

# The socio-environmental aftermath of gold mining in the Amazon: the case of Yutzupino in Napo, Ecuador

*As consequências socioambientais da mineração de ouro na Amazônia: o caso de Yutzupino em Napo, Equador*

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doi:10.18472/SustDeb.v14n3.2023.49965

Received: 25/09/2023

Accepted: 20/11/2023

ARTICLE- VARIA

## ABSTRACT

This study addresses the social and environmental repercussions on Amazonian communities due to gold mining following the conclusion of official concessions. Framed within the literature on natural resource extraction, sustainability, and social impacts in developing countries, the work employs qualitative methods, including interviews with residents and field observations in the community of Yutzupino in the Ecuadorian Amazon. It reveals that post-concession mining, often informal and illegal, sharply triggers social and environmental degradation. The research emphasises the need to incorporate sustainability principles into mining concessions to prevent such effects. This analysis enhances understanding of the complex socio-ecological aftermath of mining in vulnerable environments. It proposes recommendations for mitigation, underlining the importance of dialogue between communities, governments, and mining companies.

**Keywords:** Amazon. Gold mining. Socio-environmental impacts. Sustainability.

## RESUMO

*Este estudo aborda as repercussões sociais e ambientais em comunidades amazônicas decorrentes da mineração de ouro após o término das concessões oficiais. Enquadrado na literatura sobre extração de recursos naturais, sustentabilidade e impactos sociais em países em desenvolvimento, o trabalho utiliza métodos qualitativos, incluindo entrevistas com moradores e observações em campo, na comunidade de Yutzupino, na Amazônia equatoriana. Revela que a mineração pós-concessão, frequentemente informal e ilegal, desencadeia uma acentuada degradação social e ambiental. A pesquisa enfatiza a necessidade de incorporar princípios de sustentabilidade nas concessões de mineração para prevenir tais efeitos. Essa análise enriquece a compreensão sobre as complexas sequelas socioecológicas da*

mineração em ambientes vulneráveis e propõe recomendações para sua mitigação, ressaltando a relevância do diálogo entre comunidades, governos e empresas mineradoras.

**Palavras-chave:** Amazônia. Mineração de ouro. Impactos socioambientais. Sustentabilidade.

## 1 INTRODUCTION

The Amazon Rainforest, colloquially called "the lungs of the Earth," is an ecosystem of incalculable global ecological value. This unique ecosystem is threatened by various human activities, most notably traditional and industrial mining, both legal and illegal. The growing mining expansion in the Amazon region is of grave concern, mainly due to the potential harm to surrounding communities and the sustainability of this fragile ecosystem. This situation mirrors critical challenges in sustainable development and environmental justice.

When attempting to implement land-use change policies, the inherent ecological fragility of the Amazon region poses significant challenges. Historically, land use planning and zoning decisions have favoured economic gains over environmental and social welfare in these delicate ecosystems. While industrialisation may spur economic development, it also carries severe environmental and social repercussions that must be understood from various perspectives.

This study aims to explore and understand the ramifications of gold mining on communities near extraction sites. Specifically, it focuses on the daily life of communities near areas where illegal gold mining is practised, following years of legal exploitation with government permits. Within the framework of sustainable development, anticipating the legacy that mining will leave in communities after its closure is vital as it constitutes a crucial element of its planning (Mancini; Sala, 2018; Veiga *et al.*, 2001). The goal is to provide key insights that aid in planning land transformation and crafting policies for sustainable land use.

The community of Yutzupino, in the Napo province of Ecuador, serves as the focal point of this research. Through exploring the experiences of this community, we aspire to amplify our comprehension of the socio-economic interplay and challenges they face in the aftermath of official mining activities. Notably, this study posits the creation of a new category within spatial planning explicitly tailored for territories previously subjected to mining. A qualitative methodology encompassing comprehensive interviews and observational studies was employed to fulfil this objective.

The findings of this article contribute theoretical, empirical, and practical insights relevant to territorial planners, policymakers, and local communities. In addition, the study provides an essential understanding of the needs, challenges, and goals of the communities impacted by mining, which can inform and steer both sustainable development strategies and initiatives led by the community itself. The article's structure unfolds as follows: Section 2 provides the study's theoretical framework, focusing on the aftermath of mining following the termination of concession contracts. Section 3 outlines the methodology and approaches used in the research. The results and their corresponding analysis are presented in Section 4, divided into five subsections. The paper ends with a set of concluding remarks derived from the study.

## 2 THEORETICAL BACKGROUND

One of the main threats facing the Amazonian ecosystem is industrial and traditional mining activities. The expansion of mining poses concerns about the potential destruction of surrounding communities and the sustainability of particularly fragile ecosystems worldwide (Syahrir *et al.*, 2021). This

theoretical review explores the socio-environmental implications of gold mining in the Amazon and its consequences for local communities.

Land use zoning is a tool for regulating activities in a specific geographical area. It allows authorities to categorise lands for various purposes, such as agriculture, conservation, infrastructure, and industrial development (Sagala *et al.*, 2022). In the Amazon case, zoning favouring industrial mining has prioritised economic gains over environmental and social welfare (Araújo *et al.*, 2022). The expansion of industrial mining brings with it the destruction of forests and loss of habitats, impacting communities that depend on these resources for their livelihood and cultural identity, thereby exacerbating inequality and social conflicts (Degele, 2023).

Concurrently, the release of toxic chemicals into water bodies, such as mercury and cyanide, threatens biological diversity and disrupts the natural cycles of the ecosystem (Júnior; Carvalho, 2023; Mestanza-Ramón *et al.*, 2022). This negatively affects flora, fauna, and vital ecosystem services such as climate regulation, water purification, and food provision. The interconnection of the different ecosystem components like rivers, forests, and soils requires a holistic approach to land use management.

Deforestation, frequently spanning across borders (Andrews, 2018), often results from clearing forests to accommodate mining activities. This leads directly to extensive habitat loss and biodiversity displacement (Salisbury *et al.*, 2023). Also, the extraction of minerals and the associated infrastructure construction disrupt natural hydrological cycles, resulting in notable changes in water availability, heightened incidence of flooding, and exacerbated soil erosion (Brandão *et al.*, 2022).

Much like other mining activities, gold mining plays a substantial role in the Amazon's environmental degradation. Celi Sangurima (2005) and Velastegui-Montoya *et al.* (2022) underscore the connection between gold mining and forest loss, changes in land cover and use patterns, and decreasing biodiversity. Also, Pérez *et al.* (2021) scrutinise the detrimental effects on water quality and likewise link gold mining with long-term biodiversity loss.

Furthermore, by its very nature, gold mining requires substantial displacement of soil and rock, a factor that invariably instigates soil erosion. This erosion affects slope stability, undermines soil fertility, and hinders the ecosystem's innate regenerative abilities (Vráblík *et al.*, 2020). Comprehensive research, such as the study conducted by Balaka Opiyo *et al.* (2022) in Kenya, demonstrates that gold mining precipitates the degradation of vegetation cover and the depletion of fertile soil, posing substantial threats to agricultural productivity.

## 2.1 THE IMPACT ON SURROUNDING COMMUNITIES

Driven by the rising global demand (World Gold Council, 2023), the Amazon has seen a surge in gold mining, leading to significant land cover changes. Swenson *et al.* (2011) highlighted how this increased gold demand, local resource utilisation, and growing populations in communities around the mines have reshaped the Peruvian Amazon's environment. This demographic growth in mining areas pushes forests to be converted into agricultural land. López and Maldonado (2023) emphasise that while this land cover transition does not always spike overall deforestation rates, it notably diminishes successional forests and exacerbates water quality issues.

The health consequences of gold mining for Amazonian communities are notably alarming. The employment of hazardous substances like mercury and cyanide in gold extraction processes severely threatens human well-being (Keane *et al.*, 2023). Specifically, mercury contamination of fish and water sources has been associated with neurological and developmental disorders among communities along the Brazilian Amazon's riverbanks (Fillion *et al.*, 2011; Webb *et al.*, 2004).

Social disruptions are also of primary concern (Garvey *et al.*, 2022). The social impact of mining projects in Amazon communities is complex, marked by anticipation and conflict during various stages of mining operations (Arellano-Yanguas; Bernal-Gómez, 2022). In early phases, companies must obtain social consent to operate, leading to high expectations and sometimes resistance or division within communities. Attempts to secure local consent may involve harmful practices such as co-opting leaders and corruption. Once mining is underway, challenges include mismatches between expectations and reality, inequalities, dependency on the company, social changes, and erosion of trust in public institutions. These dynamics, along with land rights conflicts (Mestanza-Ramón *et al.*, 2022), underscore the multifaceted social impacts of mining in the region.

The literature has broadly examined the environmental and health consequences faced by communities surrounding gold mining territories in the Amazon. Much of this focus has been directed towards concession contracts for industrial exploitation, particularly emphasising the stages prior to and during the concession phases. However, a noticeable gap persists in understanding the social conflicts that arise post-concession. This underexplored area highlights a need for further investigation to comprehensively address the full spectrum of social impacts associated with gold mining in the region.

## 2.2 EMERGING APPROACHES TO MINING CONCESSIONS

Addressing the destructive consequences of mining in the Amazon requires a fundamental shift in land use zoning and resource management strategies. This includes encouraging responsible mining practices, utilising cleaner technologies, and enforcing stringent environmental regulations to reduce the ecological footprint of mining operations (Nii Ayi Aryee *et al.*, 2023). Moreover, facilitating the temporal coexistence of legally concessioned mining by industrial means with traditional mining practices has been identified as an approach to decrease social conflict between concessioned firms and local communities. This idea, supported by Loor and Evans (2021) and Roy (2005), illustrates the ongoing interaction between formal and informal spheres in the Global South, highlighting the potential for sustainable solutions that balance ecological integrity and social harmony.

Managing the challenges of mining concessions in the Amazon may also be addressed through strategic incentives. Barroso and Campos (2021) emphasise the crucial role of economic incentives, such as certification schemes and fair-trade initiatives, in promoting responsible gold mining practices. By offering financial rewards tied to sustainability, these incentives not only encourage miners to employ environmentally friendly techniques but also actively promote the restoration of areas that have been degraded.

Land tenure regularisation is another approach to tackle the challenge. According to Bernal Dávalos (2021), unrestrained mining exploitation in Bolivia has been driven by the separation of indigenous communities from their ancestral territories, leading to new mining settlements and consequent land ownership disputes. For indigenous peoples, land is more than a physical entity; it is a vital part of their cultural identity, providing wealth, comfort, security, and stability. Regularising land tenure and establishing clear ownership and rights can be a protective measure (Hänggli *et al.*, 2023). This approach could help prevent illegal mining activities, create a legal framework for sustainable land use, and preserve the delicate balance between economic growth and the conservation of culture and the environment.

Recognising and empowering indigenous communities in decision-making related to mining is also crucial. Indigenous territorial organisation and self-management play a vital role in conserving Amazonian ecosystems and protecting indigenous rights. Martin *et al.* (2022) emphasise the importance of land rights and indigenous management practices for achieving conservation and social goals. Indigenous communities possess traditional knowledge associated with sustainable practices that can help mitigate the negative impacts of gold mining and promote alternative livelihoods based on traditional resource use and cultural preservation.

Based on the literature review, a discernible gap in research has been identified in understanding the social conflicts that arise post-concession of gold mines. This unexplored aspect necessitates further investigation to provide a comprehensive understanding of the impacts of gold mining in the region. Moreover, little attention has been paid to understanding what it is like to live and subsist daily while economically depending on nearby gold mining. A comprehensive insight into these subtleties can pave the way for targeted solutions that balance economic growth with environmental stewardship.

### 3 METHODOLOGY AND METHODS

What is the social context of communities proximal to gold deposits, which are still subject to traditional and illegal mining operations in the Amazon after the end of official concessions? To tackle this research question, this study employs a qualitative and descriptive case study approach (Hollweck, 2015). The study aims for evidence-based insights into how the transition of gold mining concessions unfolds, emphasising the complex interplay between traditional mining practices and illegal operations.

The community of Yutzupino, located near Tena City in Napo Province within the Ecuadorian Amazon region, is the case selected for this study. Yutzupino is of interest because it encompasses various intersecting factors. Within this community, the interplay between traditional mining practices, industrial mining companies, and indigenous land connections forms a complex landscape. This combination yields unique challenges and insights into how mining influences the inhabitants, their lifestyles, and the surrounding environment. The specific circumstances in Yutzupino contribute to a broader understanding of the complex issues related to mining in the Amazon, marking it as an invaluable area for exploration. As part of this research, primary data were collected through detailed interviews and on-site observations, while secondary data were derived from recent censuses conducted by the Risk Secretariat of Ecuador and relevant media content. The subsequent sections delineate the case's characteristics and the data collection and analysis methods.

#### 3.1 THE CASE

The community of Yutzupino, situated 14 Kilometers away from the parish of Puerto Napo and nestled in the heart of the Ecuadorian Amazon in Napo Province, is today home to 327 Kichwa-speaking residents living in 65 dwellings and families. Despite its modest size, the community showcases a substantial demographic variety, with pregnant women, persons with disabilities, and older adults. The houses are entwined with this biodiverse region's vibrant flora and fauna. At first glance, it may seem idyllic, yet Yutzupino faces a series of challenges threatening the life and safety of its inhabitants.

Homes in Yutzupino, traditionally constructed, are perpetually endangered due to their proximity to the Jatunyacu River, a tributary of the Napo River, meaning "big river". These houses are in a high flood-risk area, constantly threatening the safety and lives of their inhabitants. Land tenure issues and the scarcity of relocation alternatives limit residents' options to move away from this hazard zone.

The community's economy is rooted in agriculture, with crops like cassava, banana, and cacao as staples. However, the people have also turned to traditional mining as a vital supplement to their income, supporting their local economy. The simple yet effective act of miners shaking pans in the water to extract gold has become a symbol of daily life in Yutzupino, reflecting both their ingenuity and their connection to the land.

Over the last two decades, the landscape of Yutzupino has been profoundly transformed by the concession of mining rights to private firms for industrial gold extraction. The Ecuadorian government

has issued 153 concessions that cover an expansive area of 32,277 hectares in Napo Province alone (Ecuador. Unidad Judicial Especializada de Violencia contra la Mujer o Miembros del Núcleo Familiar e Infracciones contra la Integridad Sexual y Reproductiva de Tena, Napo, 2022, p. 64). International companies, including Canada's Hampton Court Resources and Merendon and China's Terraeearth Resources, have been beneficiaries of these concessions, shaping the mining activities and interactions within this territory during this period.

These concessions have transformed the everyday life of local miners, who perform the extraction while dodging heavy machinery and excavators, a perilous reality that has woven itself into their routine. As the situation moved into the post-concession phase, it has further deteriorated. The blend of illegal industrial extraction, outsider traditional miners, and local traditional miners has ignited tensions and social conflicts. This mix has accelerated environmental degradation, heightened community vulnerability, and added complexity and risk to the mining practice.

### 3.2 DATA COLLECTION AND ANALYSIS

The primary data collection process unfolded as follows. Between April and May 2023, in-depth interviews were conducted with 18 heads of households, focusing on those involved in traditional gold mining. These hour-long interviews took place in the participants' homes, detailing their everyday lives, challenges, and relationships with illegal mining. Ethical considerations were paramount, with informed consent sought for all interviews and observations.

The selection of participants was carried out randomly during on-site observations between November 2022 and May 2023. Initially triggered by the interest of the Municipality of Tena, the capital city of Napo Province, to address the presence of illegal miners—a situation that escalated to become the subject of a hearing in the Ecuadorian National Assembly—the observations evolved in scope and focus. The research began with unsystematic observations to map the area and the communities affected by mining, later moving to a more structured approach. This focused on the houses, materials that sustain everyday life, and travel patterns to everyday places. Photographs were taken, and a diary was maintained to capture these observations.

Analysing the data involved content analysis and hand-coding. In-depth interviews were transcribed and organised by key themes and categories, forming the backbone for a narrative description of the community's daily experiences. This qualitative data was then linked to observations and secondary sources, allowing for triangulation and a more nuanced understanding of the area's complex, often tense, social dynamics. The researchers were mindful of the dangers and tensions in this area arising from the intersecting interests of locals, outsiders, and newcomers involved with illegal mining.

## 4 FINDINGS AND DISCUSSION

The findings unfold an unsettling reality faced by the Indigenous Amazonian community of Yutzupino. Historically engaged in rudimentary practices of gold mining as one of their diverse sources of income, these inhabitants now find themselves at a complex intersection of challenges. Their struggle to preserve their traditional way of life increasingly clashes with the need for conservation and personal safety. The current context presents a web of socio-economic, environmental, and security challenges that weave together, demanding immediate and effective intervention to untangle and resolve.

The following paragraphs are organised into five subsections. The end of mining concessions affecting the study area is reported in the first subsection, revealing their impact on the local community. The second subsection delves into traditional gold mining, elucidating its practices and significance within the community. Next, the focus shifts to the living conditions in the third subsection, where a portrayal

of the houses and limited access to essential services is given. The fourth subsection uncovers the physical vulnerabilities of Yutzupino's inhabitants, highlighting the prominent risks and challenges. The fifth section identifies governmental initiatives aiming to address the main issues.

#### 4.1 THE END OF MINING CONCESSIONS

During the mining concession's active period, a balance of exploitation was forged between the concession beneficiary, particularly Terraeearth Resources, and Yutzupino's local traditional miners. The community members coincide that this balance allowed a harmonious coexistence, with the company often employing local miners on a daily wage basis for various gold extraction tasks, including machinery maintenance. However, this cooperative relationship abruptly ended with the concession's suspension in October 2020 (Ministerio del Ambiente, Agua y Transición Ecológica, 2020).

In the aftermath of the suspension, illegal miners unfamiliar with the community rapidly invaded the area, wielding heavy machinery and aggressively competing with local miners. This dramatic shift has disrupted the previously established dynamics, creating tensions for Yutzupino's mining practices.

Yutzupino is now among the areas most severely impacted by rampant illegal gold mining. As reported in May 2021 by a technical analyst from the Ecuadorian Institute of Geological and Energy Research, citizen groups "Napo Loves Life" and "Napo Resists" exposed unlicensed gold extraction by four backhoes on the Jatunyacu river's beaches in November 2021. This illegal mining has been conducted using industrial machinery and without compliance with basic environmental standards. A report from the Andean Amazon Monitoring Project (Maap) further confirmed this, highlighting the illegal miners' swift takeover of the area.

Maap issued its initial alarm report in October 2021, identifying less than one hectare of affected land. Shockingly, by December, this damage had ballooned to 61 hectares. According to a journalism report, EcoCiencia spokespersons who participated in Maap's analysis pointed out that "87.5% of the illegal mining expansion occurred in December." By January 2022, the devastated area had expanded another six hectares (Alvarado, 2022). This alarming rate of mining activity expansion underscores the urgent need for intervention.

#### 4.2 TRADITIONAL MINING

In the community of Yutzupino, traditional mining is viewed as a secondary activity, supplemental to their primary occupation of farming and selling local products like cassava, banana, and cocoa. In interviews, Yutzupino miners explained that gold mining typically occurs at night, continuing until about 3 in the morning. Community members, including men, women, and young people, embark on a 30-minute walk along a gravel road to reach the gold extraction area. There, heavy machinery is observed excavating and forming embankments.

Describing their hands-on process, miners shared how they collect material from the base of the embankment using shovels. After removing larger rocks, they wash the material with gentle pan movements, leaving only small sediments at the pan's bottom. These sediments may or may not contain gold. They emphasised that the success of this endeavour depends on the miner's skill, with each load taking approximately 5 minutes to process.

The miners also described an adaptation of traditional gold mining techniques through a less conventional tool: a homemade version of a washing machine commonly used in small-scale mining. As explained by the miners, the device consists of a wooden ramp covered with a piece of cloth and a metal grid. The process begins with the miners pouring material onto the ramp with a shovel and then

adding water to filter the material through the cloth and grid. After all the material has been filtered, they remove the cloth, and in the centre, sediments remain where gold may be present.

These descriptions vividly show how traditional methods are being fused with innovative techniques to maximise their gold extraction efforts. Figure 1 offers a visual representation of a miner using the pan.



**Figure 1 |** Panhandler in Misahuallí Rio Napo Ecuador.

Source: Peter van Evert / Alamy Stock: April 17, 2018.

In Yutzupino, traditional mining practices occur in dark and hazardous areas where machinery operators dig. The poor visibility increases the risk of traditional miners being struck by excavators. Furthermore, the community's digging activities at the base of the embankment undermine its stability, leading to frequent collapses that pose serious dangers to those working below.

Yutzupino miners have also voiced concerns about pollution and the authorities' responses to gold mining in the area. Recent military operations to combat illegal mining have led to the confiscation of their traditional mining tools and gold, further igniting dissatisfaction within the community. One resident emotionally reflected, "At least the Chinese miners gave us work; we had breakfast, lunch, and dinner for our children," recalling a time when the concession was still active.

Concerning pollution, they describe the pollutants in nearby bodies of water. They often find deposits of oils, fats, and metallic waste, formerly components of the mining machinery. They have observed that the bodies of water near the community are contaminated with sediments, which decreases water quality, exterminates aquatic life, and affects people's health. These issues, aligning with Martin *et al.* (2022), are viewed as an affront to indigenous land rights.

However, the impact of gold mining in Yutzupino extends beyond environmental degradation. The lure of gold has attracted outside miners, leading to clandestine businesses and tolerance zones. This influx has fostered an environment marked by excessive alcohol consumption and occasional aggression, disrupting community peace. Additionally, reports of prostitution and violence during protests further underline the negative social consequences of mining within the community.



The problems the Yutzupino community is facing are complex, involving their traditional way of living, taking care of the environment, and getting along with each other. What is happening in Yutzupino might not be unique to just their community. The experiences and concerns shared by the people there show that we must look deeper into these issues. More research is needed to see if similar things are happening in other places where gold mining occurs, especially after the official permissions for mining end. This will help us understand the broader effects of mining on local communities and their environment.

### 4.3 HOUSING

Houses of Yutzupino, erected on wooden pillars and chains without formal technical design, also symbolise the precarious living conditions and the ongoing struggle for survival faced by their inhabitants. The durability of the wood elements is particularly poor, making them highly vulnerable to the extreme weather conditions common to the Amazon region. The walls of these houses are made of vertically arranged wooden planks. Occasionally, cement blocks can be observed, denoting an attempt to incorporate more durable materials, but it also highlights inequality in resource access. As a result, the structures require frequent maintenance and reinforcement to ensure their integrity and to provide enough protection for those who live within them.

The roofs of the houses are made of zinc sheets. While these roofs are lightweight and resistant to heavy rain, they create a hot and overwhelming internal environment that is hardly conducive to the well-being of its inhabitants. Often covered with plastic sheets, windows provide an ephemeral barrier against the exterior environment and lack the security and durability of a conventional window. Figure 2 displays two houses with typical features of the community.



**Figure 2 | Houses of the Yutzupino community.**

*Source: Photos by the authors, 2023.*

The poverty situation in Yutzupino is further reflected in the shortcomings of its essential public services and facilities. Access to clean water is persistently challenging, largely due to the complexities of land subdivision, an administrative and legal process that divides properties into smaller lots with individual registration. This practice, vital for clarifying land use rights and maximising property value, is hampered by the need for proper land tenure regularisation to prevent misuses such as illegal mining, as Hänggli *et al.* (2023) emphasised. In addition to water issues, the community faces problems with electricity access. Though available throughout Yutzupino, the electricity supply is often unreliable and insufficient to meet everyday needs.

Education in Yutzupino is limited to a basic level. The daily commute to Puerto Napo, necessary for young people aspiring to obtain a high school education, is emblematic of the broader challenges faced by the community. This burden not only hinders their academic development but is a manifestation of the systemic weaknesses in the area, which adds to the unreliable utilities and the need for frequent housing maintenance. Figure 3 illustrates the daily route students use between Yutzupino and Puerto Napo, a visual representation of the interconnected challenges that obstruct educational advancement and overall progress within the community.

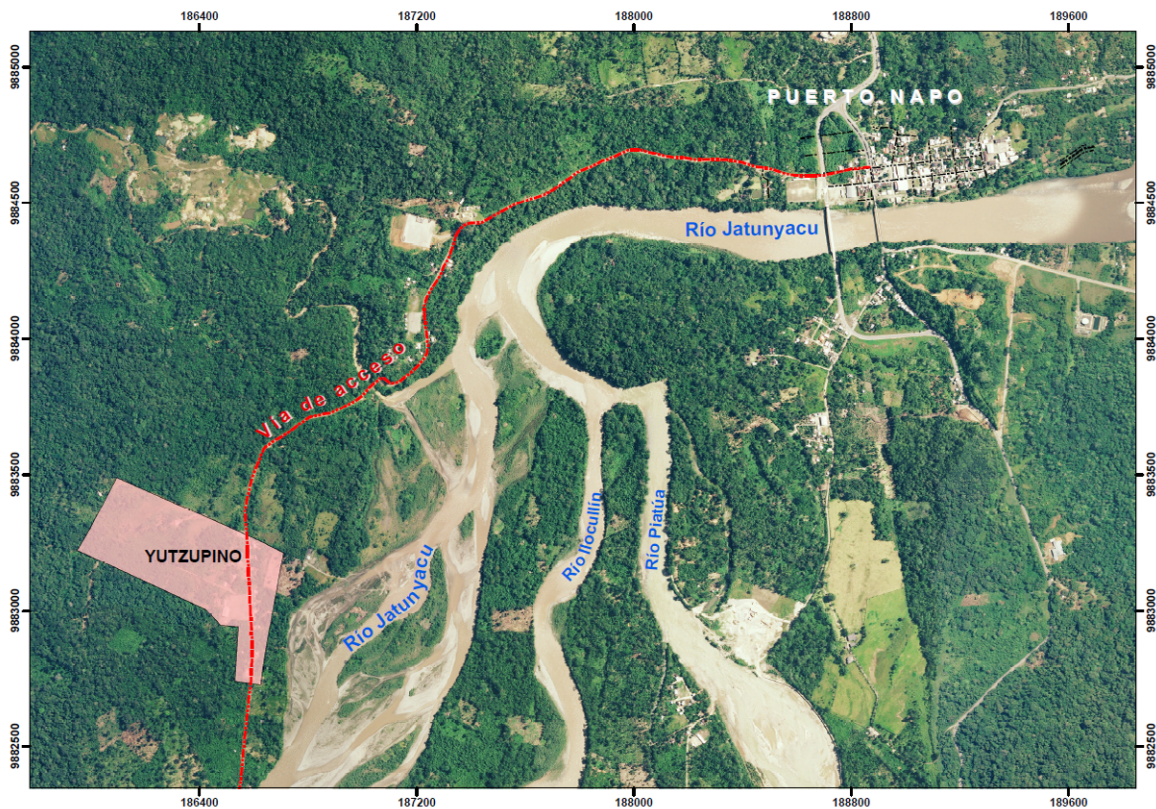


Figure 3 | Map of communication routes of the Yutzupino community.

Source: Maps by the authors, 2022.

In Yutzupino, the precarious state of housing, coupled with the lack of dependable utilities and constrained access to education, creates a vivid portrait of the challenges endemic to this Amazonian community. This complex situation does not merely reflect material hardship; it underscores a broader narrative of poverty and vulnerability. It is a call to action, emphasising the need for thoughtful intervention and support to address these multifaceted issues and empower the community.

#### 4.4 THE PHYSICAL VULNERABILITIES OF YUTZUPINO INHABITANTS

Yutzupino is close to the river, which defines the area's appearance but also makes it vulnerable. The people there enjoy the rich natural resources but face constant threats to their safety because of the location. Flooding is common, especially when it rains heavily. The residents recall times when the floods were so strong that they washed away weak homes on the riverbanks, destroying important belongings and crops. The people believe that gold mining is making things worse, changing the river's flow and washing away the banks. This makes flooding more likely and puts the homes near the river in danger.

In addition to flooding, residents of Yutzupino mention feeling small earthquakes at least once a month. While they have become accustomed to these low-magnitude tremors, the experience is always unsettling and scary. These regular quakes have revealed cracks in the houses and throughout the community, adding to ongoing concerns for the inhabitants' safety. The inability of the structures to withstand even these minor quakes underscores the precariousness of living conditions in the area and keeps the fear of a more significant disaster.

Yutzupino susceptibility to house fires also stands out as a critical concern. The residents identify poor electrical installations and the use of highly flammable construction materials like wood as the primary causes. Such conditions allow fires to ignite and spread rapidly, posing an ever-present danger to both life and property.

The community also fears the force of strong winds, a common occurrence in the area. These windstorms have the power to tear off roofs and damage crops, causing chaos in the population's livelihoods and essential infrastructure.

In the face of these environmental challenges, Yutzupino finds itself in a ceaseless battle with nature. The combined threats of flooding, earthquakes, fires, and windstorms weave a tapestry of physical vulnerability exacerbated by a lack of resources and proper planning. This precarious situation perpetuates a cycle of poverty and exposure to environmental risks, underscoring the imperative need to mitigate these threats.

#### 4.5 GOVERNMENT INTERVENTIONS

In addition to the vulnerabilities mentioned above, Yutzupino faces land regularisation and tenure security challenges. Here, 89 plots are dangerously located within the risk zone of the Jatunyacu River and do not qualify for regularisation. The Tena municipal government has played a crucial role in responding to these challenges. It has been confirmed that the lands belong to the heirs or relatives of the original owners, recognised by regulatory institutions such as the National Institute of Agrarian Development (Inda) and the Ecuadorian Institute of Agrarian Reform and Colonization (Ierac). However, instability persists due to the environmental risk that constantly imposes the threat of relocation.

To counteract these challenges, the municipality has acquired 2.35 hectares of land in the upper part of the community to relocate the endangered residents. The area was subsequently parcelled, and the parcel plan was approved and legalised. It fell to the community to take the final step to secure ownership of the individualised lands: registering them in their name at the Tena Property Registry. However, a lack of management and resources has thwarted this process, leaving the residents in an even deeper situation of vulnerability and uncertainty.

Besides interventions to resolve land tenure issues, the government has also implemented zoning plans. The annexes of the Ordinance updating the Tena Canton Development and Territorial Ordering Plan for the period 2021-2023, the Tena Canton Urban and Rural Land Use and Management Plan

2021-2023, and the Sustainable Comprehensive Urban Planning Plan of the city of Tena 2021-2023, include rural Land use plans for the canton.

In these plans, Yutzupino is categorised as a forest conservation area with minimal agricultural uses destined for sustainable forest utilisation. However, according to the map of conservation areas of the Tena canton, Yutzupino is not classified under any conservation category. On the contrary, it is identified as a metal extraction zone on the Mining Types – Mining Concessions map, which aligns with the mining concession granted to Terraearth Resources S.A. Company to explore and exploit a vast territory, including the community area. This evidences a conflict in the classification of land use in the canton.

## 5 CONCLUSION

This research sought to investigate the socio-environmental consequences of gold mining in Amazonian communities, particularly after the ending of official mining concessions. The core question revolved around the effects of mining activities, specifically how the cessation of formal concessions gave rise to an upsurge in illicit mining activities and its impact on local communities and their environment.

This study's theoretical contribution lies in a nuanced understanding of the dynamics of mining exploitation in Amazonian communities. During the active lifespan of a mining concession, a delicate equilibrium is observed to coexist between traditional and industrial exploitation, where environmental degradation occurs gradually. However, this equilibrium can be disrupted at the end of the official mining concession, marking a shift towards an anarchic state. In this phase, illegal exploitation, encompassing both traditional means and heavy machinery, overexploits resources, leading to exponential degradation. This understanding constitutes significant insights into the transitional phases of mining activity and their impact on social and environmental stability, providing a theoretical foundation for future territorial planning and industrial policy implementation.

In terms of empirical and practical implications, the study offers a rich exploration of overexploitation in mining. Empirically, it paints a vivid picture of how illegal mining practices can dramatically alter the socio-environmental context of local communities. Practically, these insights shed light on better land use planning in Amazonian mining sites. The research delivers tangible elements for developing sustainable mining policies, particularly on avoiding undesirable aftermaths of gold mining. By analysing the specific impacts and complex dynamics at play, the study equips policymakers and planners with the evidence-based understanding needed to navigate the challenges of post-concession mining activities, thus offering a robust foundation for planning and policy.

Future research in this field should focus on exploring potential measures to prevent overexploitation post the lifespan of mining concessions. A promising avenue of investigation is to evaluate the efficacy of various zoning policies that act as mitigating strategies against rampant exploitation. Furthermore, studies examining successful interventions in other regions could provide valuable insights and potential frameworks to guide policies and practices. The findings of such research would contribute significantly to devising and implementing sustainable mining policies that prioritise not just economic gain but also social welfare and environmental protection.

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