

STAKEHOLDERS' ENGAGEMENT TO STRENGTHEN THE SANCTIONING PROCESS IN THE MINING LEGISLATION OF ECUADOR

MAURICIO MURILLO¹, YAJAIRA ANDRADE TORRES¹, FERNANDO MORANTE-CARBALLO^{2,3},
MARIBEL AGUILAR-AGUILAR^{2,4}, MARÍA JAYA-MONTALVO^{2,4} & PAÚL CARRIÓN-MERO^{2,4}

¹Facultad de Ciencias Sociales y de la Salud, Universidad Estatal Península de Santa Elena, Ecuador

²Centro de Investigaciones y Proyectos Aplicados a las Ciencias de la Tierra,
ESPOL Polytechnic University, Ecuador

³Geo-Recursos y Aplicaciones, ESPOL Polytechnic University, Ecuador

⁴Facultad de Ingeniería en Ciencias de la Tierra, ESPOL Polytechnic University, Ecuador

ABSTRACT

The effective application of the mining legal framework in Ecuador is a challenge today, where, in recent years, there has been a proliferation of illegal mining activities, with few successful sanctioning processes. The objective of this study is to identify the political-administrative gaps in the country's mining legislation through a documentary review and analysis of current laws and regulations, integrated with a strengths, weaknesses, opportunities, and threats (SWOT) analysis through a focus group of experts and stakeholders to define strategies to strengthen the existing legal framework. The methodological approach used included: (i) an analysis of the current mining legal framework; (ii) a SWOT analysis through a focus group; and (iii) a strategy plan for the mining legislative framework. The results generally reflect a legal framework with critical areas that require attention to ensure effectiveness within sanctioning processes. According to the SWOT analysis, the main strategies are focused on the environmental and social axes, which include mining law reform to establish a procedure to sanction those who commit crimes in the exploitation of non-renewable natural resources. Additionally, a public state policy should be implemented so that ministries work in a coordinated manner to control and regulate illegal mining. This study offers a comprehensive and critical view of the mining sanctioning process in Ecuador as a basis for decision makers related to political reforms promoting sustainable mining management.

Keywords: public policies, mining regulation, natural resource management, mining regulations, responsible mining.

1 INTRODUCTION

Mining is an extractive activity considered one of the world's most important sources of metals and non-metals and is used as a raw material in the manufacture of different goods and services [1]. This type of activity can be classified as underground mining or open-pit mining, whose extraction volume is divided into small-, medium-, or large-scale mining [2]. The development of small-scale mining can be differentiated between technical and rudimentary extraction [3], where rudimentary operations, also called artisanal, are characterised by their scarce or null technicalisation, without environmental, health and safety considerations [4]. In many countries, according to the production and technicalisation in the extraction of natural resources, it is common to refer to the term artisanal and small-scale mining (ASM), defined as an activity that lacks standards that guarantee the health and safety of people, requires intensive use of labour, and generates a significant environmental impact [5]. In addition, Hentschel et al. [6] found that most ASM involves groups of people who extract minerals illegally and informally with little or no mechanisation.

Globally, ASM produces approximately 20% of the mineral production, employing millions of people whose main economic source is mining [7]. However, the impact of ASM on the environment and humans is a reality mainly because of economic, legislative, and



technological limitations [8]–[10]. One of the main problems in ASM is the political factor, in which scarce and weak policies/regulations hinder its formalisation and contribution to sustainable development [11], [12]. These problems associated with ASM demonstrate the need to strengthen the regulatory framework with solid policies by government entities that regulate mining and increase its potential benefits [13]. Currently, regulatory and policy responses in ASM are generally unstable, ineffective, poorly targeted, and non-existent [14].

For the effective enforcement of laws and regulations in extractive activities, government institutions must formulate laws and ensure the availability of resources and the allocation of security forces [15], [16]. According to Arias [17], there are generally two approaches to enforcing environmental regulations: deterrence, sanctions, and compliance or cooperation. Both methods allow the enforcement of regulations through key steps, prosecution, and conviction [18].

Mining in Ecuador is one of the main economic activities contributing to the GDP and generating employment for the population [19]. However, in recent years, there has been evidence of the proliferation of illegal mining activities that compromise the ecosystem, health, and safety of people, mainly in the south of the country (Zaruma-Portovelo mining district) and the Amazon region [20]–[23]. In these areas, the effects on water, air, and soil are evident, which adds to the increase in crime and insecurity and represents highly significant sources of anthropogenic contamination [24], [25].

The current legal framework in Ecuador presents areas for improvement in its sanctioning process, making it challenging to implement adequate preventive and corrective measures to regulate mining activities [20]. Recent cases of illegal mining proliferation in the country underline the need to strengthen the regulatory framework to guarantee human and environmental well-being [26]. In this sense, the participation and interaction between stakeholders (academia, governments, communities, and companies) play a fundamental role in mining governance and in improving transparency and effectiveness in formulating new sanctioning policies [27].

To address this political mining problem in a country with a projection of international replication, the following research question is raised: What are the main barriers and opportunities that stakeholder participation represents in strengthening the current legal framework for mining activity in the country?

This study aims to identify political-administrative gaps in the country's mining legislation through a qualitative analysis that integrates an exhaustive review of current laws and regulations, as well as a strengths, weaknesses, opportunities, and threats (SWOT) analysis. This analysis used a focus group with experts and stakeholders as the main tool through interviews and questionnaires to define strategies to strengthen the country's mining governance.

2 MATERIALS AND METHODS

The illegal exploitation of mineral resources, financing, and clandestine trade corresponds to multiple infractions and crimes that impact society with environmental damage that is sometimes irreversible. The legal framework for mining in Ecuador is one of the main aspects that needs to be strengthened to promote sustainable mining development in the territory. This study proposes a set of strategies aimed at improving the current legal framework, considering the criteria of key actors in the mining sector through a qualitative analysis that includes three main phases: (i) mining legal framework diagnosis; (ii) analysis of strengths, weaknesses, opportunities, and threats (SWOT); and (iii) strategies for mining the legislative framework (Fig. 1).



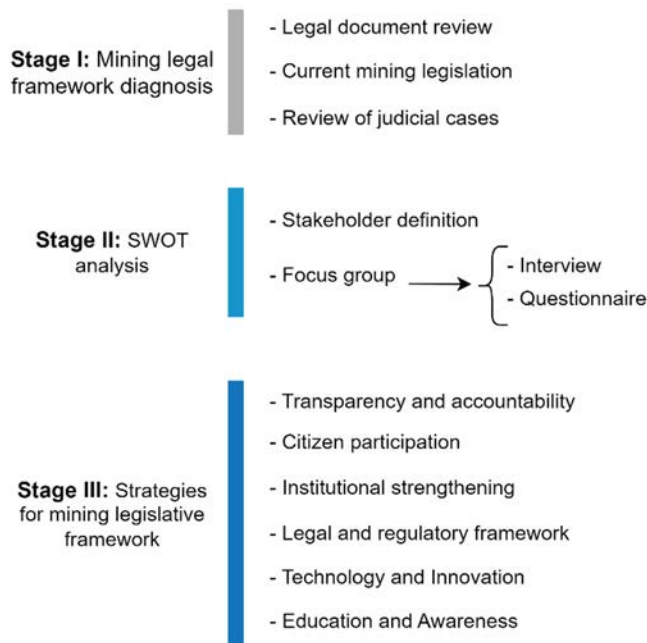


Figure 1: General methodological scheme of the study.

2.1 Stage I: Mining legal framework diagnosis

The study begins with a detailed review and analysis of the current legal mining framework in the country by processing legal documentation, judicial regulations, and the study of a completed judicial case, from the beginning of the commission of the crime to the sentencing of the crime. This case study focuses on the illegal transportation of mineral material in the Imbabura area due to the problems registered by the proliferation of illegal mining in the province, representing significant sources of anthropogenic contamination for the country. This phase aims to identify the existing gaps in the sanctioning processes and the level of stakeholder participation in the subsequent selection of key actors for Stage II.

2.2 Stage II: SWOT analysis

This phase involves defining stakeholders for SWOT analysis through a focus group of experts in five areas: legal, geological mining, hydrogeology, mining administration and the environment. Information was collected through interviews and questionnaires designed to address the social, environmental, political, economic and academic axes. The information collected is intended to understand the perspective of the group of experts on the current mining law and sanctioning processes in illegal mining exploitation. Finally, the data were evaluated to identify specific points that must be addressed in the strategies of Stage III.

2.3 Stage III: Strategies for mining legislative framework

This phase involves the design of strategies to strengthen the current legal framework for mining, with specific contributions to current sanctioning processes, promoting the

regulation and control of illegal mining with the full participation of stakeholders. The design of the different strategies considered six axes: (i) transparency and accountability; (ii) citizen participation; (iii) institutional strengthening; (iv) legal and regulatory frameworks; (v) technology and innovation; and (vi) education and awareness. The strategies proposed in this phase seek to comply with Sustainable Development Goals by controlling and regulating illegal extractive activities.

3 RESULTS AND DISCUSSION

3.1 Ecuador's mining legal framework: Identification and analysis

According to the Mining Law of Ecuador [28], illegal mineral exploitation includes operations, work, and mining tasks in different phases (exploration, exploitation, and mineral processing) carried out clandestinely and without the corresponding legal permits. In this sense, state institutions are responsible for controlling, regulating, and managing the mining sector by applying sanctions for different infractions against mineral resources. However, in the country, in the mining legislative context, two main areas for improvement are evident: (i) the officials in charge generally have limited or no experience in mining and administrative law; and (ii) there are no specific procedures to sanction infractions. According to the revision of the Mining Law, only illegal mineral exploitation and the corresponding administrative sanctions are defined, but the procedure to follow has not been established.

Specifically, for the crimes defined in Articles 260 and 261 of the Integrated Organic Criminal Code (COIP, acronym in Spanish) [29], there are two procedures for sanctioning those who commit illegal mining crimes: (i) administrative and (ii) judicial (Fig. 2). Administrative treatment is carried out at the administrative headquarters, specified in the Mining Law in harmony with the Administrative Organic Code (COA, acronym in Spanish) [30], General Regulations of the Mining Law, and Environmental Regulations for Mining Activity in Ecuador [31]. For its part, the judicial process is carried out in the State Attorney General's Office under the penal regulations of the COIP, specifically in the Sixth Section (crimes against non-renewable natural resources), where different prison sentences are stipulated.

The country's mining law is structured with different government entities that work together to control and regulate the country's mining activity. In illegal mining, administrative and criminal sanctions are established in various articles that seek to control and mitigate the illegal exploitation of mineral resources (Fig. 3).

The analysed judicial case corresponds to process 10281201801132 entered in 2018, denoting the illicit activity of mining resources presented before the State Attorney General's Office, which involves the action of three people in the transportation of mining material of illegal origin. In the trial, the facts and circumstances of the infraction and defendants' responsibility were demonstrated, the appeal was rejected, and the sentence raised to a degree was confirmed. This case reflects a time of 28 months of execution from the beginning of the process until the sentence, revealing the slowness of judicial processes when establishing sanctions in illegal mining. The sanction of the case corresponds to precautionary measures and prohibits those involved from leaving the country, demonstrating the weakness and lack of rigor in applying mining law.



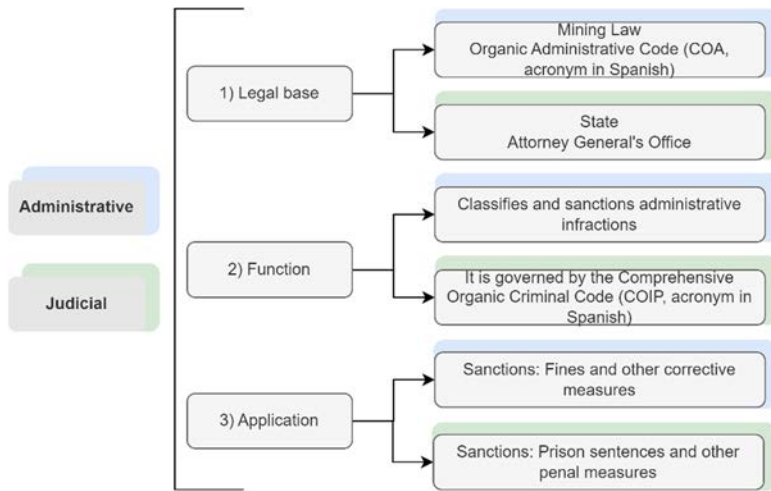


Figure 2: Procedures for sanctioning illegal mining activity in Ecuador.

Institutional Structure	Administrative and criminal sanctions
Sectoral Ministry	Custodial sentence: 5 to 7 years or 1 to 3 years for artisanal mining, 7 to 10 years for illegal activity with damage to the environment. <i>(Article 260 of the COIP)</i>
National Mining Company	
Agency for the Regulation and Control of Energy and Non-Renewable Natural Resources (ARCERNR, acronym in Spanish)	Fine of 200 to 500 basic unified remuneration <i>(Article 57, 97 and 117, Mining Law)</i>
Geological and Energy Research Institute (IGE, acronym in Spanish)	Special confiscation, seizure, destruction, demolition of assets, machinery, equipment, supplies and vehicles used in illegal activities. <i>(Articles 57, 97 and 117, Mining Law)</i>
Municipalities in the competencies that correspond to them	Fine of twenty to two hundred general minimum living wages for failure to comply with environmental protection regulations. <i>(Article 40, Environmental Management Law)</i>

Figure 3: Institutional structure of Ecuador’s mining law and the respective sanctions for illegal mining.

3.2 SWOT analysis: internal and external aspects of the Ecuadorian mining legal framework

Illegal mining is a significant problem in several countries, mainly because of the low effectiveness and enforcement of mining laws [32]. According to Espin and Perz [16], the ineffectiveness of mining legislation at the global level is mainly attributed to conflicts and poor collaboration between public and private institutions. In Ecuador, illegal mining activity has generated multiple environmental impacts and damage to people’s health and safety.

According to the results obtained from the SWOT analysis of the different experts, the results reflect two main aspects: (i) the importance of the country's mining law from the point of view of regulation and control, as well as the possibility of innovating in mining knowledge and technologies with continuous training programs; and (ii) legislation weakly supported from the financial and compliance point of view. Table 1 summarises the main internal and external aspects of a country's mining law and its impact at the regional and international levels.

Table 1: Analysis of the internal and external aspects of Ecuador's mining legislation.

Internal factors	
Strengths	Weaknesses
<ul style="list-style-type: none"> • Institutions regulate, control, and manage the mining sector. • Provisions for water protection, reforestation, and management of mining waste. • Criteria for the control and allocation of mining concessions. • State control over mining resources. • There are certain sanctions established for non-compliance with mining laws. • Promoting the use of sustainable technologies for water and environmental care. 	<ul style="list-style-type: none"> • Complexity of administrative processes that delay compliance with laws and sanctions. • Insufficient resources to effectively regulate and control mining in the country. • Dependence on external actors, mainly for investment and technological innovation. • Conflicts of interest in awarding concessions. • Significant environmental and social impacts. • Weak community integration in decision making on mining projects.
External factors	
Opportunities	Threats
<ul style="list-style-type: none"> • Adoption of environmentally responsible technological innovations. • Increased resources and strengthening of institutions responsible for mining regulations and controls. • Promoting foreign investment to strengthen legal and operational conditions. • Community training programs to raise awareness and promote sustainable mining practices. • Strengthening strategic alliances with public and private companies. • Key actors should be included in mining law reform. 	<ul style="list-style-type: none"> • Social conflicts between affected communities and illegal mining companies or groups. • Risks associated with climate change that affect mining operations and resource availability. • Risk of environmental disasters, such as water contamination due to toxic waste spills. • Loss of biodiversity is associated with deforestation due to the expansion of legal and illegal mining activities. • Political instability with changes in mining administration and policies. • Forced displacement of communities due to increased mining activity. • Increased levels of insecurity due to criminal groups in mining areas. • Decrease in foreign investment due to little or no support from the mining law.



3.3 Guidelines to strengthen mining public policies

Globally, several countries are experiencing problems associated with illegal mining and low effectiveness of legislative frameworks. For example, in Ghana, the application of laws to control illegal mining indicates that when violent means (military force) are used, it is ineffective, leads to victims, and requires innovative approaches [33]. In addition, in the Madre de Dios region in Peru, it is possible to identify the need for more collaboration between agencies responsible for regulating and controlling illegal mining activities, where ASM represents 58.3% of the population's economic activity. According to Meutia et al. [34], illegal mining in Indonesia and other countries increases unless legislative frameworks are reformulated. This highlights the need to control and regulate illegal ASM [35], promoting community empowerment [36].

Consideration of the strategies proposed in this study at the level of Ecuador represents a pillar to guarantee participatory and comprehensive mining regulation and control. However, it is important to highlight the importance of the judiciary at the national and international levels in imposing corresponding sanctions and ensuring the success of the application of mining legislation [37]. According to the results obtained from the SWOT analysis, different key actors proposed a series of guidelines as a basis for the formulation of new laws. These strategies aim to ensure comprehensive participation in the formulation of laws for six specific axes:

Transparency and accountability

- Design and strengthen public digital platforms to control and monitor assigned mining concessions and comply with sanctions.
- Publication of reports related to environmental and social impacts of mining activities to raise awareness among the population.
- Constant training in ethics and management of officials for data management in mining control and regulation.

Citizen participation

- Design committees comprised local communities in areas influenced by mining activities for supervision and participation in government decision-making.
- Carry out mandatory public consultations to approve mining projects in the country.
- Design and execute community campaigns to strengthen educational programs on rights and sustainable mining practices.

Institutional strengthening

- Define annual training plans for mining regulations and control institution officials.
- Create networks of key actors as specialised units to resolve mining conflicts between communities and mining companies or groups.
- Increase in annual funding to strengthen control and regulation capacity.

Legal and regulatory frameworks

- Review, design, and update current mining laws involving key actors' participation.
- Strengthen existing regulations to ensure the management of water resources and biodiversity in mining areas.



- Implement tax incentives for mining companies or groups that adopt sustainable resource management practices.

Technology and innovation

- Design laws that guarantee the use of sustainable technologies in mining operations.
- Implement satellite and in situ environmental monitoring systems for mining activities to define highly degraded areas.
- Promote alliances with academia to strengthen mining technology in the associated stages.

Education and awareness

- Design training campaigns on the benefits and responsibilities of mining activities.
- Integrate academia in the design of methodological approaches to environmental impact assessment in protected areas.
- Design scientific promotion programs for sustainable mining integrated into technical training for workers in the mining sector.

4 CONCLUSIONS

Illegal mining in Ecuador is one of the most significant environmental pollution problems caused by anthropogenic activities. According to the information reviewed, there are sanctioning processes for illegal ASM in Ecuador that include prison sentences, fines, and seizure of goods and services. However, the application process needs to be clarified, and compliance is limited, as evidenced by cases such as the one studied, whose process took more than three years to obtain sanctions.

According to the perspective of experts in the mining field, the SWOT results point out three general aspects: (i) sanctioning processes without a straightforward process for their execution coupled with the lack of financial resources and qualified personnel; (ii) absence of regulations focused on the design of plans for prevention and mitigation of mining impacts considering the participation of stakeholders; and (iii) need to reformulate laws established by type of mining.

The weaknesses identified in the legislation can be addressed by strengthening the country's mining law, focusing on three main areas: (i) transparency and citizen participation; (ii) strengthening institutions and the legal framework; and (iii) technological and educational innovation. The strategies proposed in this study mainly promote periodic evaluations and inclusive legislative reforms, in which the integration of the government entity with society, academia, and business marks the success of mining regulation and control processes.

This study represents a basis for political decision-makers in a country that can be considered internationally in areas where illegal mining occurs. However, the effectiveness of strengthening the legal framework for mining is conditioned by the availability of economic and human resources.

ACKNOWLEDGEMENTS

The authors sincerely thank the projects: 'Registro de sitios de interés geológicos del Ecuador para estrategias de desarrollo sostenible' (Register of geological sites of interest in Ecuador for sustainable development strategies), with code No. CIPAT-004-2024 and 'Propuesta de Geoparque Ruta del Oro y su incidencia en el desarrollo territorial' (Proposal for the Ruta del Oro Geopark and its impact on territorial development), with code No. CIPAT-02-2018.



REFERENCES

- [1] Olujobi, O.J. & Irumekhai, O.S., Strategies and regulatory measures for combatting illicit mining operations in Nigeria: A comprehensive legal perspective. *Resour. Policy*, **88**, 104459, 2024. <https://doi.org/10.1016/j.resourpol.2023.104459>.
- [2] Morante-Carballo, F., Montalván-Burbano, N., Aguilar-Aguilar, M. & Carrión-Mero, P., A Bibliometric analysis of the scientific research on artisanal and small-scale mining. *Int. J. Environ. Res. Public Health*, **19**(13), 8156, 2022. <https://doi.org/10.3390/ijerph19138156>.
- [3] Veiga, M.M., Angeloci-Santos, G. & Meech, J.A., Review of barriers to reduce mercury use in artisanal gold mining. *Extr. Ind. Soc.*, **1**(2), pp. 351–361, 2014. <https://doi.org/10.1016/j.exis.2014.03.004>.
- [4] Hilson, G., Small-scale mining and its socio-economic impact in developing countries. *Nat. Resour. Forum*, **26**(1), pp. 3–13, 2002. <https://doi.org/10.1111/1477-8947.00002>.
- [5] Siegel, S. & Veiga, M.M., Artisanal and small-scale mining as an extralegal economy: De Soto and the redefinition of ‘formalization’. *Resour. Policy*, **34**(1–2), pp. 51–56, 2009. <https://doi.org/10.1016/j.resourpol.2008.02.001>.
- [6] Hentschel, T., Hruschka, F. & Priester, M., Global report on artisanal and small-scale mining. Mining, Minerals and Sustainable Development, 2002. <https://pubs.iied.org/sites/default/files/pdfs/migrate/G00723.pdf>.
- [7] Seccatore, J., Veiga, M., Origliasso, C., Marin, T. & De Tomi, G., An estimation of the artisanal small-scale production of gold in the world. *Sci. Total Environ.*, **496**, pp. 662–667, 2014. <https://doi.org/10.1016/j.scitotenv.2014.05.003>.
- [8] Carrión-Mero, P. et al., Quantitative and qualitative assessment of the ‘El Sexmo’ tourist gold mine (Zaruma, Ecuador) as a geosite and mining site. *Resources*, **9**(3), p. 28, 2020. <https://doi.org/10.3390/resources9030028>.
- [9] Verbrugge, B. & Besmanos, B., Formalizing artisanal and small-scale mining: Whither the workforce? *Resour. Policy*, **47**, pp. 134–141, 2016. <https://doi.org/10.1016/j.resourpol.2016.01.008>.
- [10] Turner-Carrión, M. et al., A mineralogical museum as a geotourism attraction: A case study. *Minerals*, **11**(6), p. 582, 2021. <https://doi.org/10.3390/min11060582>.
- [11] Zvarivadza, T., Artisanal and small-scale mining as a challenge and possible contributor to sustainable development. *Resour. Policy*, **56**, pp. 49–58, 2018. <https://doi.org/10.1016/j.resourpol.2018.01.009>.
- [12] Carrión Mero, P., Blanco Torrens, R., Borja Bernal, C., Aguilar Aguilar, M., Morante Carballo, F. & Briones Bitar, J., Geomechanical characterization and analysis of the impacts on the rock mass in the urban area of Zaruma, Ecuador. *Industry, Innovation, and Infrastructure for Sustainable Cities and Communities: Proceedings of the 17th LACCEI International Multi-Conference for Engineering, Education and Technology*, 24–26 Jul., Montego Bay, Jamaica, 2019. <https://doi.org/10.18687/LACCEI2019.1.1.362>.
- [13] O’Faircheallaigh, C. & Corbett, T., Understanding and improving policy and regulatory responses to artisanal and small scale mining. *Extr. Ind. Soc.*, **3**(4), pp. 961–971, 2016. <https://doi.org/10.1016/j.exis.2016.11.002>.
- [14] Hilson, G. & Okoh, G., Artisanal mining in Ghana: Institutional arrangements, resource flows and poverty alleviation. *Modes of Governance and Revenue Flows in African Mining*, ed. B.K. Campbell, Palgrave Macmillan UK: London, pp. 138–163, 2013. https://doi.org/10.1057/9781137332318_5.



- [15] Robinson, E.J.Z., Albers, H.J., Ngeleza, G. & Lokina, R.B., Insiders, outsiders, and the role of local enforcement in forest management: An example from Tanzania. *Ecol. Econ.*, **107**, pp. 242–248, 2014. <https://doi.org/10.1016/j.ecolecon.2014.08.004>.
- [16] Espin, J. & Perz, S., Environmental crimes in extractive activities: Explanations for low enforcement effectiveness in the case of illegal gold mining in Madre de Dios, Peru. *Extr. Ind. Soc.*, **8**(1) pp. 331–339, 2021. <https://doi.org/10.1016/j.exis.2020.12.009>.
- [17] Arias, A., Understanding and managing compliance in the nature conservation context. *J. Environ. Manage.*, **153**, pp. 134–143, 2015. <https://doi.org/10.1016/j.jenvman.2015.02.013>.
- [18] Wellsmith, M., Wildlife crime: The problems of enforcement. *Eur. J. Crim. Policy Res.*, **17**(2), pp. 125–148, 2011. <https://doi.org/10.1007/s10610-011-9140-4>.
- [19] Sánchez, M., Ochoa, W.S., Toledo, M.E. & Ordóñez, J., The relevance of Index of Sustainable Economic Wellbeing: Case study of Ecuador. *Environ. Sustain. Indic.*, **6**, 100037, 2020. <https://doi.org/10.1016/j.indic.2020.100037>.
- [20] Mestanza-Ramón, C. et al., Gold mining in the Amazon region of Ecuador: History and a review of its socio-environmental impacts. *Land*, **11**(2), p. 221, 2022. <https://doi.org/10.3390/land11020221>.
- [21] Sellers, C., Ammirati, L., Khalili, M.A., Buján, S., Rodas, R.A. & Di Martire, D., The Use DInSAR technique for the study of land subsidence associated with illegal mining activities in Zaruma, Ecuador: A cultural heritage cite. *European Workshop on Structural Health Monitoring. EWSHM 2022. Lecture Notes in Civil Engineering*, pp. 553–562, 2023. https://doi.org/10.1007/978-3-031-07322-9_56.
- [22] Mestanza-Ramón, C. et al., Assessment of Hg pollution in stream waters and human health risk in areas impacted by mining activities in the Ecuadorian Amazon. *Environ. Geochem. Health*, **45**(10), pp. 7183–7197, 2023. <https://doi.org/10.1007/s10653-023-01597-6>.
- [23] Carrión-Mero, P. et al., Evaluation of geomechanical features and stability for the recommendations and rehabilitation of the Humberto Molina Hospital, Zaruma, El Oro, Ecuador. *WIT Transactions on Ecology and the Environment*, vol. 241, WIT Press: Southampton and Boston, pp. 455–466, 2020. <https://doi.org/10.2495/SDP200371>.
- [24] Mestanza-Ramón, C. et al., Human health risk assessment due to mercury use in gold mining areas in the Ecuadorian Andean region. *Chemosphere*, **344**, 140351, 2023. <https://doi.org/10.1016/j.chemosphere.2023.140351>.
- [25] Mestanza-Ramón, C. et al., Artisanal and small-scale gold mining (ASGM): management and socioenvironmental impacts in the northern Amazon of Ecuador. *Sustainability*, **14**(11), 6854, 2022. <https://doi.org/10.3390/su14116854>.
- [26] Spiegel, S., Analysis of formalization approaches in the artisanal and small-scale gold mining sector based on experiences in Ecuador, Mongolia, Peru, Tanzania and Uganda: Tanzania case study. United Nations Environment Programme, 2012.
- [27] Domínguez-Gómez, J.A. & González-Gómez, T., Governance in mining: management, ethics, sustainability and efficiency. *Extr. Ind. Soc.*, **8**(3), 100910, 2021. <https://doi.org/10.1016/j.exis.2021.100910>.
- [28] Gobierno del Ecuador, Ley de Minería. Quito, Ecuador.
- [29] República del Ecuador, Código Orgánico Integral Penal (COIP). Quito, Ecuador, 2021. https://www.defensa.gob.ec/wp-content/uploads/downloads/2021/03/COIP_act_feb-2021.pdf.



- [30] República del Ecuador, Código Orgánico Administrativo (COA). Quito, Ecuador, 2017. <https://www.gobiernoelectronico.gob.ec/wp-content/uploads/2020/11/COA.pdf>.
- [31] República del Ecuador, Reglamento Ambiental de Actividades Mineras, Ministerio de Ambiente. Quito, Ecuador, 2014. https://www.ambiente.gob.ec/wp-content/uploads/downloads/2015/02/REGLAMENTO_AMBIENTAL_DE_ACTIVIDADES_MINERAS_MINISTERIO_AMBIENTE.pdf.
- [32] Raharjo, B., Effectiveness of law enforcement on mining crime without permission (PETI) in Wonosobo. *J. Daulat Huk.*, **1**(2), p. 531, 2018. <https://doi.org/10.30659/jdh.v1i2.3327>.
- [33] Bansah, K.J., Acquah, P.J. & Assan, E., Guns and fires: The use of military force to eradicate informal mining. *Extr. Ind. Soc.*, **11**, 101139, 2022. <https://doi.org/10.1016/j.exis.2022.101139>.
- [34] Meutia, A.A., Lumowa, R. & Sakakibara, M., Indonesian artisanal and small-scale gold mining: A narrative literature review. *Int. J. Environ. Res. Public Health*, **19**(7), 3955, 2022. <https://doi.org/10.3390/ijerph19073955>.
- [35] Spiegel, S.J., Governance institutions, resource rights regimes, and the informal mining sector: Regulatory complexities in Indonesia. *World Dev.*, **40**(1), pp. 189–205, 2012. <https://doi.org/10.1016/j.worlddev.2011.05.015>.
- [36] Aldyan, A., The influence of legal culture in society to increase the effectiveness of the law to create legal benefits. *Int. J. Multicult. Multireligious Underst.*, **9**(11), p. 322, 2022. <https://doi.org/https://doi.org/10.18415/ijmmu.v9i11.4208>.
- [37] Rohman, A., Hartiwingsih, H., & Rustamaji, M., Improving ecological justice orientation through a typological approach to illegal mining in the criminal justice system. *Cogent Soc. Sci.*, **10**(1), 2024. <https://doi.org/10.1080/23311886.2023.2299083>.

