



Industrial Mining: Water Coloniality and Dispossession in Indigenous Territories of the Southern Amazon Region in Ecuador

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Abstract

We examine the dynamics that emerged during the exploitation and beneficiation phase of Ecuador's first large-scale mining project in the Shuar Indigenous territories of the southern Amazon. Using an integrated approach that combines hydro-social studies and political ecology, we examine the tensions, resistance, and socioenvironmental and cultural impacts resulting from the regrowth of tailings deposits, river diversions, steelmaking, and the expansion of mining activities. A mixed-methods approach was employed, including surveys, interviews, and socioenvironmental mapping. The findings highlight water disputes that serve as a form of territorial control and resource appropriation vital for community survival and ancestral practices. Our research reveals processes of water coloniality driven by territorial disputes and water privatization, resulting in the development of community governance strategies aimed at asserting rights.

Keywords Water coloniality · Governance · Hydrosocial · Impacts · Mining · Amazon · Ecuador

Introduction

The global expansion of mining, driven by rising demand for strategic minerals, has led to intense social and environmental conflicts, highlighting the limitations of the extractivist development model, which heavily relies on exploiting natural resources. This approach promotes structural violence, displaces communities, and delegitimizes ancestral knowledge, all within narratives of sustainability and progress (Nepomuceno et al., 2019; Bebbington et al., 2018). In this context, many communities have organized resistance through social mobilizations and legal actions that challenge traditional forms of environmental governance, establishing local alternatives that prioritize collective rights and recognize water as a shared resource.

In Ecuador, despite the innovative inclusion of the rights of nature in the 2008 Constitution, which recognized nature as a subject of rights, the enactment of the Mining Law

in 2009 and subsequent reforms facilitated the expansion of large-scale mining projects. These policies, although meant to regulate the industry, have shortcomings in their implementation, especially during the exploitation and commercialization phases. These issues are evident in the construction of mining infrastructure, such as tailings dams and dikes, whose poor management endangers water resources and the livelihoods of Indigenous peoples, worsening socio-environmental vulnerabilities in the Amazon (Aguilar-Pesantes et al., 2021).

In this context, the processes of water coloniality caused by socioenvironmental changes during the exploitation and beneficiation phase of the Mirador Mining Project—the first large-scale copper mine to be built in the Indigenous territories of the Shuar in southern Ecuador's Amazon—are analyzed. From a political ecology perspective, power structures, environmental inequalities, and forms of territorial control are examined, enabling the identification of how state and corporate actors influence access to and control over water through policies that legitimize privatization and intensive extraction (Martínez Alier, 2015).

Hydrosocial studies, on the other hand, examine the complex relationships among society, water, and territory, highlighting how water resources gain new social, political, and cultural meanings in conflict zones (Swyngedouw, 2009). The interdisciplinary combination of both fields enables a

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simultaneous understanding of the structural, political, and symbolic aspects underlying the processes of water coloniality imposed on Indigenous communities, as well as their local responses, expressed through water governance and cultural resistance (Harvey, 2018; Porto-Gonçalves, 2013; Escobar, 2017). Therefore, our study is well-positioned within current academic debates, making a meaningful contribution to the discussion.

We explain the concept of water coloniality as a version of the coloniality of nature, where nature is seen as a resource to be controlled within the framework of advanced capitalism (Mansilla-Quiñones et al., 2024). This instrumental view of nature has been intensified under capitalism, which aims to embody the ideals of progress and modernization, leading to the exploitation of natural resources and the promotion of systems of racial domination (Harvey, 2018).

Thus, water coloniality exemplifies a hegemonic and exclusionary power structure, as demonstrated by business practices that aim to maximize control over natural resources and by government policies that promote these practices through legislation and regulations prioritizing economic growth over the environmental and cultural rights of Indigenous communities (Nahuelpan, 2016). Moreover, this dynamic reflects an internal colonialism carried out by the State, which continues to reinforce the subjugation and marginalization of Indigenous peoples (González-Casanova, 2017).

In this context, water coloniality appears as a form of power strengthened by corporate dominance and government complicity, highlighting the multiple layers of influence that uphold inequality and dispossession in Indigenous territories (Mansilla-Quiñones et al., 2024). These processes are visible in the Mirador Mining Project, managed by the Chinese company Ecuacorriente (ECSA), located in the parish of Tundayme. The expansion of the extractive frontier has caused violent episodes resulting from conflicts among the State, the company, and the Shuar communities and residents of Tundayme parish, triggered by mining activities along the Tundayme, Wawayme, and Quimi rivers (Leifsen et al., 2017). The company proposed to reduce the flow of the Tundayme River by 58%, which could disrupt the natural drainage system and alter local hydrology (Gobierno Autónomo Descentralizado Parroquial Rural de Tundayme, 2019).

Mining activity poses a threat to biodiversity and river ecosystems, as well as to the spiritual and cultural structures that have supported communities for generations (Verdú Delgado, 2017). This issue arises from the clash between corporate governance models and those of Indigenous communities, for whom water is a vital and sacred element (Vélez-Torres & Vanegas, 2022; Martínez-Cruz et al., 2024). From this community perspective, which is

defined by collective decision-making and a holistic view of the land, they develop strong resistance to the company's impositions.

The relationship between the Shuar and water shows their understanding of their interconnectedness with nature. Water is a vital part of the Shuar cosmovision (Karsten, 2023), which is closely linked to *Arutam*, the deity representing the divine force of the forest in Shuar mythology; water is viewed as a symbol of life (Delgado Sumar, 1999). *Arutam* resides in the *Tuna*, a waterfall that functions as a habitat for aquatic life and a center of spiritual energy, expressed through *Tsunki*, who is considered the creator deity of aquatic beings and the teacher of the Shuar, sharing wisdom about fishing and health (Delgado Sumar, 1999), thereby strengthening their spiritual connection with rivers and waterfalls.

Shuar water management practices include rituals and ceremonies performed near and within water bodies, which are essential for maintaining harmony with nature and balancing the physical and spiritual aspects of their lives (Karsten, 2023). They see water as both a living being and a creator; this perspective is vital for understanding how the Shuar protect their identity, rights, and resistance to extractivism in their territories (Lalander et al., 2021).

Resistance to mining is increasing within the Shuar communities as they oppose the construction of the tailings dam, highlighting the complexity of water conflicts between the communities and the company. The project involves a dam built with low-permeability materials, initially located at an elevation of 808 m above sea level, and designed to store about one year's worth of tailings, based on a daily processing rate of 30,000 tons per day (TPD). The dam is expected to rise to 843 m above sea level, which would involve managing roughly 1.3 million cubic meters of cyclonic sand annually (Ecuacorriente, 2020).

Additionally, the State, through the Ministry of Environment, Water, and Ecological Transition, has issued a new environmental license approving the construction of the Mirador Norte Pit, the Escombrera Norte, and a plant to produce steel balls. It also permits an increase in mining output from 60,000 tons per day (KTPD) to 140 KTPD. This increase exerts greater pressure on local ecosystems and water resources in the parish, creating a notable challenge for environmental management and sustainable water resource planning, since the mine's operation will continue for about 30 years, as outlined in the mining contract signed by the State and the Company in 2012 (Gesambconsult, 2022).

Although there is relevant research on the hydrological impacts caused by mining from economic, social, and environmental perspectives, which recognize rivers as active political ecologies in the fight for water justice (Boelens

et al., 2023; Gudynas, 2018), many of these studies focus on the initial mining exploration stage, leaving a significant research gap regarding how these impacts grow during large-scale exploitation phases. In particular, understanding of the ecological and cultural effects of mining shifts into the intensive operational phase. Addressing this gap, our study examines the Mirador mine as a representative case of water coloniality, where mining exploitation is seen not only as natural resource extraction but also as a form of cultural domination of the Shuar community and territorial reorganization that sustains colonial power structures through the expansion of extractive globalization.

Therefore, we investigate how the appropriation and transformation of water resources caused by infrastructure development and mining activities create processes of water coloniality in the Indigenous territories of the Shuar. In this context, three areas of analysis are outlined. First, we examine how mining infrastructure and the power relations associated with them perpetuate colonial dynamics that subordinate Indigenous ways of understanding and managing water, disregarding their cultural and spiritual connections to the land (de la Cadena, 2010; Escobar, 2017). Second, we examine how the relationship between the state and extractive companies facilitates the appropriation of water resources through legal, technical, and administrative mechanisms that undermine community methods of water use and control, ultimately leading to processes of territorial and symbolic dispossession (Harvey, 2003). Lastly, we assess the impact of these changes on Shuar collective life, highlighting the ecological, social, and cultural tensions that have led to water conflicts over unequal access and the effects of the expanding extractive model on Indigenous and peasant communities (Swyngedouw, 2009; Martínez Alier, 2015).

Theoretical Framework

The extractivist model has exacerbated inequality and economic dependence in Latin America, leading to socio-environmental conflicts and various forms of community resistance (Martínez-Alier, 2015; Gudynas, 2018; Svampa, 2019). Based on political ecology and hydrosocial studies, these conflicts are viewed not only as struggles over access to natural resources but also as battles over knowledge, narratives, and authority (Gudynas, 2018). They often stem from the logic of techno-managerial modernization, which supports the construction of large infrastructures that tend to overlook the rights and views of local communities, thereby increasing territorial and socioenvironmental tensions (Hidalgo-Bastidas et al., 2018).

A deep understanding of water conflicts requires a discipline that acknowledges their political and territorial dimensions. Political ecology and hydrosocial studies provide frameworks that enable us to view water not only as a natural resource but also as something intricately linked to power, institutions, and development models (Lalander et al., 2021; Martínez Alier, 2015). From a political ecology perspective, access to and control over water are viewed as processes shaped by historical inequalities, where actions like dams, privatizations, or extractive projects produce different impacts, often benefiting corporations at the expense of local and Indigenous communities (Rodríguez-Labajos & Martínez Alier, 2015).

In turn, hydrosocial studies view the hydrological cycle as a socational construct shaped by infrastructure, policies, and resource governance disputes (Boelens et al., 2023). In this framework, extractive activities reorganize the hydrosocial cycle through the dynamics of accumulation by dispossession (Harvey, 2003), emphasizing the commodification of water and undermining human rights-based approaches (Swyngedouw, 2009). Both fields help to understand water coloniality, a key concept of this research, as a form of structural domination that transforms territories and social relations through water control, making conflicts and resistance to alternative management and ways of life visible (Mansilla-Quñones et al., 2024; Harvey, 2018; Porto-Gonçalves, 2013).

The concept of water coloniality is based on three main premises: first, epistemic violence that delegitimizes ancestral knowledge and Indigenous practices related to water and nature management; second, the creation of a political project that promotes the degradation of all forms of life; and third, the development of a hierarchical ontology that prioritizes human interests over ecological integrity (Losada Cubillos et al., 2022; Mansilla-Quñones & Melin, 2019). Consequently, water management becomes a tool of territorial control that reinforces broader colonial systems, impacting the biocultural relationships that native peoples have with their environments (Nahuelpan, 2016). These practices reshape the physical landscape and deepen coloniality in water governance, coercively changing the interactions between communities, corporations, and the State (González-Casanova, 2017).

Large-scale mining activities demonstrate how modern pressures on land and water resources are rooted in historically unequal power structures (Sánchez Contreras & Matarán Ruiz, 2023; Boelens et al., 2015). From the perspective of the coloniality of power, these dynamics show how hierarchical structures persist over time, impacting Indigenous peoples and their lands (Quijano, 2020). The concept of territorial coloniality helps explain this, as it reveals how extractive activities reshape territories by enforcing power

logics and influencing community life, especially in the Andean Amazon (Porto-Gonçalves, 2009). In countries like Colombia, Ecuador, Peru, and Bolivia, these tensions are currently expressed through socio-environmental conflicts that threaten community autonomy (Betancourt-Santiago & Rubiños-Cea, 2021).

In Ecuador, where biological, cultural, and mineral diversity thrive, these practices have a significant impact on the access, quality, quantity, and control of water resources. The analysis of the Mirador mining project demonstrates how the neoextractivist model, from the perspective of water coloniality, reactivates the complexities of power and inequality inherent to extractivism in the region (Gudynas, 2018; Sánchez Contreras & Matarán Ruiz, 2023).

Thus, water coloniality is closely connected to the concept of accumulation by dispossession (Harvey, 2003), as both describe mechanisms through which capitalism takes and controls vital resources needed for life. According to Harvey (2003), accumulation by dispossession occurs through the privatization and commodification of common goods, such as water, driven by policies and infrastructure that prioritize capital over collective rights. In this framework, the concept of water coloniality reinforces these processes by perpetuating historical patterns of external control over water sources through unequal and exclusionary governance systems. Extractive projects like Mirador align with the logic of capitalist growth, where hydraulic infrastructures and management policies prioritize corporate profit over ensuring local access to water, transforming a vital resource into a privilege (Hidalgo-Bastidas et al., 2018).

In response to the processes of dispossession and water coloniality that characterize the expansion of extractive capitalism, Escobar's (2018) proposal of the pluriverse and relational ontology presents an alternative framework for redefining socio-ecological relationships, particularly concerning water. This perspective acknowledges the existence of multiple worlds, ontologies, and ways of life that not only coexist but also challenge the homogenizing logics of development and the market. Water is no longer viewed as a commodity to be bought and sold but is redefined as a relational good with cultural, spiritual, and political significance, and its care and management are connected to people's territorial autonomy (Escobar, 2018).

However, the move toward a pluriverse horizon faces significant tensions and structural barriers: the continuation of centralist regulatory systems, the influence of corporate interests, internal inequalities, and organizational fragilities within territories. Therefore, instead of being a finished solution to the capitalist system, the pluriverse should be viewed as an ethical-political horizon in ongoing development, whose viability relies on communities' ability to maintain their water governance forms against various acts

of co-optation, fragmentation, and dispossession that occur at different scales (Escobar, 2017).

Water justice is a vital response to extractivist and technocratic water management models that perpetuate structural inequalities and marginalize local communities. It is also viewed as an interdisciplinary approach that integrates fair distribution, recognition of knowledge, effective participation in governance, and overcoming functionalist views that focus on efficiency and institutional control (Ochoa-García & Rist, 2018).

This perspective is connected to the concept of the coloniality of power, developed by Mignolo (2007), who warns about how colonial logic continues in the appropriation of territories and resources, especially in extractive projects that violate collective rights and ignore the needs and priorities of communities. In response, community organizations and resistance networks emerge to defend their biocultural knowledge, which is understood as knowledge systems historically built through interactions between communities and their ecological environments, thereby advocating for water justice (Boelens et al., 2023). Through processes of constitutionality, communities establish their forms of governance that challenge state and corporate structures, reconfiguring territorial power based on frameworks of water justice, autonomy, and legal pluralism (Hanasz, 2017; Ochoa-García & Rist, 2018).

Social and Territorial Context and Study Area

The Mirador Mining Project is Ecuador's first large-scale metallic mining operation, marking a milestone in transforming the country's extractive policy. The 2012 contract signing between the Ecuadorian State and the Chinese company Ecuacorriente S.A. (ECSA) marked the beginning of territorial intervention in the southern Amazon, aligning with the concept of "Good Living" and the national goal of transforming the country's productive matrix. Its implementation follows the 2009 Mining Law and the 2008 Constitution, which identify mining as a strategic activity for the country's territorial and economic development (Ecuacorriente, 2019).

The project encompasses a concessioned area of about 6,000 hectares within the Tundayme parish, which has a total area of 25,643 hectares (Gobierno Autónomo Descentralizado Parroquial Rural de Tundayme, 2019). The parish is home to the Shuar and Mestizo communities. It is characterized by high biodiversity, endemism, and complex water systems, including micro watersheds such as those of the Quimi and Tundayme rivers. These watersheds comprise tributaries, streams, and creeks that are part of the Zamora River subbasin, a vital resource for the region. The Quimi River, originating on the western slopes of the Cordillera

del Cóndor, is one of the three main microwatersheds in the area, covering 29.04% of the parish. Additionally, the Wawayme and Tundayme rivers—covering 21.94% of the basin—are essential for water management (Gobierno Autónomo Descentralizado Parroquial Rural de Tundayme, 2019), as shown in Fig. 1.

The Shuar people have been living in the Tundayme parish since the early twentieth century (Teijlingen, 2019). Their territorial organization is reflected in officially recognized communal centers, including El Quimi, Machinatza Alto, Churuwia, Etza, Yanua Kim, Valle del Quimi, and Numpaim San Carlos (Gobierno Autónomo Descentralizado Parroquial Rural de Tundayme, 2019). These communities coordinate their collective life through a spatial pattern that features house placement, food cultivation in the chakras, and decision-making by communal authorities. The houses are typically situated near water sources and surrounded by land suitable for farming, resulting in a dispersed layout that follows traditional territorial occupation practices (Teijlingen, 2019).

The natural environment provides food and materials; it also serves as a spiritual and normative framework that shapes daily life. Extensive subsistence farming is one of their main activities, involving the cultivation of cassava, corn, bananas, cacao, coffee, and medicinal plants in family plots that lack modern irrigation or formal water rights (Verdú Delgado, 2017). Access to water sources originates from streams and rivers, whose availability is closely tied to an ancestral understanding of territorial boundaries. Besides being vital for everyday tasks, water plays a key role in the relational structure that organizes Shuar life. Rivers and springs are regarded as entities that, through their presence, form part of a network of interactions among humans, nature, and spiritual beings (Karsten, 2023).

The communities also participate in complementary activities such as artisanal fishing and gathering wild fruits, practices rooted in intergenerational ecological knowledge. Social cohesion is upheld through forms of communal organization and reciprocity practices, such as *mingas* (Gobierno Autónomo Descentralizado Parroquial Rural de Tundayme, 2019). Shuar territoriality extends beyond merely occupying

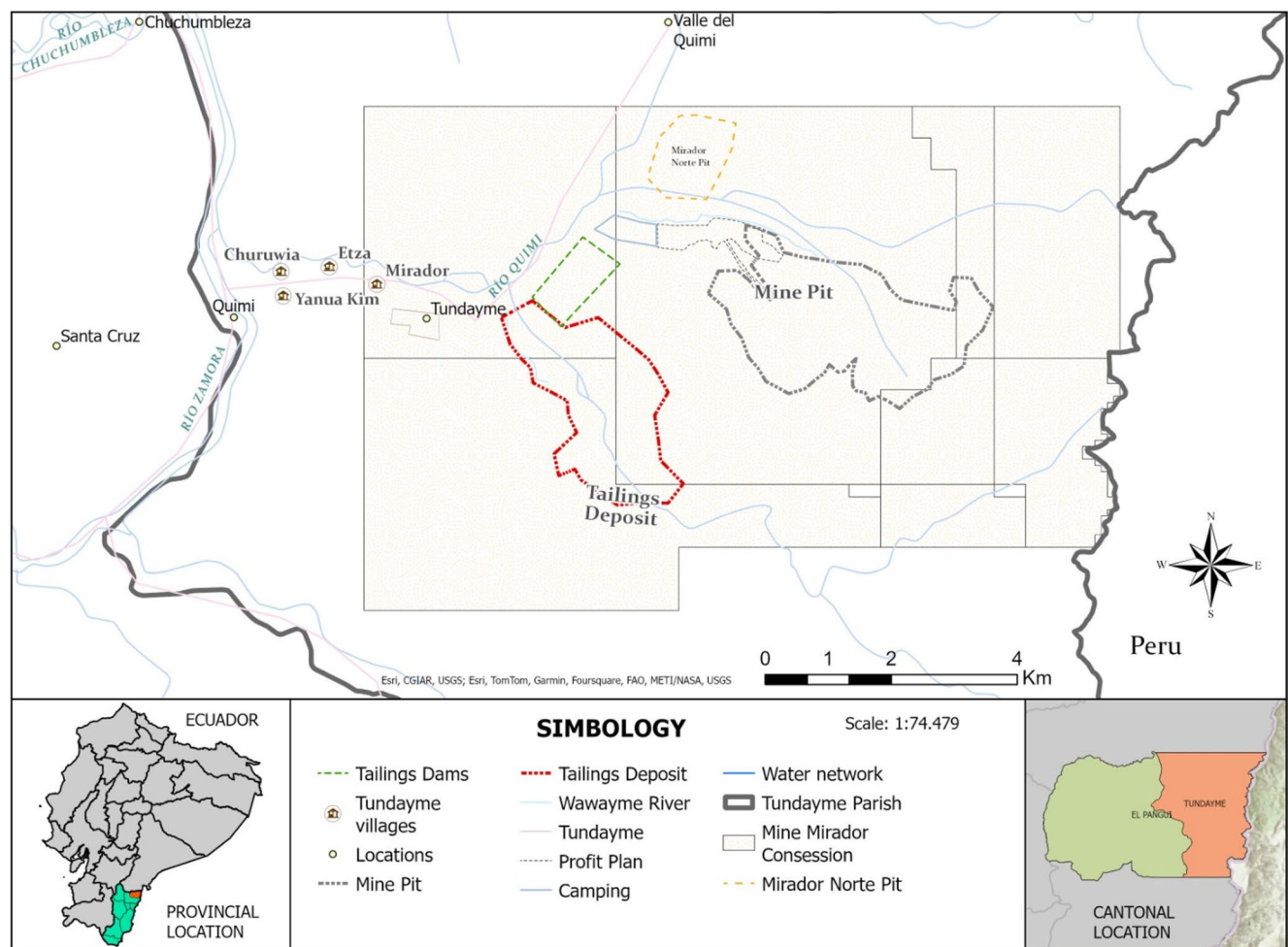


Fig. 1 Location of the Mirador Mining Project and Indigenous communities. Source: the authors (2024)

space; it involves a complex system of relationships with nature, where the material, spiritual, and normative aspects that guide their way of life and ensure their continued existence as a people are interconnected.

Materials and Methodology

Description and Justification

In 2003, the Canadian company Corriente Resources, Inc. began exploring in the parish of Tundayme. In 2010, ownership of the Mirador Mining Project was transferred to a Chinese consortium comprising Tongling Nonferrous Metals Group Holdings Co., Ltd. and China Railway Construction Corporation (CRCC). As a result of this transfer, the company responsible for executing the project is Ecuacorriente S.A. (ECSA), a subsidiary of the Chinese consortium (Ecuacorriente, 2019).

Since 2019, with the start of the exploitation phase, mining projects have driven extractive dynamics through territorial reconfiguration processes that promote an accumulation-focused approach to water management. Since its initial design, the project's productive capacity has doubled from 30,000 tons to 60,000 tons per day and now reaches 140,000 tons per day over an area of 154.9 hectares (Gesambconsult, 2022). This growth has necessitated successive operational redesigns, modifications to environmental licenses, and infrastructure expansion, including the

construction of tailings dams and river diversions within Indigenous territories.

These transformations are spatial and regulatory control mechanisms that change how communities inhabit and manage water (Harvey, 2003; Martínez Alier, 2015). The company's water management illustrates this dispossession. The daily use of 13,572 m³ for industrial activities, the shift from underground sources to surface spillways, and the lack of prior consultation with Indigenous communities all show a model of intensive resource appropriation (Gesambconsult, 2022).

Methods of Data Collection

We used a mixed-methods approach with a localized and participatory focus, based on the territorial work of the Observatory of Socioenvironmental Conflicts (OBSA) at the Universidad Técnica Particular de Loja in the Tundayme parish. Since 2012, OBSA has documented the impacts of the Mirador mining project through ethnographic research, participant observation, and the compilation of conflicts across different mining phases. These processes show that, according to community perception, water is the primary concern in mining activities (Observatorio de Conflictos Socioambientales y Cultura de Paz, 2012). This situation prompted further research within the context of extractive transformations, aiming to deepen understanding of socio-environmental impacts and analyze the dynamics of water coloniality.

A sequential mixed-methods explanatory design was employed (Creswell & Plano Clark, 2018; Hernández Sampieri et al., 2014), complemented by participatory action research strategies. This approach enabled the complementary integration of quantitative and qualitative phases, offering both an overview of community perceptions and socioenvironmental impacts, as well as a contextual understanding of hydrosocial relations, cultural practices, and water conflicts. Table 1 outlines the variables established in the research design.

Table 1 outlines the variables and stages of data collection. In the initial stage, the research concentrated on creating a structured survey based on a comprehensive review of bibliographic and documentary sources. This review examined the Environmental Impact Assessments (EIA), Environmental Management Plans (EMPs), the Development and Land Use Plan (PDOT), and other technical reports issued by government agencies related to the Mirador mining project. The information from these sources provided objective and verifiable data on the ecological, technical, and territorial dynamics associated with the use, transformation, and impact of water resources. This documentary base enabled the characterization of the main types of mining

Table 1 Research design using a hydrosocial approach—source: the authors, 2024

Categories	Detail
Variables investigated	• Sociodemographic: gender, age, ethnicity, position/occupation. • Socionatural: perception of water impacts, water quality, access and availability, impacts on flora and fauna. • Socioeconomic impacts: Alterations in economic activities, displacement. • Cultural and ancestral impacts: relationship with water, rituals. • Water coloniality: water management and control, inequalities, and exploitation. • Water governance: community responses, actions taken, participation.
Collection phases	1. Initial approach and explanation of the study to the communities. 2. Application of surveys and socioenvironmental mapping to analyze territoriality. 3. Semistructured interviews and ethnography to explore water justice. 4. Community governance proposals.
Population	146 inhabitants of the Shuar communities and 591 mestizos, totaling 737 inhabitants
Sample size	260 surveys distributed according to demographic and socioeconomic characteristics.

activities in the river ecosystem, as well as the processes involved in altering water and social environments. This analysis served as a critical input for designing the survey, which aimed to gather the perceptions of the Shuar Indigenous communities and mestizo populations regarding water and its changes during the exploration and mining phases (Creswell & Plano Clark, 2018).

Two samplings were conducted, using 260 structured surveys of the residents of the Shuar and Mestizo communities located in the area directly affected by the mining project. The first survey took place between June 2018 and July 2019 during the exploration phase; the second was carried out between June 2023 and July 2024 during the exploitation phase. The sample design was probabilistic by clusters, with representativeness criteria based on age, sex, ethnicity, and occupation. Heads of households, male or female, over 18 years old, were considered the unit of analysis (Creswell & Plano Clark, 2018; Hernández Sampieri et al., 2014).

The variables examined included perceptions of impacts on water resources, water access and quality, economic and cultural effects, sociocultural relations with water, and local governance forms (see Table 1). The instrument was validated by specialists from the Socioenvironmental Observatory (OBSA), including anthropologists, environmental experts, and lawyers. During the development and implementation of the surveys, the environmental interpretation methodology was employed to translate technical mining concepts into language understandable to the communities, thereby facilitating the collection of accurate data on perceptions of socioenvironmental impacts (Chiblow, 2020; Chan et al., 2023). Table 2 provides details on the sampling design and techniques used. Additionally, Table 2 describes the sampling types and the research’s field phase.

As detailed in Table 2, during the qualitative phase of the study, ethnographic techniques were employed using non-probability purposive sampling (Creswell & Plano Clark, 2018). Thirty-six semistructured interviews were conducted across two periods (June 2018–July 2019 and June 2023–July 2024) with Shuar and mestizo men and women aged 18 and older, including *síndicos*, community leaders, representatives of local organizations, companies, decentralized autonomous governments, and state entities. The goal

was to gather diverse perspectives on experiences related to water and mining. Data collection was carried out by the principal investigators and included participant observation of community activities, water-related rituals, and spaces for discussion. This approach provided access to daily practices, memories, feelings, and narratives about water as a territory and spiritual element, as well as the impacts caused by extractive activities.

The socioenvironmental mapping technique was also used in ten participatory workshops with children, youth, adults, and elders from Shuar communities. In these sessions, participants collectively identified sacred water sources, contaminated areas, and disputed territories, which they mapped based on their memories of the past, the current situation, and future hopes for the territory (Chan et al., 2023). Using this input, the community was encouraged to reflect on and develop water governance models that incorporate traditional practices, local authorities, and cultural principles. The study adhered to the principles of water justice (Boelens et al., 2015; Arsenault et al., 2018), encompassing fair access to water, territorial self-determination, and recognition of Indigenous governance systems. These principles served as the foundation for evaluating the sustainability of mining practices and creating proposals for community management of water resources.

Among the main limitations were the complexity of integrating qualitative and quantitative data analytically, the time needed for processing, and the challenges in accessing official and current water quality information in the study areas. This lack of transparency and data availability limits the ability to compare community findings with institutional records. Nevertheless, these methodological challenges were addressed through ongoing triangulation, participatory validation, and sharing results with the communities. The research is rooted in an ethical and political commitment to the territorial rights of Indigenous peoples. It aims to contribute to the creation of collaborative knowledge and the strengthening of water governance models built from the territories impacted by extractivism.

Methods of Analysis

ArcGIS Pro software was used to create the maps. The quantitative data were analyzed with SPSS statistical software (version 28), and both descriptive and correlational analyses were performed. The qualitative data consisted of semi-structured interviews, observation notes, and cartographic narratives, which were transcribed and analyzed using NVivo software (version 12). A thematic analysis approach was employed, combining inductive coding with key theoretical categories from political ecology and hydro-social studies, including water justice, territoriality, water

Table 2 Types of sampling and phases of data collection. Source: the authors, 2024

Categories	Detail
Sampling	Probabilistic by clusters or multistage for the survey. Intentional non-probabilistic for qualitative interviews.
Harvesting techniques	Surveys, semistructured interviews, ethnography, participant observation, and socioenvironmental mapping.
Date of field work	June 2018–July 2019 June 2023–July 2024

coloniality, and dispossession. The principal investigators initially conducted the coding process and then reviewed it with a multidisciplinary team from the Observatory of Socioenvironmental Conflicts (OBSA) to ensure interpretative coherence and internal validity. Finally, a data triangulation process was implemented to integrate the quantitative and qualitative findings, allowing a comprehensive assessment of the mining project's impacts on the sociocultural, territorial, and environmental dimensions of the Shuar Indigenous communities.

Results

Water Impacts of the Mirador Project: Technical Changes and Community Views

We studied the interaction between access to, quality of, and quantity of water in Indigenous Shuar territories from the perspectives of hydrosocial studies and political ecology. The development of the mining project restructured the allocation and control of water resources. This analysis reveals that mining has established a new system of dominance over water resources, influencing community access in accordance with water justice principles and giving rise to a new form of water coloniality. Figure 2 displays the

perceptions of the Shuar and Mestizo communities and their relationships with socioenvironmental impacts.

Figure 2 shows that mestizos (41%) and Shuar (25%) identify the mining company as the primary responsible agent. Additionally, a correlation analysis was conducted regarding gender and the primary resource affected, revealing that 59% of men, both mestizos and Shuars, recognized the presence of socioenvironmental impacts on water resources, while 41% of women acknowledged existing damage in their territories. This perception of company practices may be influenced by direct interaction with mining operations, geographic proximity, and cultural differences in valuing environmental impacts. Importantly, although the percentage of women is lower, their role in protecting and caring for nature is fundamental, as many are responsible for managing natural resources and maintaining traditional practices related to their territory (Verdú Delgado, 2017).

The mining project's mineral processing capacity has increased to 140 ktpd thanks to infrastructure improvements such as the Mirador Norte pit and the north dump. The project permits the use and extraction of water from the Wawayme River at a flow rate of 243 l per second (l/s) and manages runoff and percolation at a flow rate of 317 l/s. Additionally, the project utilizes 3.7 l per second of water from the Wawayme River for human consumption. These licenses illustrate the scale and complexity of water

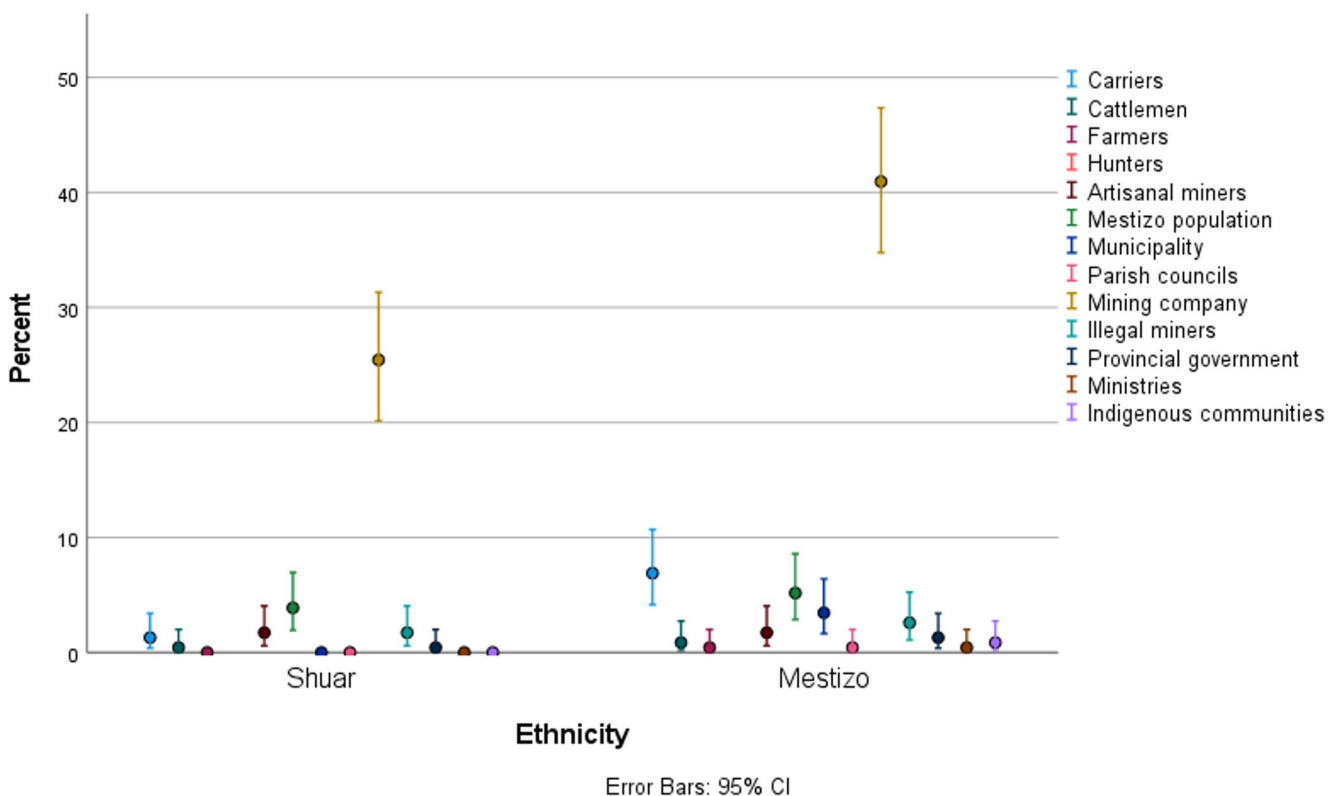


Fig. 2 Perceptions of the Shuar and Mestizo populations on who is responsible for socio-environmental issues. Source: the authors, 2024

management during mining operations (Gesambconsult, 2022).

The Wawayme River basin, previously used by Indigenous communities and settlers, has been fully concessioned for the project, highlighting the interactions between geomorphology, hydrology, and the Indigenous Shuar communities that reside in the area. The geomorphological features of the watershed, characterized by high elevation and steep slopes, support a hydrological system that is crucial for local biodiversity and the cultural and subsistence practices of the communities. The proposed surface water management—diverting small streams into interceptor channels—though common in mining projects, raises significant concerns. These diversions change natural water flows, affecting aquatic ecosystems and the water supply for downstream communities (Sotomayor & Vázquez, 2018).

From the Shuar perspective, the extractive process is not a physical change to the land, but rather an act of historical dispossession. The Shuar leader of the Churuwia community expresses this:

They tell us, “Land usurpers? Instead, the company is the real usurper. They have come to steal our ancestral lands by building constructions. Because they are newcomers to the countryside, while my grandmother, her parents, and their parents have lived here for many, many years. We were born from this Mother Earth. Our ancestors knew how to live in balance; they took care of the Wawayme River. Previously, ancient people were more respectful. Water was not only for drinking; it was sacred; it purified us. Instead, all that is being lost because the ECSA has conceded the entire territory, causing our sources to dry up and destroying the mountain that gives life. (Personal communication, September 15, 2019)

From a water justice perspective, any changes in water management should be made with an understanding of hydrological systems and ongoing consultation with affected communities (Ochoa-García & Rist, 2018). However, in the case of the Mirador project, various community testimonies reveal a lack of effective consultation and participation processes, highlighting the fundamentally unequal nature of the extractive model. As a Shuar woman from the Churuwia community states:

For me, the government would be the most responsible, because they are the ones who have done all this, mining without prior consultation with the communities. Therefore, I say this because in this place, we have not heard anything about consultation; only

mining comes and sits down like a sparrow hawk. (Personal communication, August 19, 2023)

Such perceptions serve not only as critiques of the State and corporations but also as narratives of territorial invasion, seen as a loss of water sovereignty and self-determination. In this context, infrastructure planning should focus on minimizing disruptions to the hydrological cycle and implementing continuous, adaptive monitoring systems that enable real-time adjustments to mining operations. These systems should protect water resources and reduce the risk of natural disasters, such as flooding and erosion, which are more likely to occur due to changes in natural runoff patterns. Additionally, the connection of the Wawayme watershed to the larger Amazon river system highlights the importance of considering cumulative impacts related to sedimentation and pollution, which could affect areas far beyond the local region (Gesambconsult, 2022).

The operation of the mine in the Tundayme River Basin poses significant environmental and sociocultural risks. In the upper reaches, the average annual flow is 4.5 m³/s (Gesambconsult, 2022), and environmental sensitivity varies along the river, which heightens the vulnerability of communities that rely on these ecosystems. These effects are also evident in local experiences. A Shuar woman noted:

The entire community wants to have good water because we no longer have access to it. This is why we want to propose a proposal, make an official request, and make a claim. Here, there is a place to conserve water, but it no longer belongs to the community. Now they say that it is external, that it is no longer ours. (Personal communication, April 15, 2024)

This perception reflects water scarcity and increasing territorial dispossession, where even conservation areas are no longer under community control. Consequently, processes of water coloniality are reinforced, connected to the expansion of mining that displaces and directs resources used toward industrial purposes.

Territorial Reconfiguration and Cultural Resistance: Evictions and Socioenvironmental Conflicts

An analysis of land distribution and management at the Mirador mining project indicates that the company primarily owns land directly within the intervention areas. There are 16 owned parcels, totaling 1,262.96 acres, with sizes ranging from 44.1 to 255.4 acres. In contrast, the land under mining easement—land where the company does not hold property but has exclusive use rights—covers 223.49 acres,

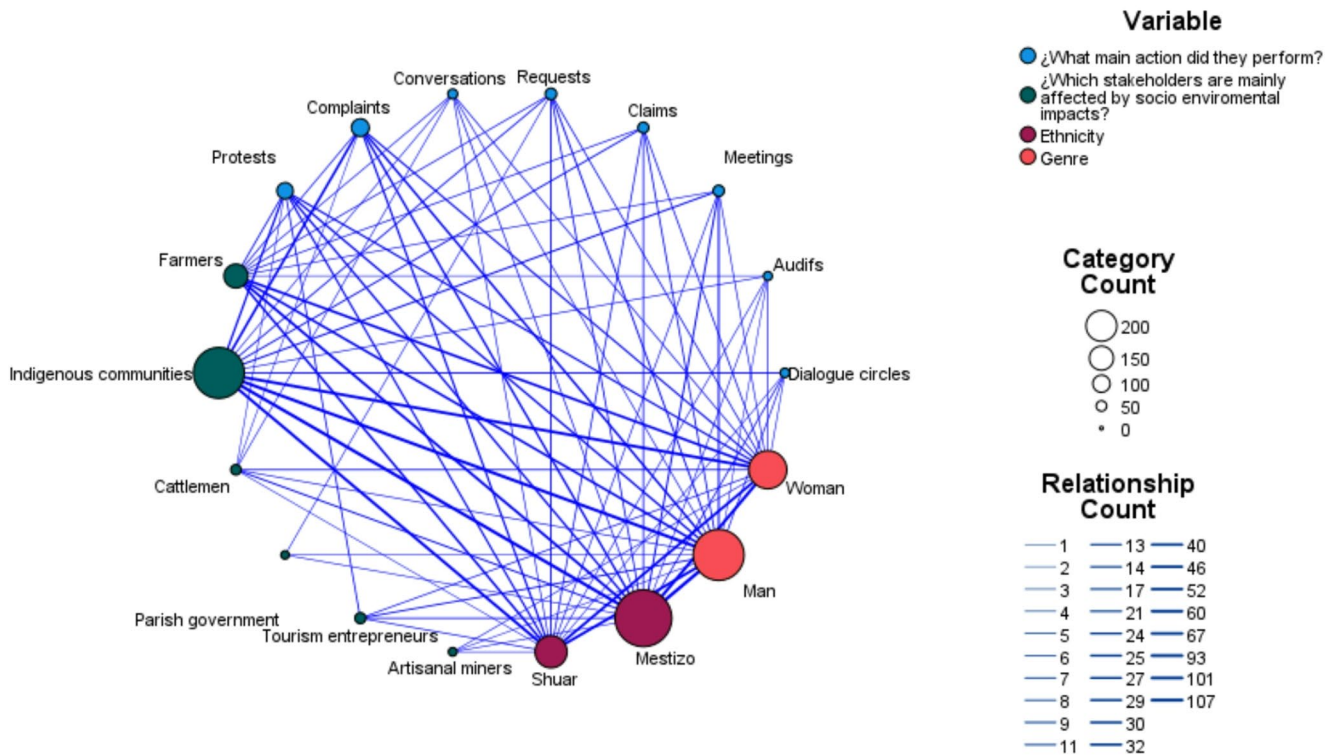


Fig. 3 Correlations among gender, ethnicity, and resistance actions. Source: the authors, 2024

as designated by the resolution of the Ministry of Agriculture and Livestock (MAGAP).

Mining easements permit the company to access and utilize the subsoil for mineral extraction without acquiring full ownership of the land, which is common in areas where purchasing entire plots is not practical. This approach, backed by direct control over large areas, aims to provide legal and operational stability for large-scale extraction activities (Yacoub et al., 2016). However, this legal and technical framework conflicts with the lifestyles, territoriality, and worldview of the Shuar people. Although legally, the territories under easements still belong to their owners, in practice, it results in *de facto* dispossession, restricting the community's use, access, and control over land and water. A member of the Shuar nation in Tundayme expressed this:

Here, the territory was not sold, but it was still displaced. Because with easement, it is not that one gives up the land of one's own free will; it is a forced lease imposed by the State. They say it is for 30 years, but then they put in another contract. In the end, we are still the owners, but we are no longer able to use or care for the water or plants as we did before. We have been waiting for more than five years for a legal response; they do not give us priority. (Personal communication, April 25, 2019).

This testimony illustrates how mining services alter the property system and transform the territory and hydrosocial connections, displacing cultural, spiritual, and subsistence practices associated with water and land, and promoting an extractive logic that disregards collective rights and Indigenous governance of the territory (Boelens et al., 2023; Escobar, 2017). This dispossession has tangible effects and elicits community responses in the form of resistance. The impact on territory, even if it does not involve the legal loss of property, motivates collective efforts to defend water, life, and territorial control.

In this context, the territorial changes caused by the mining project have prompted organized resistance from the Shuar communities. To understand these collective actions, a correlation map was created from the survey results, which visualizes variables such as gender, ethnicity, affected actors, and the actions taken concerning the project's water impacts. This dynamic is shown in Fig. 3.

Figure 3 illustrates a complex network of interactions among Indigenous communities and other stakeholders. These relationships highlight community involvement and active resistance to the adverse impacts of large-scale mining. Protests, claims, and audits are signs of an ongoing struggle for accountability and environmental justice. The figure organizes the relationships based on three key questions: (1) What main actions did they take, such as protests, meetings, audits, complaints, and dialogue circles?

(2) Which groups are most affected by socio-environmental impacts, including Indigenous communities, farmers, ranchers, tourism entrepreneurs, artisanal miners, and parish governments? (3) What identity variables are involved, such as ethnicity (Shuar, mestizo) and gender (male, female)?

The strongest correlations indicate that Indigenous women, particularly from the Shuar community, are more involved in direct resistance efforts, such as protests and community environmental monitoring. In contrast, mestizo men tend to engage more with institutional channels such as meetings or formal requests. These findings help us understand how social identities shape different collective action strategies against extractivism, highlighting Indigenous women as key players in territorial defense through a combination of ancestral knowledge and political mobilization (Verdú Delgado, 2017; Lalander et al., 2021).

The expansion of mining projects has intensified socio-environmental conflicts in Indigenous communities, especially among the Shuar, who have consistently opposed mining expansion since 1995, the year exploration began (Gesambconsult, 2022). In 2010, negotiations to acquire land within the mining concession, along with the shift in management from Canadian to Chinese ownership and the signing of the 30-year exploitation contract, worsened tensions. These negotiations led not only to legal disputes over illegal settlements and mining easements but also to conflicts over access, control, and water use.

As a form of resistance, the Amazonian Community of Action Cordillera del Condor Mirador (CASCOMI) was established, organizing its struggle to defend territory and water as interconnected elements (Leifsen et al., 2017). This defense is not only legal or political but also spiritual and cultural, as expressed by the president of CASCOMI in an interview.

We do not fight for our interests. We fight for the water that gives us strength, for the land that nurtures us, for the life of our families. Our territory is not a mine. As Shuar people, to defend it is to defend who we are. (Personal communication, March 12, 2019)

In Tundayme, a highly complex socio-environmental conflict has emerged, with water at the center of the dispute among the CASCOMI community, the State, and the company. The development of the extractive project has led to the disappearance of the Wawayme River due to the construction of mining infrastructure, the forced diversion of the Tundayme River, and the contamination of the Quimi and Tundayme Rivers with tailings and toxic waste (Leifsen et al., 2017). These actions have violated cultural meanings associated with water as a living entity, leading to forced

displacement, the destruction of symbolic sites, and the fragmentation of the community's social fabric.

Faced with this problem, CASCOMI has implemented a range of legal and social actions since 2015, condemning violations of the rights to water, prior consultation, territory, and a healthy environment (Observatorio de Conflictos Socioambientales y Cultura de Paz, 2012). Despite these efforts, institutional responses remain limited, exposing a power structure that favors extractive rationality over Indigenous ways of inhabiting and managing the land, thereby reinforcing a form of water coloniality that denies the validity of other epistemologies and their connection with nature.

The social impact of the project has been highly divisive (Observatorio de Conflictos Socioambientales y Cultura de Paz, 2012). Although support was noticed in several communities, partly due to job creation and infrastructure improvements, acceptance of the project varies. Some groups support mining only if it is done responsibly, while others, such as the community of Chuchumbletza, oppose it, prioritizing the protection of their traditions and natural resources. This divide is also reflected in family and community relationships. As a Shuar woman from Chuchumbletza said:

We used to live quietly, work a little piece of land, and eat from hunting, fishing, and chakra. The bush meat and the river water were ours. However, when the company arrived, everything changed. It affected me and my grandmother a lot. Instead of helping us, it disunited us as a family. (Personal communication, March 25, 2024)

Shuar communities have strengthened their organization in response to mining activities, highlighted by violent events such as the 2013 evictions and the murder of Shuar leader José Tendetza in 2014, which symbolize both direct violence and structural violence against opponents of extractivism (Jiménez Bautista, 2016). These incidents have been condemned internationally, exposing Indigenous resistance to the project.

With the start of industrial operations in 2019, existing environmental and social concerns were confirmed by community reports and testimonies, which documented the turbidity of water in the Quimi River, as well as the loss of water sources traditionally used for human consumption and agricultural irrigation. A member of the Shuar community expressed the following:

Before, the Wawayme River gave us strength; we fished, drank, and lived with it. Now, there are no more fish or clean water; only mud comes down, and it does not smell good. The company does not let us

use it, as if it were no longer ours. (Personal communication, September 17, 2024)

This testimony highlights the significant changes in the relationship with water and underscores the territorial dispossession experienced by local communities. The mobilization led by the Shuar community of Tundayme, in coordination with national organizations and NGOs, expressed their rejection through collective actions, marches, and legal complaints. This resistance occurs because the imposition of extractive practices on Indigenous territories results in dispossession and structural barriers to accessing water. As a young Shuar person expressed during an interview:

We live as if we were criminals, as if, by taking care of our water, we are bad guys. The government is not there, there is no authority, and we are left alone, abandoned. (Personal communication, May 27, 2024)

The testimony reveals not only a sense of criminalization of territorial care but also a sense of abandonment by the state, which is a key aspect of modern colonial water issues. In the Shuar worldview, water holds a sacred significance and is connected to territorial harmony, ancestral memories, and cultural traditions. It is seen not just as a physical resource but also as part of a spiritual system that supports community life. The expansion of mining has impacted this relationship, altering ritual spaces and disrupting the natural flow of rivers that traverse the territory. As one Shuar woman interviewed explained:

There were many evictions. The mining company entered the parish without consulting the communities. The company is situated above and the people below, above which we have a 70-meter dam pressing the Tundayme River, Namakunts Entsa River, Wawayme River, and Quimi River. I know this because I was evicted from the San Marcos neighborhood. Upstream, we had waterfalls; my ancestors used to perform rituals in the Quimi and Wawayme rivers. It is a sacred river for us. (Personal communication, June 16, 2023)

Water coloniality, far from being just an abstract idea, manifests in the Tundayme area through a series of actions that alter how water is accessed, used, and understood, based on a logic of functional dispossession (Aguilar-Pesantes et al., 2021). The enforcement of mining easements, which are legally valid but unacceptable from the Indigenous perspective, enables the company to control vital water sources without fully owning the land, thus limiting traditional water uses such as irrigation, fishing, rituals, and drinking

(Teijlingen, 2019). In this process, the Wawayme, Quimi, and Tundayme rivers, considered living beings in the Shuar worldview, have been turned into infrastructure subordinate to extraction activities—diverted, dammed, or contaminated by mining tailings, leading to the loss of sacred waterfalls and disrupting ancestral spiritual practices (Gudynas, 2018; Observatorio de Conflictos Socioambientales y Cultura de Paz, 2012).

This dynamic of territorial and symbolic reconfiguration illustrates the structural violence that denies Indigenous ways of inhabiting and governing water, replacing them with a technical-productive rationality that views water as a utilitarian resource (Descola, 2005; Jiménez Bautista, 2016). This is why the Shuar communities, especially women, have organized collective actions that combine territorial defense, spirituality, and environmental justice through community surveillance, litigation, international complaints, and social mobilization (Observatorio de Conflictos Socioambientales y Cultura de Paz, 2012). The organizational efforts of CASCOMI and the testimonies of displaced people show that this struggle is not just about rejecting extractivism, but also about affirming an alternative way of life where water not only supports subsistence but also embodies the memory, identity, and autonomy of indigenous peoples (Escobar, 2017; Swyngedouw, 2009; Martínez Alier, 2015).

Water Coloniality and Territorial Change: Tailings Dams and their Effect on Shuar Indigenous Communities

The Quimi tailings dam expansion project at the mine underscores the complexities of water resource management, as water demand and pressure on local areas continue to rise. The design and operation of infrastructure, such as emergency tailings dams with a storage capacity of 9.6 million m³ and an adequate capacity of 7.5 million m³, emphasize the scale of water use and management in mining (Ecuador, 2019).

The operation of the Quimi tailings dam has altered the water flows of the river and its tributaries, directly affecting the availability and quality of water that shape the life practices of the Shuar people. The contamination of these water bodies disrupts activities such as artisanal fishing and chakra cultivation, as well as the social network rooted in an ontology where water is seen as a living being and spiritual agent (Karsten, 2023; Lalander et al., 2021). A Shuar elder related in the interview:

We used to follow the Quimi River, and along its banks, we lived well; we hunted, fished, and had clean water. The animals came to the saltworks, and

our grandparents used to look for strength and luck in the waterfalls. However, since mining began, the river has become polluted, the animals have left, and the forest no longer thrives. Everything is disappearing... the forest is dying. (Personal communication, June 18, 2023)

These transformations represent ontological conflicts, where the dispute involves not only the resource but also the ability to inhabit the territory by the normative and cosmological principles of the Shuar people (Sempértegui & Báez, 2023). From this perspective, water impacts imply not only material restrictions but also the disruption of daily practices that connect communal and spiritual life. As one Shuar member explained when discussing changes in their subsistence practices:

We used to use barbasco, which left small eggs alive so that the corronchos could grow, but they no longer live because of the company's contamination (Personal communication, October 19, 2024).

These testimonies reveal an ecological and symbolic shift in the environment that undermines intergenerational knowledge, ritual practices, and ways of life that maintain Shuar cultural continuity, shaping a process of territorial dispossession driven by environmental decline (Leifsen, 2017; Sempértegui & Báez, 2023).

Similarly, the increase in the emergency capacity of tailings deposits shows the growing pressure on the land (Ecuacorriente, 2019). This impacts the ecosystem and threatens food security and the health of communities by endangering water sources. The community's response to these risks could escalate socio-environmental conflicts, as Indigenous communities see one of their most valuable resources at risk, both physically and symbolically. As the trustee of the Shuar community of Churuwia points out:

We went to the board to complain and request that they stop using so many chemicals, as the chemicals they use to extract the ore are toxic. They say no, they do not use them, but they continue to use them. They do it at night, not during the day. I am Shuar. I am a native here. I know well how it smells, how that smell reaches our homes at night. Here, we are no longer free of contamination. Little by little, it is affecting us. (Personal communication, June 18, 2023)

According to a technical study presented by the company (Ecuacorriente, 2020), construction activities related to tailings deposits, such as land clearing and dam compaction, modify the physical landscape and create a territorial

reorganization that reflects unequal power relations among the state, the company, and the Indigenous communities. This framework is part of a centralized water governance model that restricts local authority and the normative capacity of communities to make decisions about their territories and resources (Boelens et al., 2015).

The State, acting as a facilitator of extractivism, prioritizes macroeconomic interests over collective rights. At the same time, mining companies enforce standardized environmental mitigation measures that ignore the Shuar people's own relational ontologies and normative frameworks. These dynamics exemplify what Svampa (2019) describes as the neoextractivist turn, a development narrative that justifies new forms of territorial dispossession. In this context, water coloniality extends beyond physical control of water to encompass an epistemic imposition that reshapes its meaning, use, and governance according to modern Western rationality (Mignolo, 2007).

Field findings reveal that this hydrosocial reorganization disconnects cultural, economic, and spiritual practices essential to Shuar communal life, reinforcing a power regime that renders their forms of knowledge and authority invisible. As Jiménez Bautista (2016) states, socioenvironmental conflicts should be understood as disputes over civilizational models, where water is not just a resource but also a reflection of worldviews in conflict. In conclusion, the impacts of extractivism should be seen not only as ecological externalities but also as part of a power structure that reinforces the epistemic and territorial marginalization of Indigenous peoples (Spalding, 2018).

Impacts of Mining Expansion Across Project Phases: Effects on Water, Land, and Community Dynamics Among Indigenous Peoples

The Mirador Norte Pit expansion, located in the lower basin of the Wawayme and Quimi rivers, covers over 139.85 hectares within the ancestral territory of the Shuar Valle del Quimi community. The project features an acidic water management system with four sedimentation ponds holding 30,400 m³, designed to control mining contamination (Ecuacorriente, 2020). However, from a water justice perspective (Ochoa-García, 2018), these measures are inadequate and exclusionary, as they fail to address the needs and protection criteria established by the communities themselves, thereby impacting both access to and the quality of water. As a Shuar leader states:

In the Quimi valley, a dark river flows down there, a black river, we call it the Namakunts Entsa River, because, on the hill, there is a waterfall that divides into this arm; we drink water there, but now we cannot,

because the ECSA owns all the high mountains. (Personal communication, June 21, 2024)

Through the community's perception, the extractive regime redefines the governance and cultural meanings of water, subordinating Indigenous practices of ancestral care and applying a technocratic logic of management. In this way, both material and symbolic dispossession of rivers and aquifers take place, reinforcing forms of epistemic and territorial exclusion (Porto-Gonçalves, 2013; González-Casanova, 2017; Losada Cubillos et al., 2022).

From a hydrosocial perspective (Martinez-Cruz et al., 2024), water is seen not only as a physical resource but also as a network of ecological, cultural, and political relationships. The expansion of the project, whose beneficiation phase has a processing capacity of 20 million tons per year, involves managing large volumes of water that influence these relationships. Water use is expressed across various sectors, including industrial, domestic, and agricultural. During the construction phase alone, 13,572 m³ of water were used daily, with 96 m³/d being new water and 13,476 m³/d being recycled (Ecuacorriente, 2020). Although 99.3% reuse has been reported, the quality of this water and its final destination have not been shared with the communities, creating uncertainty and distrust regarding its ecological and health impacts.

The estimated acid water production could reach 46,700 m³/day in later stages (Gesambconsult, 2022). This indicates a potential reduction in mitigation capacity. Additionally, the company has been extracting groundwater at a rate of 5.2 l/s for 20 years, which could impact water tables and increase the risk of contamination from mine waste infiltration. These issues are reflected in the testimonies of the Shuar people.

The company destroyed 72 water sources, drilled up to 1,600 m, and ruptured an aquifer. Since then, the water has become contaminated, and some young people have bathed there, resulting in skin irritation. What they have done to the water cannot be repaired. (Personal communication, June 2024)

Given the limited availability of official water quality data, due to both the lack of transparency from the mining company and economic and access barriers to the affected areas, participatory monitoring efforts have been promoted with the Shuar Indigenous communities by the Universidad Técnica Particular de Loja and the Observatorio de Conflictos Socioambientales (OBSA). These efforts have included the use of bioindicators, such as aquatic macroinvertebrates, to assess water quality. This approach enables the recognition and valuation of local knowledge in interpreting changes

in the Tundayme, Wawayme, and Quimi rivers, such as color changes, increased sedimentation, and species disappearance. The communities see these signs as empirical evidence of ongoing deterioration in their territorial water quality (Observatorio de Conflictos Socioambientales y Cultura de Paz, 2012).

Additionally, as part of analyzing the impacts of the project's expansion phase, participatory socio-environmental mapping was conducted in Shuar communities within the area of influence, involving children, youth, and adults. Through visions of the future, the Shuar communities shared their perceptions of the changes to their territory. They proposed community water governance mechanisms based on life plans that are linked to cultural, spiritual, and ecological practices. During the workshops, the main threats identified were the construction of tailings dams in water recharge areas, the diversion of rivers, and their contamination, which traditionally supplies water for consumption, fishing, and rituals.

These company interventions have been carried out without prior consultation and have altered community water management systems. In the former community of San Marcos, incidents of violence, forced evictions, and destruction of homes to make way for mining infrastructure, especially the Tundayme tailings dam, were documented. These actions have led to increased socio-environmental conflicts, resulting in displacement, community fragmentation, and territorial loss. Consequently, organizations like CASCOMI have developed resistance and territorial defense strategies. The findings suggest that Indigenous governance forms emerge as local responses to dispossession, institutional exclusion, and ecosystem degradation (McNeish, 2018; Haslam, 2018; Swyngedouw, 2009).

Discussion

Our research reveals how the Mirador mining project establishes a new imposed sense of territory, where hydraulic infrastructures, such as tailings dams, open pits, and river diversions, act as extractive technologies and tools of domination (Leifsen, 2017; Teijlingen). In practice, these infrastructures alter access to, use of, and the meaning of water in Shuar Indigenous territories, leading to a process of dispossession that does not involve physical displacement but works through the functional exclusion of the resource (Harvey, 2003). The loss of access to sacred water sources, river contamination, and the enforcement of mining easements weaken the cultural, spiritual, and customary relationships that sustain Shuar life, creating a modern form of water coloniality (Mansilla-Quñones & Melin, 2019).

This phenomenon is evident in the technical-legal appropriation of water through state-issued licenses, without prior, free, and informed consultation, and in the subordination of local knowledge to technical and productivist discourses that legitimize exploitation (Quijano, 2020; Svampa, 2019). Through testimonies and community maps, communities express their concerns about environmental degradation and the breaking of intergenerational bonds with water as a living being and a spiritual mediator. Therefore, water ceases to be a relational element of life and becomes a commodity controlled by an extractive rationality (Gudynas, 2018).

The results align with studies that warn of the territorial reconfigurations and hydrosocial conflicts caused by mining megaprojects (Yacoub et al., 2016; Bebbington et al., 2018; Schoderer et al., 2021). However, the Mirador case offers a unique perspective; it is not only about extracting water as a resource but also about the comprehensive transformation of water ontologies (Sempértegui & Báez, 2023). Unlike other projects, such as those in Cajamarca, Peru, or among the Yaqui people in Mexico, where disputes center on access or contamination (Yacoub et al., 2016; Chagnon et al., 2022; Silva et al., 2018), the Shuar territory reveals a deeper ontological dimension, where water is seen as a living entity displaced by an instrumental and silently colonizing logic (Awume et al., 2020; Spalding, 2018).

Our study also builds on the contributions of Boelens et al. (2023) to water justice by demonstrating how Shuar resistance advocates for fair resource distribution and the recognition of their way of life, both epistemically and politically (Awume et al., 2020; Radonic, 2017). The contribution of this study is both conceptual and empirical. Conceptually, the debate on water coloniality advances by illustrating how this process happens not just through privatization or legal dispossession but also through the symbolic and spiritual redefinition of water, which rejects the relational links that support it as part of the fabric of Shuar life (Boelens et al., 2015). Empirically, it shows that the phase of intense exploitation—less studied in the literature—creates critical moments that worsen hydrosocial dispossession, during which impacts on Indigenous autonomy, community cohesion, and ecological sustainability become more severe.

The integrated approach of political ecology and hydrosocial studies, combined with a mixed methodological design, enables a multiscale understanding of socioenvironmental transformation processes. This spans from the dynamics of industrial flows and extractive infrastructure to symbolic practices, social memories, and displaced ritual systems (Radonic, 2017). Therefore, water coloniality emerges as a regime of power that enforces technological and normative mechanisms that violate formally recognized rights and Indigenous ontological frameworks, which are connected to water as a relational entity. This form of

domination is reflected in the forced reorganization of territories, the erosion of ancestral socioecological practices, and the subjugation of alternative normative frameworks, functioning as a form of epistemic and material violence of a structural nature (Jiménez Bautista, 2016; Reyes-Hernández et al., 2022).

From a theoretical perspective, our research highlights the importance of adopting an ontological and relational approach to understanding water, particularly in contexts of extractive intensification in Indigenous territories (Sempértegui & Báez, 2023). Revaluing the notion of water as a living subject is not just a symbolic act but also a reconfiguration of the dominant water governance frameworks, which remain anchored in technocratic rationalities, quantitative indicators, and centralized management logics (Hanasz, 2017; Escobar, 2018; Karsten, 2023).

Future research should conduct comparative analyses among Indigenous communities affected by megaprojects at different stages of the mining cycle to identify differences in the processes of impact, territorial reorganization, and collective responses (Haslam, 2018; Artiga-Purcell, 2022). It is also important to examine resistance strategies and hydrosocial regeneration that emerge as forms of sociopolitical and epistemic reproduction amid extractive dynamics. In this context, the case of the Mirador project exemplifies how hydrocoloniality results in the reorganization of territories, the disruption of sociocultural practices, and the dismantling of ways of life rooted in ancestral rationalities (Reyes-Hernández et al., 2022).

Conclusions

Our research reveals that the Mirador mining project consolidates a system of water coloniality, reshaping Shuar Indigenous territories through extractive practices rooted in control infrastructures, government licenses, and technoscientific rationales. These changes impact ecosystems and water sources vital to the community's survival, weakening the systems of knowledge, governance, and meaning that have historically maintained the relationship between Indigenous peoples and water. The study illustrates how the expansion of the mining project functions through technical and regulatory mechanisms that displace local water management methods, enforcing a logic focused on the economic extraction of natural resources.

Despite the institutional discourse promoting participation, the findings reveal that the mechanisms put in place have been limited, formal, and exclusive, without ensuring prior, free, and informed consultation or genuine co-decision processes. This instrumentalization of participation reinforces criticisms from political ecology and decolonial

perspectives, which warn about the inadequacy of procedural remedies in achieving effective environmental justice. Although recognizing alternatives such as water justice, community governance, and respect for indigenous normative systems presents a meaningful ethical outlook, their implementation faces significant structural challenges. Current conditions characterized by extractive expansion, institutional weakening, and territorial fragmentation—factors that hinder their viability—necessitate a critical rethinking of the normative and epistemic frameworks supporting water management.

In this scenario, the hydrosocial approach enables an understanding of water disputes as multiscale conflicts that extend beyond technical and environmental issues and are rooted in historical processes of territorial domination. Water coloniality is not an isolated exception or phenomenon but rather a structural power strategy that redefines the meaning, access, and use of water based on interests outside the territory. In response, local forms of resistance, both material and symbolic, counter dispossession and promote alternative civilizing projects, which are essential for advancing toward a more deeply rooted, intercultural model of socioenvironmental justice.

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Author Contributions Maleny Reyes Conza: Conceptualization, Methodology, Investigation, Formal analysis, Writing—original draft, Writing—review & editing, Funding acquisition, Resources. Francisco Jiménez Bautista: Conceptualization, Methodology, Investigation, Formal analysis, Writing—original draft, Writing—review & editing.

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Data Availability The data used and analyzed in this study are available and can be requested from the corresponding author if necessary.

Declarations

Ethics Statement This research involved gathering both quantitative and qualitative data from Indigenous communities and social actors who provided informed consent prior to participation. Participation was voluntary, and confidentiality was maintained throughout the study.

Competing Interests The authors declare no competing interests.

Clinical Trial Number Not applicable.

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