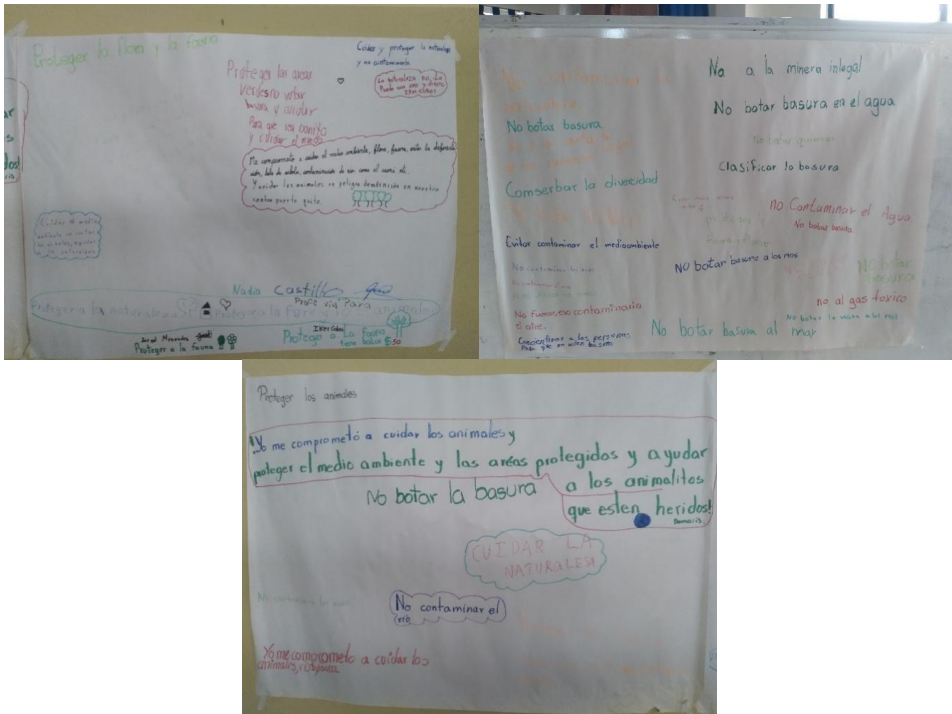


Fig. 7: Mind maps of actions to protect the Caoní River in schools (Source: E. Dupuits)

⁵ Intervention during an illustration workshop at a school in Pedro Vicente Maldonado, October 2025.

At the end of the environmental education talks, the children wrote words and phrases about what it means to them to be guardians of the Caoní River, as preparation for the illustration and art workshops for their stories (Figure 7). On the one hand, most of the responses focused on pollution from trash and plastics and the need to control and adopt better environmental care practices at an individual level. On the other hand, the children often linked the river and the environment to the protection of emblematic animals of the area such as ocelots, fish, birds, frogs, and pumas. They expressed how the pollution of the river and its animals affect human health due to the food chain and the interconnectedness that exists between human and non-human nature.

The evaluation phase of the illustrated stories highlighted the inclusion of various elements of the Caoní River's natural and cultural environment (Figure 8). Most of the stories narrate the actions of one or more river guardians who unite to rescue the river from the threats of pollution and environmental destruction. Some stories focus on representative flora and fauna of the area, including amphibian species such as the devil frog and the glass frog, while others depict the livelihoods and Afro-Ecuadorian culture of Puerto Quito. Certain stories emphasize the importance of intergenerational transmission by narrating dialogues between children and their grandparents about environmental awareness, traditions, and caring for the river for future generations. Finally, some stories evoke mystical elements, bringing with them myths, legends, and magical beings that protect the river and connect the ecosystem with humankind.

These environmental education and art activities also aimed to connect individual awareness of river pollution with collective justice dynamics, which often remain invisible or marginalized. For example, if sewage and wastewater are dumped directly into the river, it is not only due to a lack of environmental awareness among residents but also to deficiencies in waste treatment and collection services at the political level. The activities addressed how the river connects territories and people upstream and downstream, and the need to adopt water treatment and protection policies at the river's headwaters in San Miguel de los Bancos to avoid impacting populations in downstream cantons. Furthermore, it was shown how the river encompasses much more than just its channel, connecting forest ecosystems, animals such as amphibians, and the people who live along its banks. Finally, it was revealed how the river is a space of history, memory, and culture, highlighting the history of its first inhabitants, from the Yumbo and Afro-descendant communities, especially in the Puerto Quito area, and the different periods of migration and colonization of the territory driven by economic and development interests.

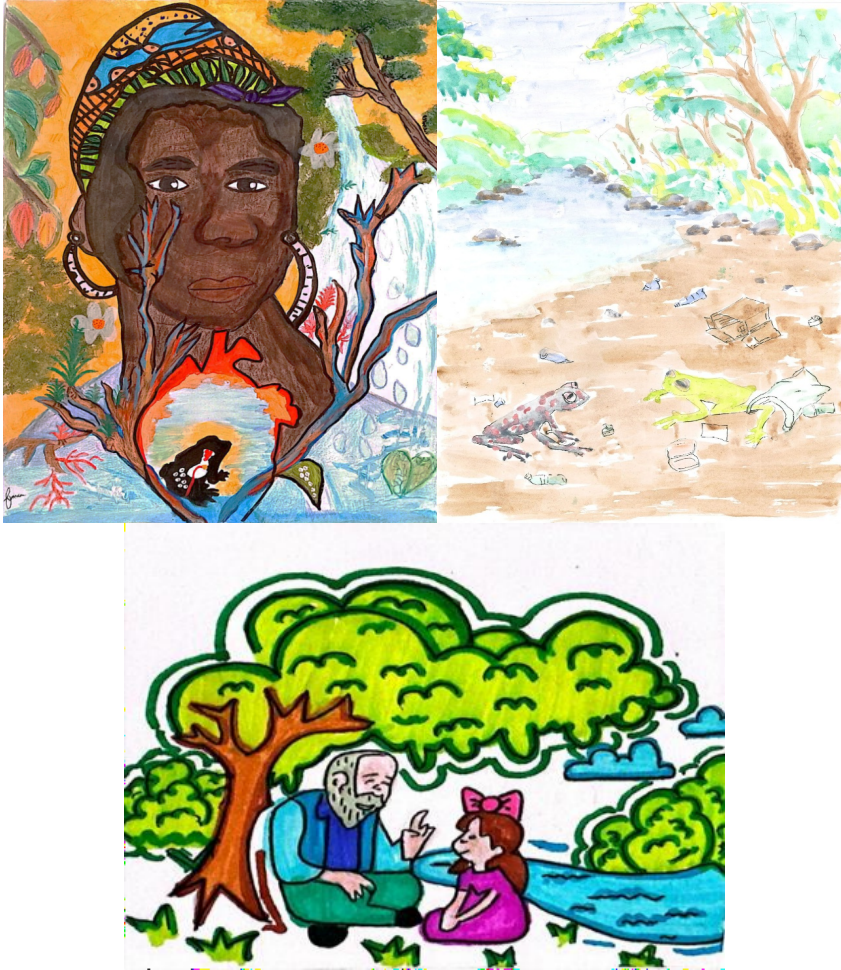


Fig. 8: Winning illustrations from the story contest that saves rivers (Source: Francisco Erazo, Eyden Suarez, Katherine Gaona)

Beyond this specific competition, the goal was to encourage the long-term integration of transformative environmental education programs into the curricula of schools in the area. A good example of this is the existence of an environmental guardians club at the San Patricio Fe y Alegría school in San Miguel de los Bancos. These types of programs not only raise awareness among young people and the general population

about environmental and river conservation, but can also influence the adoption of public policies focused on sustainability at the local level.

Discussion: Contributions and challenges of transdisciplinary research for the construction of a collective identity and action of the river

Within the framework of the participatory conservation project for the Caoní River and its threatened species, we have implemented several transdisciplinary research tools to facilitate collaboration with local stakeholders and guide reflection on local needs and realities. In this discussion, we revisit these tools to reflect on the contributions and challenges of transdisciplinary research in building a collective identity and action around the river's commons, within a context of highly fragmented ecosystems and human societies.

The use of social mapping tools and "talking maps" of the river allowed for the valuation of the local and situated knowledge of the inhabitants of the territory, many of whom have lived their entire lives in relation to the river and the forest, and who transmit local knowledge about the culture and history of the area. Giving voice to marginalized actors and visibility to their situated knowledge is the basis of the feminist political ecology perspective and the concept of embodied learning (Haraway, 2013). Most of the actors involved in the Save the Caoní initiative are rural inhabitants who experience abandonment by the central government. Additionally, some inhabitants of Puerto Quito belong to communities that self-identify as Afro-descendant and report a historical situation of territorial marginalization. These tools made it possible to highlight the emotional connection that several local actors maintain with the territory, with childhood memories, feelings of sadness about the current state of pollution of the river, and feelings of abandonment by the government (Arostegui, 2025).

The use of social mapping tools and embodied learning (Stolz, 2015; Humphreys & Blenkinsop, 2018), central to the transdisciplinary research approach adopted in this study, emerges as a key element in constructing a collective identity around the river. This aspect is particularly relevant in a highly fragmented territory like the Caoní River basin, where there is limited historical or ancestral identification with the river and where relationships with the river ecosystem have been marked by productive and utilitarian uses. However, various actors in the Save the Caoní initiative have strengthened emotional, cultural, and territorial ties with the river through community tourism activities, the recovery of knowledge associated with traditional

national cacao production, and the study of local species—such as native angelita bees, amphibians, birds, and emblematic trees like the chíparo—that are part of the ecological network that sustains the river's life. These experiences reflect the coexistence and tension between two ways of relating to the territory: one focused on exploitation and the other based on care, interdependence, and the construction of a relational ethic with the river ecosystem.

When creating participatory maps of the Caoní River's condition, stakeholders identified local conservation and sustainable development practices and experiences they implement or are familiar with, giving visibility to spaces and actors within the territory. Furthermore, the participatory map becomes a tool for critical reflection and empowers individuals to demand accountability for the injustices and responsibilities related to environmental pollution (de Souza et al., 2025; Boelens et al., 2025). For example, through the social mapping of the Caoní River's rights, it was possible to identify violations of several rights, such as the right to integrity, the right to exist, and the right to flow freely, and the need for concrete actions from the defendants, primarily the three municipal governments. Based on these participatory exercises, various representatives of civil society and communities expressed their interest in promoting mechanisms to influence public authorities through a protective action that vindicates the rights of the river, based on the Ecuadorian constitutional framework of the Rights of Nature (Kauffman & Martin, 2023; Martínez-Moscoso & Warner, 2025).

However, the still fragile collective identification with the river limits the possibility of initiating and sustaining a legal process of this nature, which requires a more consolidated and organized group of river guardians. This situation demonstrates how power relations, territorial inequalities, and the heterogeneity of actors can hinder the construction of a unified collective action to claim the rights of a river ecosystem. Power relations are illustrated in this case by the absence of clear, unified leadership at the basin level and a division between the upper, middle, and lower basins, which are disconnected.

Faced with the difficulties of moving forward with protective measures, spaces for reflection and dialogue also provided support for the development of another conservation mechanism for the Caoní River basin, which currently lacks concrete forms of territorial protection. The prioritized mechanism was the creation of a Conservation and Sustainable Use Area (ACUS), conceived as a tool to protect water sources and remaining forest areas, while also allowing for the development of

sustainable productive activities compatible with local livelihoods. Although the creation of an ACUS requires institutional coordination and political will, this mechanism appears to local stakeholders as a more tangible and viable alternative than protective measures, which demand significant technical, financial, and legal resources and whose results could take years to materialize.

The construction of shared environmental narratives through the "Short Stories to Save Rivers" contest gave a voice to stakeholders who are not usually represented in working groups or participatory spaces within research projects. Interaction with children, adolescents, parents, and primary school teachers revealed environmental awareness among the local population regarding the river's pollution and the importance of its restoration and protection. This finding contradicts common narratives that blame local residents and rural communities for environmental pollution due to their ignorance, lack of knowledge, and lack of education (Alier, 2021). On the contrary, many of these stakeholders expressed their interest in contributing to the river's recovery with concrete proposals and their willingness to adopt best practices for its care, if necessary, and to join the collective effort. Beyond the individual effort of not throwing garbage into the river or protecting local fauna, the environmental education workshops made it possible to highlight the need to demand support and solutions from the public authorities in charge of environmental care and the provision of basic services (García, 2022). According to the results presented, this pollution is moderate, so efforts should focus on preventing the pollution from worsening rather than on the recovery of a highly polluted river.

Final conclusions

This article analyzes how transdisciplinary research tools can contribute to building a collective identity around the Caoní River as a common good in a territory marked by ecological and social fragmentation. Through the integration of community monitoring, participatory mapping, and the construction of environmental narratives, it demonstrates that the defense of the river does not emerge solely from scientific evidence of pollution or biodiversity loss, but also from relational processes of learning, trust, and territorial reappropriation. The results show that these methodologies reinforce each other: while community monitoring produces empirical evidence of the river's moderate deterioration, participatory mapping allows for the territorialization of conflicts and the visualization of pollution sources from situated knowledge, and environmental narratives foster emotional connections, intergenerational memories, and a sense of belonging to the river ecosystem.

This study contributes to the debate on *riverhood* and the governance of the commons by showing that constructing a river identity is a necessary—and often underestimated—step toward sustaining collective action and the legal defense of nature's rights. In the case of the Caoní River, the will to move toward protective action faces limitations stemming from a fragmented social fabric, distinct historical trajectories of land occupation, and predominantly utilitarian relationships with the river. This demonstrates that the legal recognition of a river as a subject of rights depends not only on favorable constitutional frameworks but also on the existence of care communities capable of collectively mobilizing around its protection.

Furthermore, the article demonstrates the potential of *embodied learning* as a central dimension of transdisciplinary research applied to river conservation. Bodily, affective, and territorial experiences—through monitoring, river exploration, local memories, and creative practices with children and communities—strengthened situated knowledge and rebuilt emotional connections with the river in a context where this relationship had been historically weakened. This finding is particularly relevant for rural territories undergoing recent colonization, agricultural expansion, and a diverse range of actors with heterogeneous interests.

Finally, the case of the Caoní River allows for critical reflection on the scope, contradictions, and limitations of transdisciplinary research in contexts of participatory conservation and governance of riverine commons. While the process contributed to strengthening local capacities, fostering collaboration among previously disconnected actors, and generating technical and social inputs for conservation mechanisms such as the Area of Conservation and Sustainable Use (ACUS), it also highlighted the inherent tensions in the co-production of knowledge in socially and politically fragmented territories. These tensions include power asymmetries between local actors, academia, and international cooperation, as well as the different timeframes, expectations, and languages that permeate these collaborative spaces. While local communities and organizations prioritize concrete responses to immediate problems of pollution and loss of livelihoods, academic institutions tend to respond to longer research timelines and knowledge production agendas, and international cooperation operates within limited timeframes conditioned by external funding priorities.

Furthermore, experience shows that participation does not necessarily imply social cohesion or sustained collective action. In the case of Caoní, the heterogeneity of actors—agricultural producers, tourism operators, urban residents, Afro-descendant

communities, local governments, and environmental organizations—generated diverse and even conflicting views on the river, its legitimate uses, and the responsibilities for its care. This limited the consolidation of strong community leadership and a shared identity robust enough to sustain complex legal processes, such as a protective action based on the Rights of Nature. In this sense, transdisciplinary research should not be idealized as a space free of conflict or automatic consensus, but rather understood as an arena of constant negotiation where disputes, inequalities, and tensions emerge regarding what knowledge is considered legitimate, who defines priority problems, and what territorial futures are desirable.

However, it is precisely in these tensions that one of the most significant contributions of the transdisciplinary approach lies. Beyond producing scientific data or territorial diagnoses, the process opened spaces for encounter, listening, and mutual learning, where community monitoring, participatory maps, and environmental narratives acted as translation tools between different languages of scientific, territorial, affective, and political knowledge. This fostered the gradual emergence of new ways of relating to the river, understood not only in terms of its economic utility but also in terms of memory, belonging, care, and shared responsibility. The experience suggests that building participatory governance and river justice cannot be reduced to isolated interventions or technical solutions but requires long-term processes based on sustained trust, flexible institutions, transformative environmental education, and mechanisms capable of articulating scientific evidence with situated experiences and collective aspirations. Ultimately, the challenge is not only to conserve an ecosystem but to rebuild the social, affective, and political relationships necessary to imagine and sustain shared futures of caring for the river as a living common good.

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