FEBRUARY 2021

Characterization and Analysis of Some Key Socio-Environmental Variables in the Orinoco Mining Arc

The Mining Arc is nothing more than a policy based on informalization at all levels, where there are no environmental regulations, no formal issuance of permits, no official inspection, no public services; ***the only thing that exists is an efficient system implemented by the irregular armed groups that guarantees that a high proportion of the gold extracted reaches the hands of the senior leaders*** *of the structure implemented by the regime.*

Content

Introduction

Venezuela, one of the world's twelve richest countries in biological diversity[1], is also very rich in minerals, and is undoubtedly suffering the worst environmental crisis in the Western Hemisphere, with the largest proportional number of illegal mines and one of the highest deforestation rates in the Americas and the Amazon[2]. This is partly explained by the progressive and now definitive collapse of an economy based on the extraction of oil, which now pressures the Maduro regime into accelerating unbridled exploitation of gold south of the Orinoco River.

In 2016, the Maduro regime illegally decreed the so-called Orinoco Mining Arc (MA) for the purpose of promoting, deepening and facilitating all mining, especially gold, diamonds, coltan and "rare earths", in a very extensive portion of the Guiana Shield, one of the planet's most extraordinary regions from the biological and physical point of view, located south of the right bank of the Orinoco River, with an extension of about 112,000 km², which is equivalent to 12% of Venezuela's continental territory, an area the size of Portugal[3]. This decree is a milestone in the unstoppable "gold bonanza" that has spread to areas that are beyond what was originally defined as the MA, including national parks, among them, Canaima National Park, a World Heritage Site recognized by UNESCO, and is where Angel Falls, the highest waterfall in the world, is located.

Ironically, environmental organizations and international media, concerned with the policies of rulers such as Brazilian President Jair Bolsonaro, elsewhere in Amazonia, seem to have very little interest in the much more serious devastation being caused in the forests of the Guayana Amazonia Regions by the Nicolas Maduro regime, for which there is a "silencing" of the destruction and chaos that has been enthroned in the southern Venezuela, and about which little is said in international circles. Mining in southern Venezuela has practically become the only source of income for the dictatorial regime, and is being conducted with total contempt and disdain for social and environmental concerns, which exacerbates the health crisis, the increase in human rights violations and in all kinds of illegal activities, and the growing insecurity at the national as well as hemispheric levels. Based on its experience, SOSOrinoco has taken upon itself to delve deeper into analyzing the mining situation, specifically in the so-called Orinoco Mining Arc. This has been addressed by mapping the mines' physical footprints and tracking social situations. Upon analyzing all of this spatially, it has become possible to understand the impact of the regime's mining policy, thus allowing us to propose guidelines for solutions that will eventually mitigate the damage and help rebuild Venezuela. Out of concern for the consequences of Venezuela's institutional collapse resulting from the corrosive nature of the internal political debate and its process of searching for solutions in a manner devoid of facts and figures, our team made use of technology and data science, especially remote satellite sensing and Geographical Information Systems (GIS), in order to collect, organize, analyze and share the largest possible amount of georeferenced data (with precise spatial location), describing and detailing the different realities and challenges in the Mining Arc area.

This is not easy if we consider that there has been a deliberate policy on the part of the regime to hide or not bother to collect information on key socio-environmental variables (incidence of diseases, the status of health infrastructure, deforestation, etc.). In this sense, organized civil society has been fulfilling an essential role,

[1] https://www.biodiversitya-z.org/content/megadiverse-countries

[2] https://www.amazoniasocioambiental.org/en/publication/amazonia-under-pressure-2020/ activo el 11 de enero de 2021

[3] http://www.desarrollominero.gob.ve/zona-de-desarrollo-estrategico-nacional-arco-minero-del-orinoco/ activo el 11 de Enero de 2021

that of gathering information from newspaper sources, testimonials, and even field data, which is scattered and difficult to access, especially considering that those who do this are subject to persecution or harassment by the regime's security forces. In this sense, SOSOrinoco has made an effort to compile this information, while ensuring the confidentiality sources, in order to incorporate it into this analysis.

A conclusion that we dare to advance in this introduction, derived from the analysis that will be shown here, is that environmental security is a key factor for a peaceful and democratic solution to the serious social, political, and economic crisis that the country is going through; not to consider it would be a very serious mistake that will have unsuspected consequences.

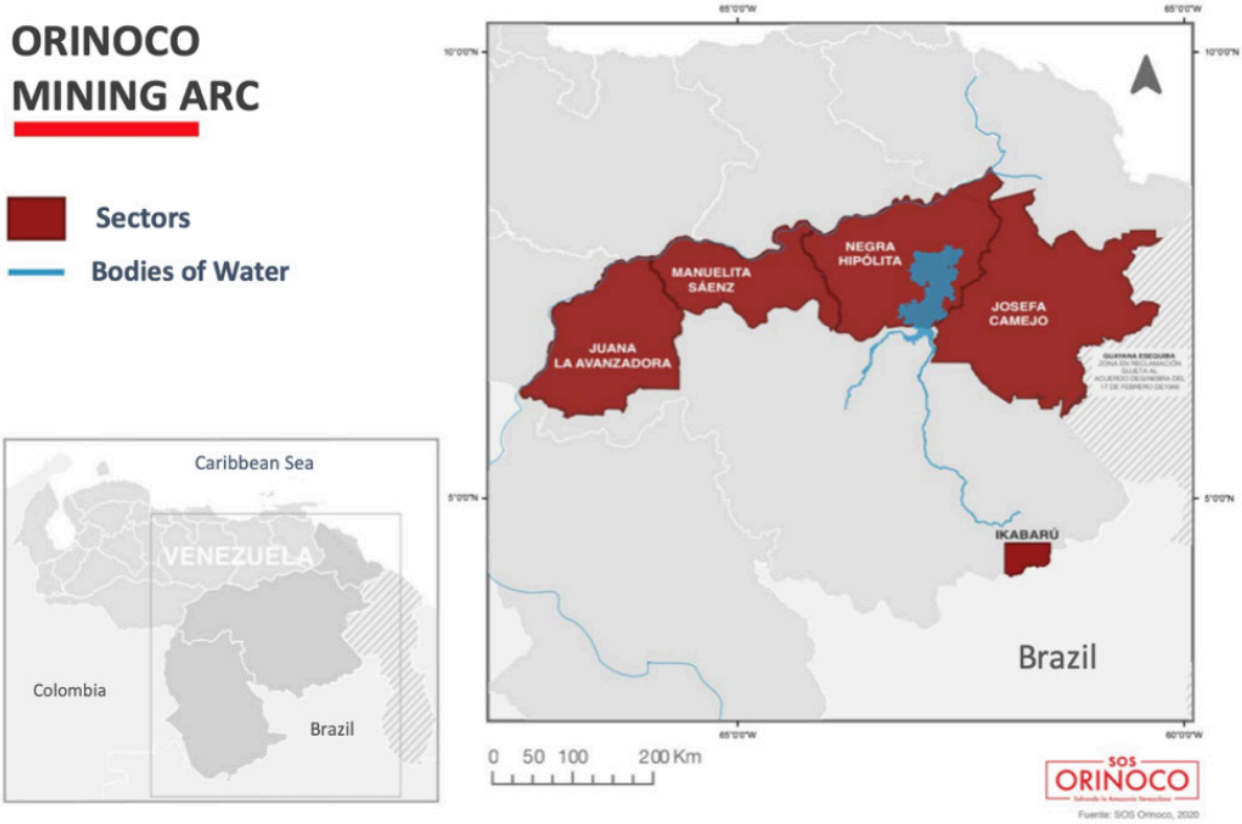

Figure 1. Map of the Mining Arc
Source: SOSOrinoco

Much is written in the Venezuelan media about this Mining Arc (Figure 1) but little is said about its statutory origin. The decree by which it was created is supposed to be an implementation of the Law for the Integral Regionalization for the Socio-productive Development of the Fatherland (Official Gazette 6151-E of 18 November 2014) which was enacted through the use of enabling legislation, whereby the Legislative Branch delegates to the Executive Branch the power to draft and enact laws. The legitimacy of the aforementioned law is made questionable by the very fact that it originated as "enabled" legislation, but going beyond that, we see that this instrument defines a concept called the "national strategic development zone." The goal of this concept is "to promote or create a special regime for the development and protection of a specific sectorial activity pursuant to the highest interests of the Fatherland." (Article 26).

This law is a normative instrument that seeks to centralize political power in the figure of the President of the Republic and ignores what is contemplated by other pre-existing organic laws of a higher rank (Salas-Bourgoin 2017)[4], which renders it null and void.

It is essential to remember and consider that the MA decree was declared illegal and unconstitutional on 14 June 2016 by the National Assembly, the only legitimate Public Power in Venezuela. A formal accord of the National Assembly disallowed and negated the constitutional authorization pertaining to Decree 2.248, by arguing that it violates articles 150 and 187-9 of the Constitution of the Bolivarian Republic of Venezuela, establishing that "contracts of national interest" require constitutional authorization by the National Assembly, and that it also violates articles referring to environmental rights (127, 128, 129, 130, 304, 327, and the preamble to the Constitution), with regard to the "ecological balance and environmental legal rights as humanity's common and inalienable heritage."[5] Likewise, the National Assembly enacted the Organic Law on the Fresh Water and Biodiversity Mega-Reserve of the Southern Orinoco and Amazonia Regions[6]. This Organic Law was unanimously approved by this same National Assembly, which is the Bolivarian Republic of Venezuela's National Legislative Branch, on 27 November 2018, after approval during preliminary discussions on 2 October following an intensely wide debate in legislative committees, in plenary sessions, among political organizations, with NGO's, at universities and over the news media and social networks[7]. This law, the aforementioned Decree 2.248 pertaining to the MA, was legally repealed in the "First Derogating Provision" of the legal text.

Mining activity was already in existence in this region much before the MA was decreed. However, this activity has now intensified dramatically and has exceeded the limitations of the environmental and constitutional framework, thus becoming the cause of severe socio-environmental impacts on terrestrial and aquatic natural ecosystems, on biological diversity, as well as on the health and well-being of indigenous peoples and Criollos (non-indigenous people of Spanish linguistic and cultural heritage)that inhabit that space and its surroundings, affecting mine workers as well as the entire resident population.[8]

Added to this, we maintain that the Nicolás Maduro regime has for several years unleashed an institutional crisis in all spheres of national life that places the entire southern Orinoco region in a situation of social, economic and environmental defenselessness. In this last area, it is noteworthy, and very telling, that the Ministry of the Environment was eliminated in 2014, given that Venezuela had been the pioneer in Latin America in the creation of a ministerial body specialized in this matter (1976). Between 2014 and 2018, this ministry was replaced three times by other ministries, confusing governance in environmental matters related to issues such as housing, or giving the replacement ministries an ideological bias with the label of "eco-socialism." In short, the resulting environmental ministers came to wield negligible political clout within the cabinet. Additionally, an absurd Ministry of Ecological Mining Development was created (2016), which ended up dismantling the rational institutional framework necessary for administering environmental regulations in Venezuela.

[4] Salas-Bourgoin, M.A. 2017. Ley de Regionalización Integral para el Desarrollo Socioproductivo de la Patria ¿Instrumento normativo para el desarrollo regional o para la centralización política en Venezuela? CUESTIONES POLÍTICAS Vol. 33 No. 59, (July - December) 7 -10 (Revista de la Universidad de Los Andes, Mérida, Venezuela).

[5] https://www.asambleanacionalvenezuela.org/actos/detalle/informe-de-la-comision-mixta-de-creacion-de-la-zona-de-desarrollo-estrategico-nacional-arco-minero-del-orinoco-104 Available as of 9 JAN 2021.

[6] https://sosorinoco.org/wp-content/uploads/2020/07/3.3-Ley-de-Megareserva.pdf Available as of 9 JAN 2021.

[7] It is not possible to find a digital source from the National Assembly from which one may download the text, because there is no access to the Official Gazette, given that the National Press is controlled by the Nicolás Maduro regime.

[8] https://sosorinoco.org/es/informes/ Available as of 11 JAN 2021.

Another important aspect to consider when analyzing the MA is that no disclosure has yet been made of the presumed Specific Development Plan, which the decree said would be drawn up within six months. Nor has there been any compliance with the required strategic socio-environmental evaluation required by the Constitution for a proposed project of this magnitude, nor with the prior, free and informed consultation with the indigenous peoples and communities that live within the MA, as established in Article 120 of the Constitution. All of this has been brought to the attention of the Inter-American Commission on Human Rights. Furthermore, the Maduro regime has politically and financially committed the Republic to contracts and agreements within the MA without the required constitutional authorization that needs to be granted by the National Assembly (and which was denied to the regime as is evidenced in the National Assembly Accord of June 14, 2016) and has given de facto permission for this activity to illegal and irregular armed groups, Venezuelan nationals and foreigners alike, in areas such as the Imataca, El Dorado-Tumeremo and San Pedro forest reserves, in the Caura and Canaima national parks[9], as well as in indigenous territories, all of which are legally protected[10].

In this context, this report aims to show the results of the evaluation of the status of some important socio-environmental variables, within the MA space, and to analyze their links to mining through a preliminary spatial analysis, without claiming to be exhaustive. For this we used a geographic information system, where documentary, statistical, cartographic, thematic data and satellite images are integrated. All this, bearing in mind the potential relationship of the mining activity with all those variables considered and especially with the acts of violence, the presence of irregular armed groups, the participation of the Venezuelan Armed Forces and the spatial-temporal behavior of diseases such as malaria. The sources of information are technical, scientific and testimonial, all recent, the goal being coverage of the period between 2016 and 2020.

[9] https://sosorinoco.org/es/informes/situacion-actual-2020-de-la-mineria-aurifera-en-el-parque-nacional-canaima-sitio-de-patrimonio-mundial-venezuela-actualizacion-del-informe-del-ano-2018/ Available as of 11 JAN 2021.

[10] https://sosorinoco.org/es/informes/mineria-guerrilla-y-enfermedades-el-legado-de-la-revolucion-a-los-indigenas-de-la-reserva-de-biosfera-alto-orinoco-casiquiare-amazonas-venezolano-informe-de-actualizacion-agosto-2019-julio-20/ Available as of 11 JAN 2021.

Chapter 1

Socioeconomic aspects: populated centers and indigenous communities

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According to the latest National Census, carried out in 2011, the state of Bolívar had a population of 1,413,115 inhabitants, equivalent to 5.2% of the national total, with a demographic density of 5.9 inhabitants per km² (INE, no date). The projection for the year 2020 is 1,721,782 inhabitants for the state (UCAB-IIES, 2020) with an estimated distribution by municipal districts, as shown in the following table. It is estimated that Caroní municipal district, whose seat is Ciudad Guayana, encompasses half of the state's population, and is followed in order of importance by Heres, Piar, Cedeño and Sifontes municipal districts. These five municipal districts encompass 90% of Bolívar's population, and together with Roscio, El Callao and Padre Pedro Chien municipal districts they are included within the scope of the MA, at least within most of its surface area. Angostura, Sucre and Gran Sabana municipal districts are also affected by the MA, but to a lesser degree.

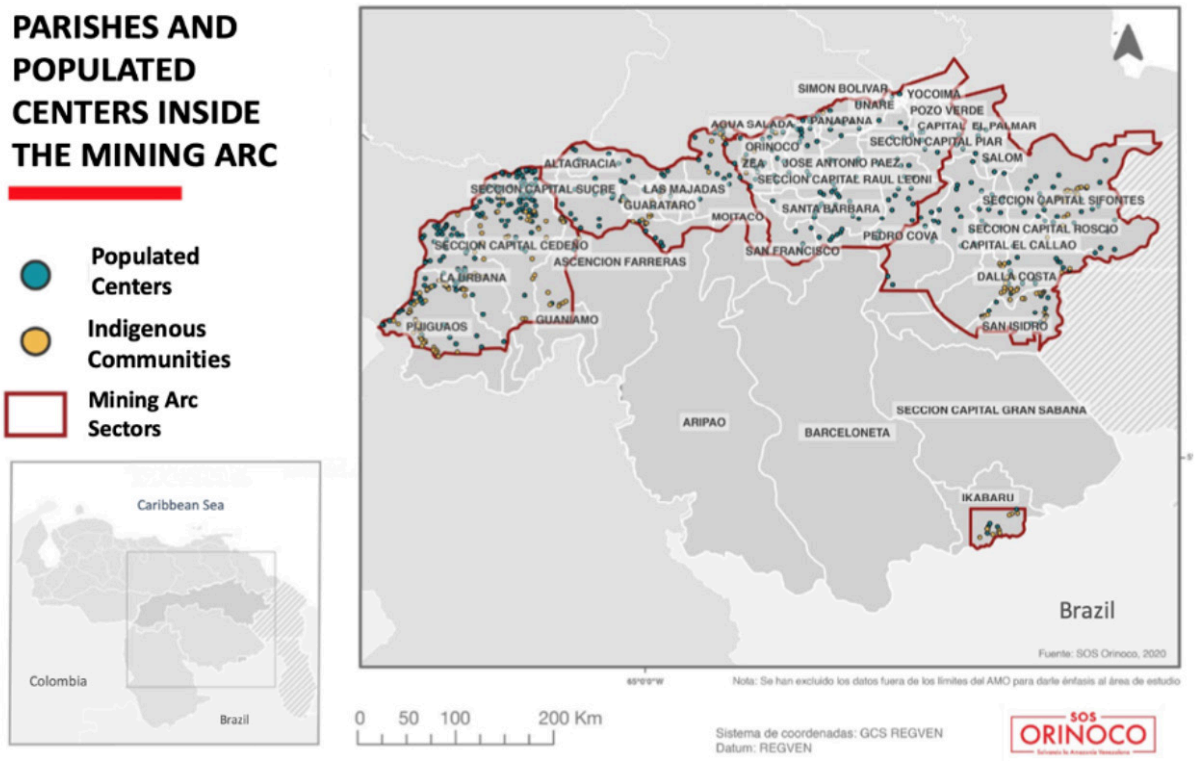


Figure 2. Parishes and Populated Centers inside the Mining Arc

Source: Data layers from Instituto Geográfico Simón Bolívar updated in 2011 following last national census.

Municipal Districts	Population	%
Caroní	864,217	50.2
Heres	400,684	23.3
Piar	120,108	7.0
Cedeño	97,984	5.7
Sifontes	60,359	3.5
Angostura	50,090	2.9
Gran Sabana	36,610	2.1
Roscio	26,299	1.5
El Callao	24,413	1.4
Sucre	23,383	1.4
Padre Pedro Chien	17,635	1.0
State of Bolívar	1,721,782	100.0

Table 1. Population Projection for the State of Bolívar by Municipal Districts.
Source: ENCOVI, 2020

As can be seen in Figure 2, the delimitation of the MA does not coincide with the political-administrative division of the state of Bolivar. However, most of the population, located in the major cities, populated centers and road corridors, is found in the northern portion of the state, coinciding with the location of the MA. On the other hand, to the south, the areas that are not part of the MA are inhabited by indigenous populations in small, scattered communities. We can then estimate that around 95% of the population of the state of Bolívar (approximately 1,635,000 people) lives within the realm of the MA.

However, it is important to clarify that it is very risky to do conclusive estimates of the state of Bolivar's demographics, for several reasons: The first has to do with the lack of demographic information; the last population census was conducted 10 years ago and projected estimates are not reliable due to the intense population dynamics of recent years. Secondly, an estimated 5.4 million people have left the country, fleeing the violence, insecurity and threats, as well as lack of food, essential medicines and services (UNHCR, 2020).

Furthermore, the state of Bolívar constitutes a transit zone, because of it borders on Brazil and the Essequibo Reclamation Zone, which facilitates the mobility of its population into neighboring countries. However, the enormous boom in small and medium-sized mining has turned the state of Bolívar into a magnet that attracts population flows from all over the country, as well as neighboring countries. It is estimated that the mining population reaches 150,000 people, although there is no official information in this regard (García, 2018), as this involves a mostly itinerant population that swings like a pendulum, repeatedly traveling to the mines and then returning to their places of origin periodically.

In the geographical area of the MA, the most important cities are Ciudad Guayana -including Puerto Ordaz and San Félix- which constitutes the main regional center, with the largest population and the most economic, service and trade activity. Ciudad Bolívar - the state capital - is the seat of political-administrative power. Next in importance are the cities of Upata, Caicara del Orinoco, Tumeremo, Ciudad Piar, Guasipati and El Callao, as local service economy centers. Among the smaller populated centers are San Francisco, El Palmar, El Dorado, Las Claritas, El Manteco, El Pao, Maripa, La Urbana, Los Pijiguaos and Icabarú (Muñoz, 2008).

The current official database registers 589 populated centers in the state of Bolívar (Table 2), including cities, small hamlets and indigenous communities. From a descriptive spatial analysis, one observes that 429 populated centers (73%) are located within the confines of the MA, while 160 (27%) are outside the realm of the MA. Table 2 also shows the distribution of the populated centers in each of the MA areas.

In Bolívar there are twenty indigenous peoples[11] that have long occupied their own territories within the state. The MA's surface coincides with that of 14 of them: Akawayo, Arawak, Eñepa, Jivi, Kariña, Kurripako, Mapoyo, Pemón, Piapoko, Piaroa, Sáliva, Sanema, Warao and Ye'kwana. For these peoples, only five indigenous lands have been officially demarcated and titled, and all are located within the MA (table 3).

[11] Generally speaking, the concept of "a people" refers to a society that is identifiable through a series of unique characteristics that differentiate them from others. Venezuela's Constitution and its laws recognize the existence of indigenous peoples and communities. The "indigenous people" are groups of human being that are the descendants of the original inhabitants of the geographical space pertaining to the nation's territory, and who recognize themselves as having one or more of the following elements: ethnic identity, lands, languages, social, economic, political and cultural institutions and their own justice systems, all of which distinguish them from the rest of the nation's society. Meanwhile, "indigenous communities" are groups created by indigenous families related to each other, belonging to one or more indigenous peoples, located in a determined geographical space and organized according to their own cultural norms. (Organic Law Indigenous Peoples and Communities, 2005, Article 3).

Mining Arc (MA)	Populated Centers	%
Block 1	160	27
Block 2	55	9
Block 3	116	20
Block 4	93	16
Icabarú Block	5	1
MA	429	73
Non-MA	160	27
TOTAL	589	100

Table 2. Distribution of populated centers by Mining Arc Sectors.
Source: IGVSB, SOSOrinoco

Mining Arc (MA)	Indigenous Communities	%
Block 1	84	16
Block 2	18	3
Block 3	7	1
Block 4	57	11
Ikabarú Block	10	2
MA	176	34
Non-MA	348	66
TOTAL	524	100

Table 4. Distribution of indigenous communities by sectors of the Mining Arc.
Source: INE, 2001; SOSOrinoco

Municipal District	Indigenous People	Community	Surface Area (hectares)	MA
Cedeño	Mapoyo	El Palomo	261,493.29	Area 1
Sucre	Kari'ña	Camurica	20,525.23	Area 2
Heres	Kari'ña	Mata de Tapaquire	13,259.89	Area 3
Heres	Kari'ña	Panapana	20,827.84	Area 3
Gran Sabana, Angostura	Pemón	Icabarú	597,982.87	Icabarú Block

Table 3. Indigenous titled lands inside the Mining Arc.
Source: Ministry of the Environment and Ministry for Indigenous Peoples

When analyzing the spatial distribution of indigenous communities according to the 2001 Population Census, one observes that of the total 524 communities, 176 (34%) are located within the confines of the MA, while 348 (66%) are outside of the realm of the MA. Table 4 shows the distribution of indigenous communities in each of the areas of the MA.

Main economic and subsistence activities

Mining Sector

What is known today as the state of Bolívar has had mining activity since Spanish colonial times. Until a couple of decades ago, the iron and steel industry in the state of Bolívar had been the second most important economic activity for the country after oil production. The extraction of iron ore began in 1949 with the Orinoco Mining Company, and passed into the hands of the Venezuelan State in 1975 under Ferrominera del Orinoco, a CVG subsidiary. Iron and steel was produced mainly by Siderúrgica del Orinoco (Sidor), located at Ciudad Guayana (Muñoz, 2008). Since 2008, when the company was re-nationalized, it entered into a process of falling production until 2018, when it became paralyzed. Some plant operations were restarted in mid-2020 (Siderúrgica del Orinoco, 2020).

Bolívar also has important bauxite deposits, which are being extracted in the Los Pijiguaos area of Cedeño municipal district, by the CVG-Bauxilum. In Ciudad Guayana, the bauxite was processed for the production of alumina and aluminum by the CVG-Alcasa and the CVG-Venalum companies. The electric power crisis of 2009 caused serious damage to the industry, whose production went into a freefall until 2019, when an electrical power outage and mismanagement of the situation completely ruined the facility's few reduction cells that were still active. This is an industry totally dependent on an abundant and continuous supply of electric power. Currently the aluminum production industry sits paralyzed (Aluminio del Caroní, 2020).

It is noteworthy that, although there are no official statistics in this regard (a situation that seems to be created on purpose), the informal and illegal mining sector currently constitutes the most important economic activity in the state of Bolívar, around which associated economic activities are developed for providing goods and services, many of them linked to drug and weapons smuggling, human trafficking, plus labor and sexual exploitation, among other illicit activities run by organized crime groups.

Hydroelectric Sector

The production of hydroelectric energy, by taking advantage of the flow of the Caroní and Paragua river system, is the second most important productive sector in the state of Bolívar. This sector was developed by the Venezuelan State through the Electrificación del Caroní (CVG-Edelca) company, starting in 1963 with the construction of the Guri, Macagua I, II and III and Caruachi hydroelectric plants on the lower Caroní. Altogether, more than 13 thousand MW were generated, supplying 70% of the nation's electric power consumption (Muñoz, 2008). Up until a few years ago, part of the demand from northeast Colombia and northwest Brazil was also met, but these feeds into those neighboring countries stopped completely due to the crisis in Venezuela's electric power system. Starting in 2008, all management of the hydroelectric system was transferred from CVG-Edelca, a fundamentally technical entity, over to the National Electric Corporation (Corpoelec), well known for its inefficiency, politicization and corruption, all of which had dire consequences for the operation of the electric power sector and the national economy (Pardo, 2015; Transparencia Venezuela, n.d.).

Unfortunately, the inexplicable economic policies of the Chávez government, the enormous corruption, the abandonment of capital expenditures and the lack of maintenance, have led to a precipitous drop in production down to minimum levels and even to the paralysis of entire companies. Sidor, the country's main steel producer, shut down in 2018; Alcasa and Venalum have been inactive since the great power blackout of 2019 that caused serious damage to machinery; Bauxilum is practically paralyzed. Meanwhile, Ferrominera del Orinoco was the company with the highest production in 2019, but only reached 12% of its installed capacity (Prat, 2018; Siverio, 2020). All this means high levels of unemployment and underemployment.

Bolívar also used to have an important private industrial sector, a large part of which revolved around the processing of ore produced by basic industries, aimed at generating value-added products. Due to the collapse of the basic industries in the Guyana region, and the country's deep economic crisis, most of the "downstream" industries have also had to close, thus magnifying unemployment and underemployment (Prat, 2020).

Agricultural Sector

Although Bolívar is the state with the largest surface area in the country, it does not have large areas with good quality soils (precisely because its geological substrate is part of the Guiana Shield) nor does it have sufficient people with agricultural vocations, yet it does have potential for livestock and forestry production (although this is may be questionable due to the forests' limited capacity for regeneration, also a result of the poor soil). On the other hand, more than half of the state's territory is under environmental protection rules that establish reasonable limits or prohibitions on large-scale farming and animal husbandry. However, in the northern part of the state, and associated with the main population centers and road corridors, there are spaces for production. The most important agricultural products were corn, roots and tubers, rice, cotton, sugar cane, fruits, forest products, cattle, and poultry. Bolívar also has important river fisheries, worked by artisanal fishermen, mainly along the Orinoco River (Muñoz, 2008). This last item deserves special consideration in light of evidence of heavy contamination by mercury from mining operations in the region.

The deep economic crisis that affects the country has also manifested itself in an agricultural recession with a sustained fall in production at the national level, thus producing a contraction in regional economies, unemployment, poverty, and a greater dependence on imports to satisfy domestic consumption (Briceño, 2018). Among the main problems that Bolívar's producers face is the shortage of fuels for transportation and the operation of machinery, the shortage of supplies, fertilizers, seeds and veterinary medicines (Zambrano, 2020). In the state of Bolívar, the recession in the agricultural sector manifests itself in the abandonment of production and the migration of agricultural workers toward the mining areas, where gold mining is a more gainful activity for them, monetarily speaking.

It is important to note that in addition to agricultural production for meeting local or national demand, there are also numerous indigenous and peasant communities, scattered throughout the region, and which maintain traditional small-scale agricultural practices, along with the use of forest resources, hunting and fishing, which are part of a low-impact local and subsistence economy adapted to the particularities of ecosystems of the Guayana region. However, the deterioration of living conditions, the lack of access to economic resources, and the regime's policies of incorporating indigenous and peasant communities into the mining activity in the MA, have drawn many of these populations toward working at the mines, thus abandoning their traditional economic practices.

The state of Bolívar's potential for the production of wood and other forest products deserves special mention. There are several ABRAE's (spaces subject to special regulations) that lend themselves toward this type of activity, including six Forest Reserves and seven Forest Areas under Protection, all oriented toward sustainable use, conservation and protection of resources. However, according to Hernández, Parra and Sanoja (1994), nutrient-poor soils and fragile forest communities predominate in these areas and they are very susceptible to intensified exploitation of the forests and other economic activities (agriculture, livestock, mining, etc.). Since the 1980s, economic exploitation processes have been promoted in the Imataca Forest Reserve and the Boscoso San Pedro Block, through concessions under land use and management plans, but the exploitation of forests in these areas was far from being sustainable due to the lack of compliance with the designed plans (Hernández, Parra and Sanoja, 1994). However, Lozada argues that thanks to the management plans there have been "small but significant protective efforts in these areas," which contrast with the high rates of deforestation and forest destruction

in the El Caura and La Paragua Forest Reserves. According to Lozada, “in the Reserves where there was no Forest Management, the forests disappeared due to agricultural occupations” (Lozada, 2007). Currently there are no active legal logging operations, but illegal logging is a problem that continues to raise pressures as an agent of deforestation in the region (Gil, 2010).

Tourism

The state of Bolívar has been one of the main tourist destinations in Venezuela and has high potential for a much greater development of the sector, due to the attractive natural and cultural settings that show potential. The region’s great tourism strength is based on the spectacular landscapes and natural beauties, unique in the world, and part of the Guiana Shield, and is also based on its indigenous cultural heritage. This region is particularly attractive for ecotourism, an activity consistent with the existence of environmental protection measures aimed at conserving more than 70% of the state’s surface. However, the state has a series of weaknesses that have limited the development of its tourism potential: deficient and insufficient services, absence of land use and management plans for most of the ABRAE, low capacity and quality of accommodation, deterioration of transportation routes, among other things (Muñoz, 2008). The country’s precarious serious situation, the humanitarian emergency and the suspension of flights due to the Covid-19 pandemic have resulted in the almost complete paralysis of tourist activities in the country, as well as the accentuation of the deterioration and weaknesses in the conditions for the development of this economic sector.

According to Blanco and Montenegro (2018), tourism is the economic activity that generates the most direct jobs in the world, per monetary unit invested, and is positioned as one of the most important industries for the future of the economies of countries such as those in South America. Ecotourism, the sector’s activity with the fastest growth in recent years, is characterized by contributing to the conservation of the environment: it is sustainable, it incorporates and provides benefits to communities, and it is sensitive to local cultures. The area south of the Orinoco is an ideal region for the development of ecotourism, but this activity is totally incompatible with mining and the environmental damage that the MA is generating. The social deterioration of local communities, the increase in tropical diseases such as malaria, and personal insecurity are factors that reduce the attractiveness of the region for tourism.

Infrastructure and services

Roadways, ports, airports and landing strips

Within the MA there was already a pre-existing road system made up of terrestrial transportation routes (major, local, secondary and minor roads). Among the most important roads for this region are the main roadways that provide interconnections with all the MA blocks and internationally with Brazil and Colombia.

We will first refer to Troncal 16 as the major highway that crosses Block 3 from north to south, from Ciudad Bolívar to the town of El Cristo, at the southern end of this Block, and it is possible to travel along Troncal 16 parallel to the Guri Reservoir, where the country’s the main hydroelectric power plant is located. Troncal 19 crosses the MA from east to west, linking Ciudad Guayana, Ciudad Bolívar and Caicara del Orinoco. For its part, Troncal 12, with a northeast-southwest direction, connects Caicara del Orinoco with El Burro, at the extreme southwest of the MA, El Burro being a town that is very close to Puerto Páez (state of Apure) and close to Puerto Carreño (in Colombia’s department of Vichada). It should be noted that Troncal 12 and Troncal 19 interconnect Blocks 1, 2 and 3 regionally (Figure 3).

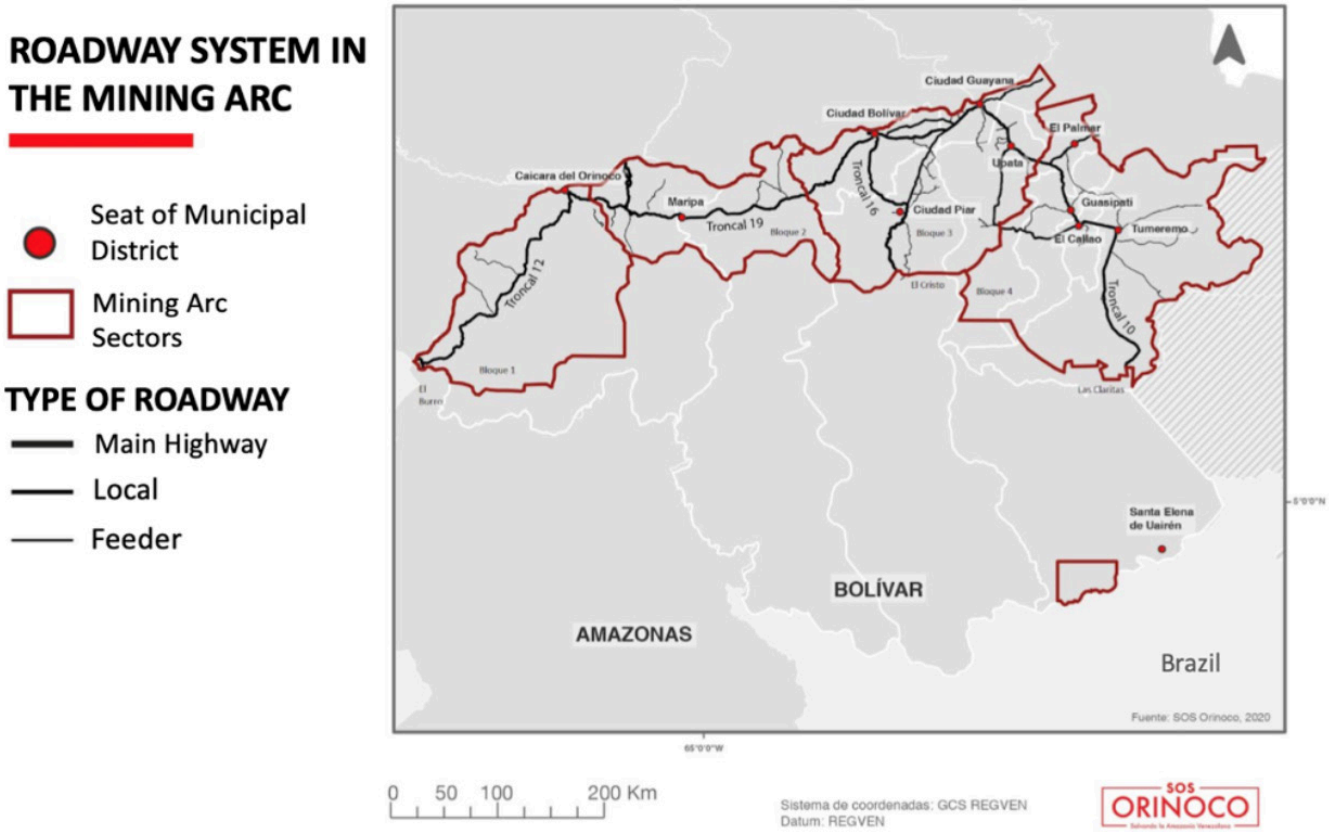


Figure 3. Roadway system in the Mining Arc
Source: Data base of the IGSB.

Troncal 10 connects the towns of San Isidro and Las Claritas, located at the southeast end of Block 4, to Ciudad Guayana (Block 3), in addition to facilitating access to the special Icabarú Block (Block 5). This Troncal is of great importance since it gives the region a link to the Brazilian state of Roraima.

This is how the major highways, which cross the MA and connect this region with border cities such as Puerto Carreño and El Carmen (both in Colombia), as well as Boa Vista and other towns in northern Brazil, are used not only as a means of transportation through which flows material extracted from the mines, as well as drug shipments, both of which are later distributed to other national destinations, the Caribbean, and neighboring countries, and from there beyond to overseas destinations[12].

With respect to ports, airports and landing strips, Figure 4 shows that there is an air base in Block 3, located at Ciudad Guayana (Lieutenant Colonel Teófilo Méndez Air Base) and a naval station in Block 1 (Isla Vapor Naval Station) on the Orinoco River near the town of Los Pijiguaos.

The airports and landing strips are distributed throughout all the MA blocks, with a total of 33 (Figure 4 and Table 5). However, the largest number of runways (17) and heliports (2) are located in Block 3 (Negra Hipólita). Of the total of those located in Block 3 (19), most are clay runways (16), and seven (07) belong to the national government and eleven (11) to private individuals. It is worth mentioning that there is one (01) airport for international cargo (Manuel Carlos Piar), located at Ciudad Guayana.

[12] For more information, read these news reports: https://elpitazo.net/guayana/brasil-investiga-desvio-de-alimentos-hacia-minas-de-oro-en-venezuela/; https://www.radiofeyalegrianoticias.com/suspenden-transito-de-camiones-de-comida-de-brasil-a-venezuela/; https://www.aporrea.org/contraloria/n293382.html

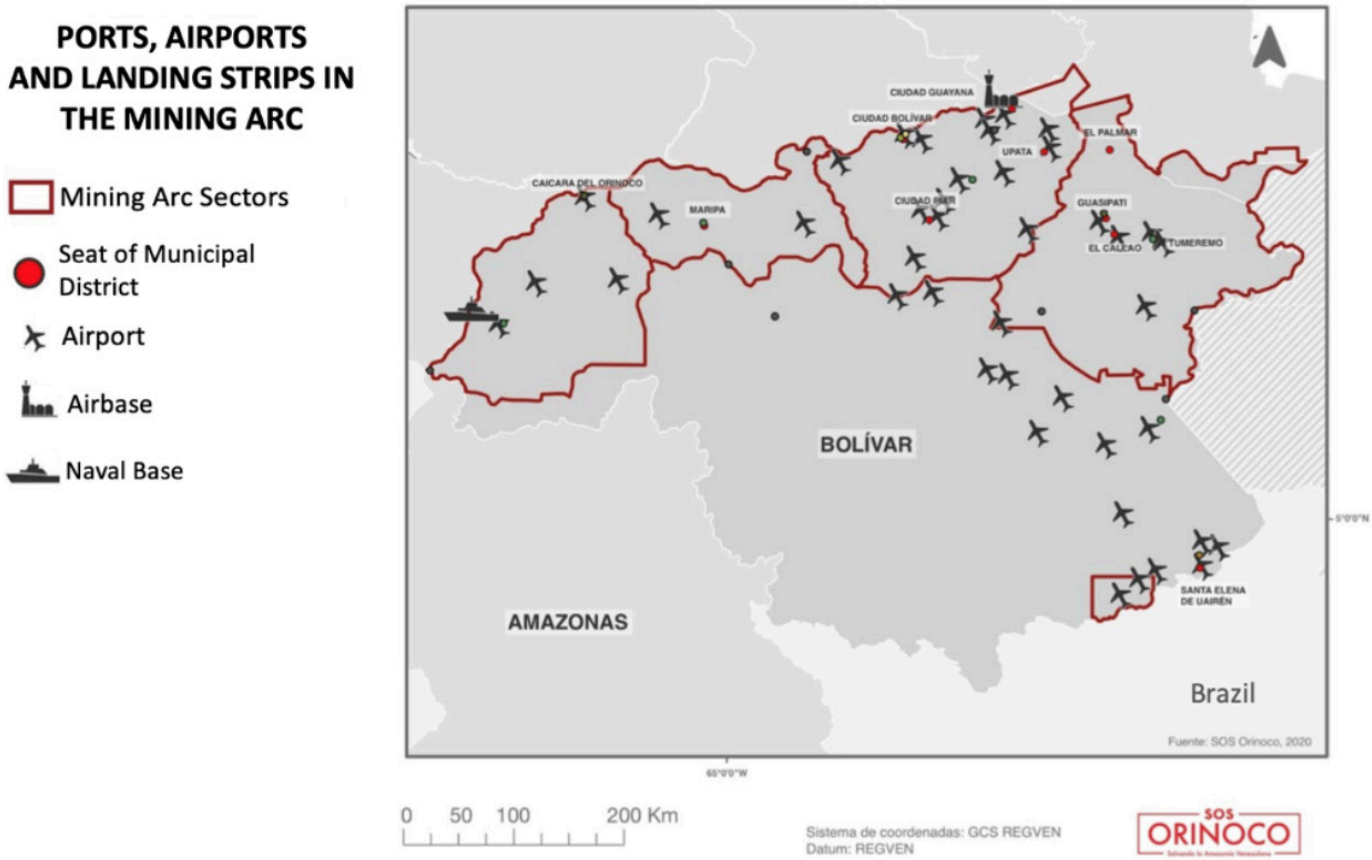


Figure 4. Ports, airports and landing strips inside the Mining Arc.
Source: Georeferencing conducted by VE360 based on official documents.

Blocks	Number of Aerodromes	Type of Aerodrome		Runway Surface				Authority		
		Land Aerodrome	Heliport	Clay	Asphalt	Chips	Gravel	International Cargo	National	Private
Block 1	4	4			2	1	1		1	3
Block 2	2	2			1	1			1	1
Block 3	19	17	2	16	3			1	7	11
Block 4	6	5	1	1	3	2			3	3
Block 5	2	2				1	1		2	
TOTAL	33	30	3	17	9	5	2	1	14	18

Table 5. Airports and landing strips in the Mining Arc.
Names of Blocks with corresponding numbers: 1) Juana La Avanzadora; 2) Manuelita Sáenz; 3) Negra Hipólita; 4) Josefa Camejo; 5) Icabarú

Municipal District	Education Centers	%
Caroní	429	31
Heres	374	27
Cedeño	195	14
Piar	117	8
Gran Sabana	74	5
Angostura	53	4
Roscio	37	3
Sifontes	31	2
Sucre	30	2
El Callao	25	2
Padre Pedro Chien	13	1
State of Bolívar	1,278	100

Table 6. Distribution of education centers by municipal districts of the state of Bolívar.
Source: Official data from the Ministry of Health, georeferenced by VE360.

Education centers and healthcare coverage

Education centers

In the state of Bolívar there are 1,378 school buildings (Table 6) for the first 3 levels of Venezuela's education system: preschool education, basic education, and diversified and professional secondary education. In addition, there are nine higher education institutions. Of the educational institutions, 86% are located in Caroní, Heres, Cedeño and Piar municipal districts, coinciding with the state's largest population areas. There are university-level education centers in Ciudad Bolívar and Ciudad Guayana.

Mining Arc (MA)	Education Centers	%
Block 1	159	11
Block 2	58	4
Block 3	962	70
Block 4	110	8
Icabarú Block	10	1
MA	1,299	94
Non-MA	79	6
TOTAL	1,378	100

Table 7. Distribution of education centers according to Mining Arc Blocks.
Source: SOSOrinoco

From a spatial distribution analysis (Table 7, Figure 5), one observes that 1,299 educational centers (94%) are located within the boundaries of the MA, while only 79 (6%) are outside the MA. In Table 6, one can also observe the distribution of the education centers in each sector of the MA. It is noteworthy that 70% of the educational establishments are located in Block 3, where the largest cities in the state are located.

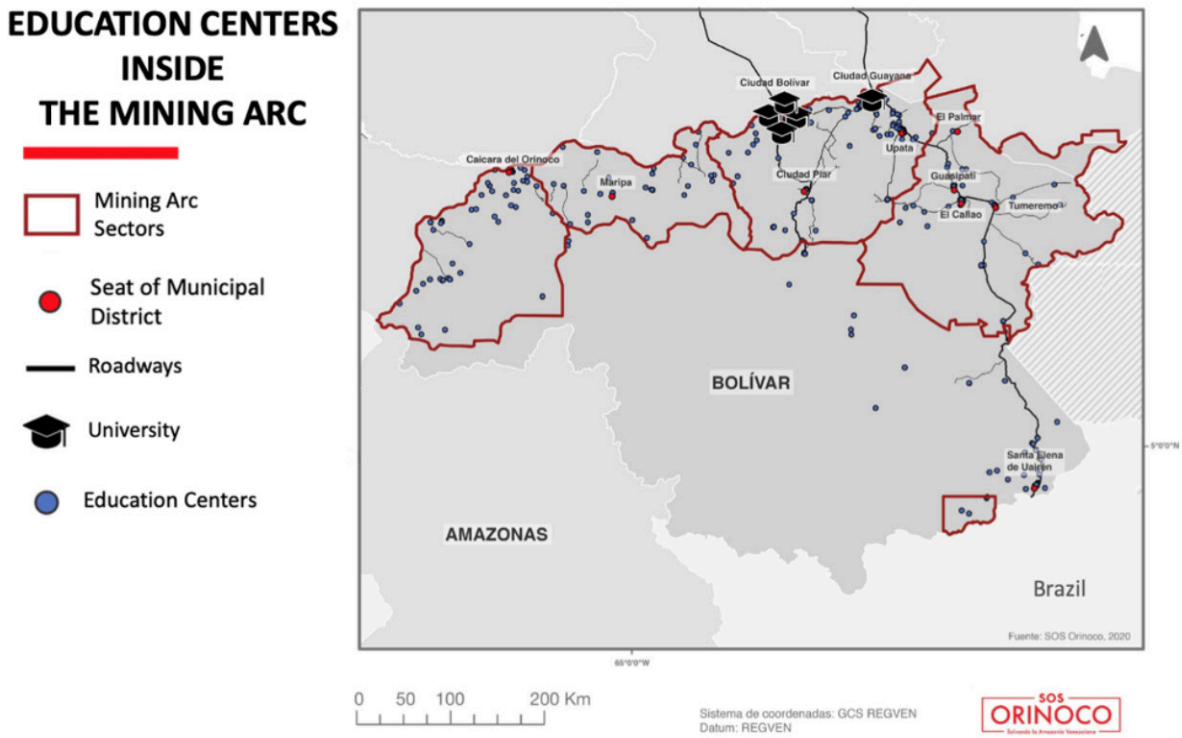


Figure 5. Location of elementary, middle, diversified and university-level education centers in the state of Bolívar.
Source: SOSOrinoco

According to the National Population Census of 2011, the state of Bolívar had a low illiteracy rate, with only 4% of the population aged 10 and over being illiterate. Although some municipal districts, especially those with a larger indigenous or rural population, showed higher levels of illiteracy, as in the case of Sucre municipal district with 21%, Cedeño with 14%, Angostura and Padre Pedro Chien with 8%. The rate of enrollment for the age 7 to 12 group, corresponding to basic education, was 94% in the state of Bolívar in 2011; while for the age 13 to 17 group, corresponding to mid-level diversified education, it was 81% (INE, 2002-2012).

However, the situation today is quite different: According to the Teachers' Guild of the State of Bolívar, at least 88% of public school teachers have quit their jobs and the student dropout rate exceeds 40%. The economic crisis and low wages have forced teachers and students to work in the informal economy or to go work at the gold mines, as economic alternatives that allow them to subsist. In towns such as Santa Elena de Uairén, El Callao, Tumeremo and El Dorado, located near the mining sectors, the dropout rate has reached its maximum. Multiple complaints report boys and girls being taken to the mines to be exploited for their labor or sexually. It has also been reported that during the confinement due to the Covid-19 pandemic, the national education system has practically collapsed due to the lack of conditions appropriate for distance learning classes. In the state of Bolívar there are schools that have been subjected to armed robbery and ransacking by criminals, and schools are in a full state of abandonment, with breakdowns in the delivery of water and electric power, the deterioration of building structures, a severe shortage of school supplies and the suspension of school meal programs (Amnesty International, 2019; Castillo, 2020; Prensa FVM Bolívar, 2019; Siverio, 2019; Siverio et al., 2020; Suniaga, 2020).

Public healthcare services

The network of public healthcare services in the state of Bolívar encompasses approximately 774 establishments (Table 8), including the so-called traditional "outpatient network" (AMB), Consisting of 365 outpatient clinics that are rural (Types ARI and ARII) and urban (Types AUI, AUII and AUIII), 378 low-income clinics (CP) and 16 comprehensive diagnostic centers (CDI) of the Barrio Adentro Mission and 15 hospitals (Types I, II, III and IV) (Figure 6). Of all healthcare facilities, 70% are located in Caroní, Heres, Cedeño and Piar municipal districts (Table 8). The hospitals having the greatest importance and capacity are located at Ciudad Guayana and Ciudad Bolívar.

Municipal Districts	Outpatient Clinics (AMB)	Low-Income Clinics (CP)	Comprehensive Diagnostic Centers (CDI)	Hospitals	Total	%
Caroní	35	159	3	4	201	26
Heres	39	133	3	4	179	23
Cedeño	83	11	1	2	97	13
Piar	33	26	2	1	62	8
Sucre	52	3	1	0	56	7
Angostura	49	0	1	1	51	7
Gran Sabana	35	12	1	1	49	6
Sifontes	16	15	1	1	33	4
Roscio	11	8	1	0	20	3
Padre Pedro Chien	8	6	1	0	15	2
El Callao	4	5	1	1	11	1
State of Bolívar	365	378	16	15	774	100

Table 8. Distribution of healthcare establishments according to municipal districts in the state of Bolívar.
Source: Ministry of the Peoples Power for Health and SOSOrinoco.

The spatial distribution of healthcare establishments (not including low-income clinics) with respect to the MA (Table 9, Figure 6), shows that 242 healthcare facilities (61%) are located inside the boundaries of the MA, while 154 (39%) are located outside. 32% of the healthcare services are concentrated in Block 3, which is where the state's largest cities are located.

Mining Arc (MA)	Healthcare Establishments	%
Block 1	36	9
Block 2	44	11
Block 3	128	32
Block 4	33	8
Ikabarú Block	1	0
MA	242	61
Non-MA	254	39
TOTAL	396	100

Table 9. Distribution of healthcare establishments according to Mining Arc Blocks.
Source: Official data from the Ministry of Health, georeferenced by VE360.

Currently the healthcare services network, from basic outpatient clinics to hospitals, is seriously impaired as a result of the complex humanitarian emergency affecting the country since 2015. While the operation of healthcare facilities is highly compromised, no information is available on the operational status of these services. Many outpatient clinics and other medical facilities are closed or are unable to look after patients due to multiple deficiencies; while other larger capacity establishments are operating at half capacity. This collapse of the public healthcare system has profoundly limited its capacity to provide the population with prevention, care and rehabilitation, thus causing people to suffer serious physical and mental damage, and has resulted in the reappearance of diseases and epidemics that had long been eradicated.

There has been is a severe shortage of medical and nursing staff, as well as a decrease, down to a minimum, of medicines and essential supplies, a breakdown in infrastructure and basic services for hospitals and other establishments in the public healthcare network, a serious limitation in the availability of specialists, low vaccination coverage and an inability to control public health problems such as HIV, tuberculosis or Covid-19 infection, a lack of adequate care for people with chronic life-threatening diseases and an increase in maternal and infant mortality. The outbreaks of diphtheria, measles and malaria that initially spread throughout the state of Bolívar are clear evidence of the inability of the healthcare system to tend to, contain and reverse the health emergency.

Given the lack of official information on the operating conditions of healthcare services, several NGOs are monitoring and denouncing the failures of the health system at the national level. Here are some examples that illustrate the collapse of public health services in the state of Bolívar. Physicians at the Raúl Leoni Hospital at Guaiparo, in the city of San Félix, Caroní municipal district, denounced the death of more than 100 patients due to the lack of supplies in the first two months of 2018. They report a shortage of antibiotics, the closings of operating rooms, the lack of laboratory reagents and blood-derived substances. Starting in early 2018 the hospital went into technical shutdown due to massive resignations by doctors.

At the Menca de Leoni Pediatric Hospital, an annex to the Raúl Leoni Hospital, six newborns died in February 2018 following a 24-hour power blackout. The hospital's power plant was damaged and the neonatal units where the babies were being given artificial respiration were left without electricity. The hospital also has unsanitary problems because the sewage is overflowing and seeping. The drug deficit is greater than 90%, and the equipment is outdated and has received no maintenance in more than 10 years (Transparencia Venezuela, 2018).

At the Ruiz y Páez Hospital in Ciudad Bolívar, the doctors denounced the shortage of personnel and supplies, which makes it impossible to give medical assistance. Patients have to obtain all the necessary supplies on their own; in cases where surgery is required, they must bring with them sterile gauze, solutions and even anesthetics. Many people cannot afford medical supplies or tests, resulting in no treatment being given at all, and a deterioration in the condition of patients that end up dying from preventable causes (Buada, 2019).

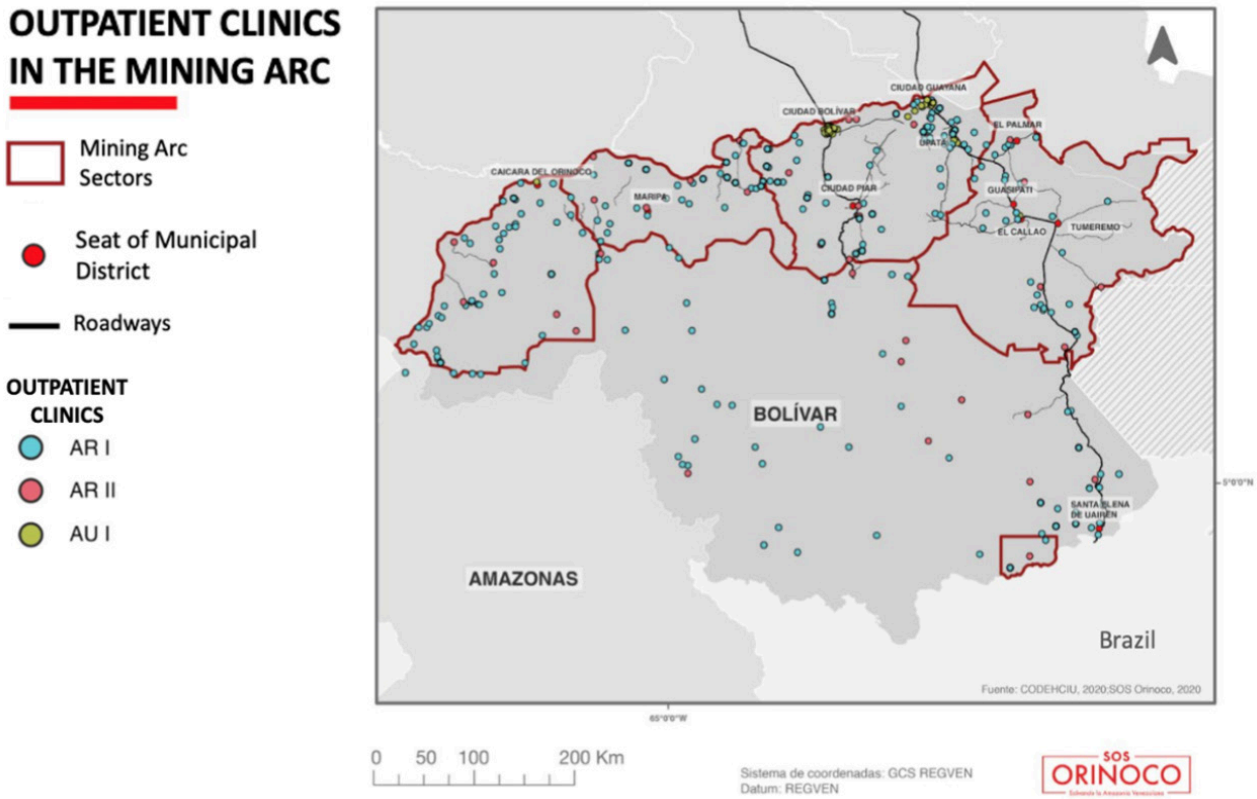


Figure 6. Location of outpatient clinics in the Mining Arc.
Source: Data from official VE360 georeferencing, modified by SOSOrinoco.

Chapter 2

The mining situation in Bolívar

Chapter 2

The mining situation in Bolívar

Following the financial debacle of 2008 and the subsequent drop in oil prices, the Hugo Chávez regime turned to the extraction of other minerals in order to compensate for the considerable decrease in oil revenues when the price of a barrel of oil went from USD 88.42 in 2014 to USD 44.65 in 2015. According to the BCV (2019), in 1999 the exportation of goods and services associated with the oil industry represented 76% of Venezuela's export, at a time when 3.1 million barrels of oil were produced per day (BOPD); in 2005, it reached 86% and in 2015 it rose to 98%. By October of 2020 Venezuela's oil production was around 400,000 BOPD, a reduction of 90%, in relation to 1999 (Infobae, 2020).

This former chief executive turned to the exploitation of minerals such as gold, diamonds and a metallic mineral called columbite-tantalum or coltan, thus starting a rampant fever for mining in Venezuela that included the reform of the legal regulations on this matter, the creation of joint ventures (national and international), the incursion of the Armed Forces through the Military Mining, Oil and Gas Industries Corporation (CAMIMPEG) in a totally unknown activity that was foreign to them, and the creation in 2016 of the Orinoco Mining Arc National Strategic Development Zone, better known as the Orinoco Mining Arc (we will use the acronym MA to refer to it) (Decree No. 2.248).

In Figure 7 one can see that the MA is divided into 4 Areas (although, at the time of its announcement over an obligatory national radio and TV simulcast on 24 February 2016, Nicolás Maduro also announced a special block in the Icabarú River basin[13] consisting of 1754 km², which did not appear in the Official Gazette).

This point deserves clarification since the Mining Arc is usually represented by official sources as spaces made up of 4 sectors, identified interchangeably as "Areas" or "Blocks"[14] and in fact Decree 2.248 only describes these 4 sectors. However, we know that in reality there is a fifth Block, which we call the Icabarú Special Block (Block 5), whose coordinates were provided by internal sources at the Ministry for Ecological Mining Development, and which was announced by Nicolás Maduro in a public address, and recorded by the official written media,[15] and which we will transcribe below: "The Chief of State explained that Orinoco Mining Arc consists of four blocks: Area 1, (...) To them has been added the Special Icabarú Block, with a surface area of 1,754 km², with an abundant presence of diamonds and gold, added the Nation's Chief Executive, also adding that the Orinoco Mining Arc has a total area of 111,846 square kilometers." Knowing that the policies of the Maduro regime are known but rarely put in writing in the Official Gazette, we consider it necessary to include Icabarú as an integral part of the Mining Arc. On this website one can see the Ministry of Energy and Mines map of the MA that includes this "Block 5," located in Icabarú river basin, in the southern part of the state of Bolívar, close to the border with Brazil, and geographically separated from the rest of the Mining Arc, which is situated to the north. This main part of the Mining Arc, located to the north, consists of Blocks 1, 2, 3, and 4, contiguously arranged in a line, occupies the northern part of the state of Bolívar, encompassing part or all of the municipal districts of Cedeño, Angostura del Orinoco (formerly Heres), Sucre, Angostura (formerly Raúl Leoni), Caroní, Padre Pedro Chien, Sifontes, El Callao, Roscio, Piar and Gran Sabana, and a small portion of the state of Delta Amacuro, with its municipal districts of Antonio Díaz and Casacoima.

[13] https://issuu.com/correo_del_orinoco/docs/co2303
[14] Please see http://www.desarrollominero.gob.ve/zona-de-desarrollo-estrategico-nacional-arco-minero-del-orinoco/
[15] Please see page 2 at: https://issuu.com/correo_del_orinoco/docs/co2303

The MA covers an area of 111,843.70 km² (approximately 12.2% of the Venezuelan continental territory), of which only 5% (5,592 km²) is the total area eventually usable for extractive mining[16]. Of the total area of the MA, 1.5% pertains to what would be exploited in the first phase of the project (1,676.65 km²), that is to say, an area greater than the state of Vargas. The 4 Blocks or Areas of the MA have been given the following names: Juana La Avanzadora (Block 1 with 22% of the area of the MA), Manuelita Sáenz (Block 2, with 15%), Negra Hipólita (Block 3, with 26%), Josefa Camejo (Block 4, with 35%). Aside from these, the Chief Executive has made reference to a "Special" Icabarú Block, which we will call Block 5 (2%) here. These blocks, when going from 1 to 5 consecutively, will appear on the map in clockwise fashion, going from west to east, as in Figure 7.

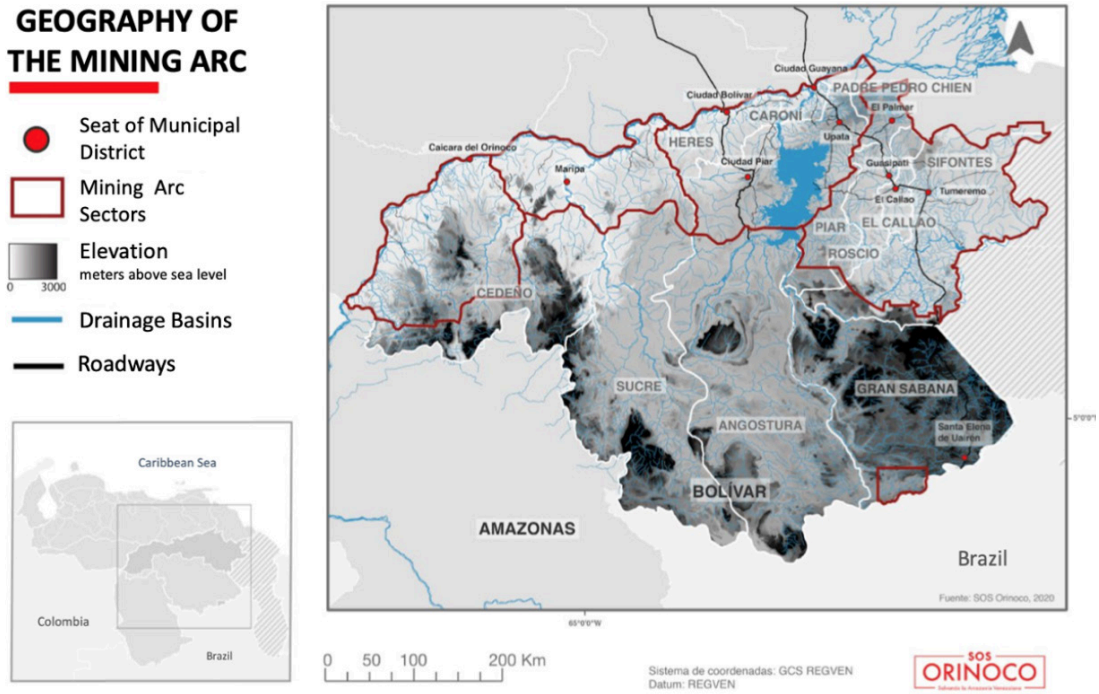


Figure 7. Municipal Districts in the Mining Arc.
Source: SOSOrinoco

The Mining Arc project is being implemented, in the midst of a situation of high physical and legal insecurity as well as political opacity, under a strategy based on establishing alliances with small-scale mining operators, which has yielded substantial results for the regime, and, in parallel fashion, by means of the application of a mechanism of mixed partnerships with mining companies, with a participation of 55% of shares for the State and 45% for the private companies, whether national or foreign. While at the same time, within its almost 112,000 square kilometers, other measures have been carried out, such as the creation of special zones, consisting of "areas designated for mining use and eco-socialist development" (AUMDE) (Decree No. 3188 of 6 December 2017, and the installation of gold processing plants that make use of cyanide leaching, supposedly to replace private mills, allowing the regime to centralize of an important part of the gold production. TThe strategic partnerships with small miners have been designated specifically for obtaining gold, as well as diamonds but in smaller volumes. Meanwhile, the matter related to the creation of joint ventures has been carried out for the purpose of extracting mineral resources such as coltan, which in some cases also includes gold and diamonds[17]. The State, through its Corporación Venezolana de Minería (CVM) and Minerven, has partnered with Palestinian, Turkish, Russian, Iranian, Canadian, South African and Chinese companies, as well as others. Nevertheless, the information relating to mining activity by these players in the MA has not been made public, except for the occasional company that works with coltan (Figure 8).

[16] This fact lends evidence suggesting that the original intention of the political reach of the Mining Arc was not just limited to matters pertaining to mining. Then, why is it that 95% of the MA encompasses spaces that are not inside areas having known potential for mining?

[17] http://www.desarrollominero.gob.ve/category/noticias/page/29/

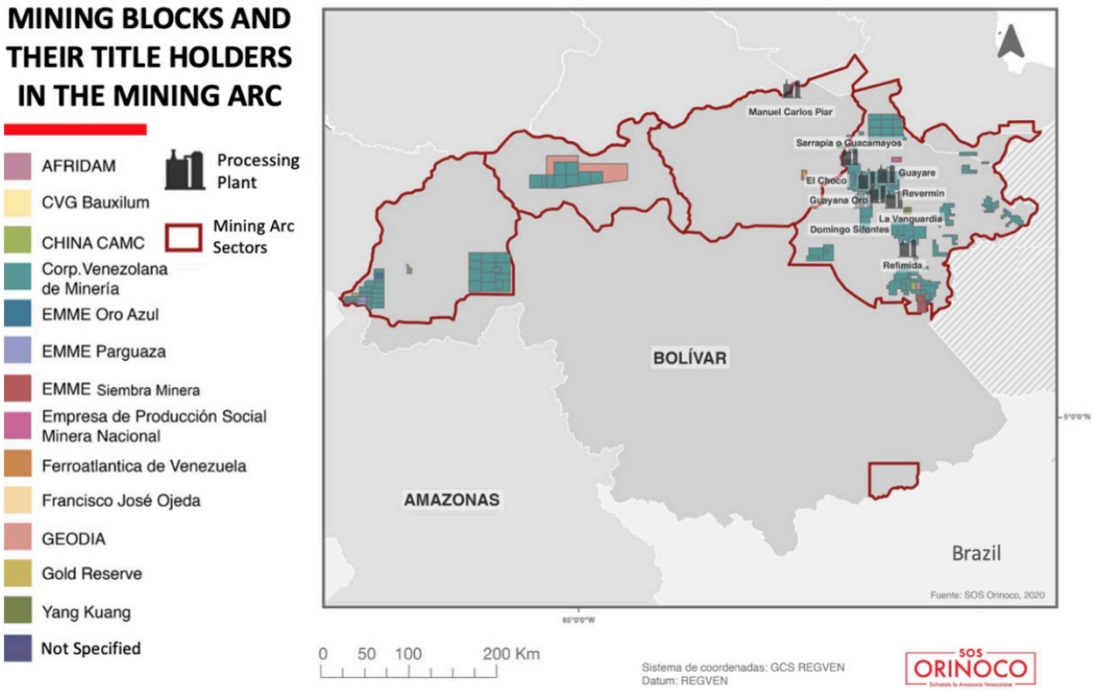
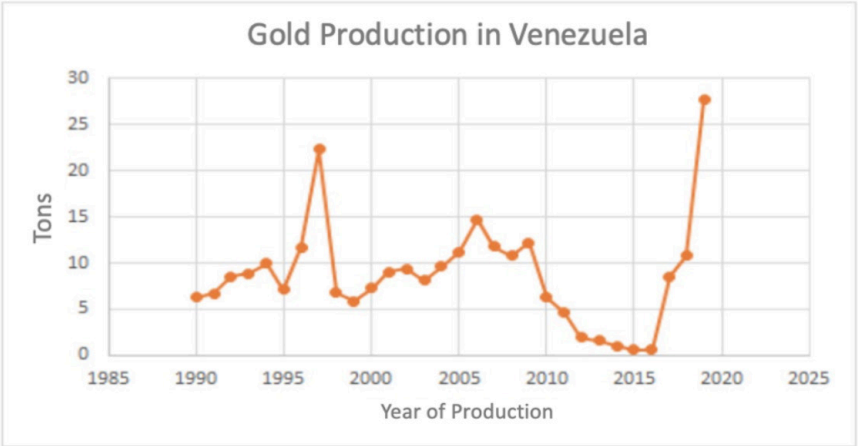


Figure 8. Location of mining blocks, or plots, and their respective title holders in the Mining Arc.
Source: official documents and georeferencing by VE360 and SOSOrinoco.

Ever since 2016, when the petty cash and slush funds derived from converted PDVSA assets was depleted, the path being followed by the Maduro regime for obtaining financial resources has been the extraction of gold and other minerals, together with the sale of central bank gold reserves that are traded for commodities and payments in kind. This extractive activity, which has been carried out under minimal fiscal and institutional control, in addition to having sidestepped the need for approval by the Legislative Branch, has served the regime for the purpose of staying in power and "sharing the pie" with the military and other Chavista-Madurista stakeholders (for example, certain merchants of Arabic origin). Current gold production (year 2019, pertaining to the most recent data) is 27.8 tons[18], the highest figure that has been recorded in the last three decades (Figure 9).



Based on data obtained from: Ministry of the People's Power for the Development of Ecological Mining 2019; Mariño, Noel. Minería en Guayana: Situación actual, potencial, crisis e inseguridad. July 2015; and Gold.org. Production as of 30 June 2020.

Figure 9. Gold Production in Venezuela (1990-2019).
Source: Gold Hub.

[18] https://www.gold.org/goldhub/data/historical-mine-production

Since 2017, the total volume of official gold in the country has been provided by small-scale mining, according to information published on the website of the respective ministry. Gold miners are paid in bolivars (Venezuela's national currency, which has broken the world records for devaluations)[19]. But the government, through the Central Bank of Venezuela (BCV), which acts as a banking agency that answers to the Executive, makes the conversion into foreign currency, thus generating good "business deals," considering that during these past few years the price of gold has been anywhere between USD 1,500 and USD 2,000 per troy ounce (oz t)[20]. If, for instance, we took the price of gold[21] on 8 January 2021, which was USD 59,900.32 per kilogram, and multiplied it by a hypothetical 27.8 tons produced in 2019, the result would be USD 1,665,228,896. This is no negligible figure, especially when compared to the 2010-2016 period, when the annual average production of gold was only 2.36 tons (specifically in the years 2014, 2015 and 2016 it was 1.0 tons, 0.6 tons, and 0.6 tons respectively). In addition, it must be considered that the main gold producer at that time was the state-owned company Minerven, which had to meet payroll obligations, including payment of socio-economic benefits to its employees. However, on a macroeconomic scale, theoretical payments to the treasure derived from current gold production would not offset the oil industry's shortfalls, and this is on the order of tens of billions of dollars.[22] The strategy of extracting gold, and also diamonds, coltan, copper and silver (and perhaps other minerals) has enabled the regime to raise funds for political and strategic dealings with allied sectors, and not for serving the country during its critical collapse or for responding to the needs of the people. Furthermore, social and political players from the Guayana region, as well as scholars knowledgeable of the reality of precious minerals in Venezuela assume that the reported data on the country's gold production reflects only a fraction of what is really being extracted. Some of them estimate the official figures to be only between 15 and 30 percent of what is actually produced.[23] Some presume that the rest will go directly into the hands of those running that business, mainly active military, members of the regime's hierarchy and associates. This assumption is difficult to refute, in a country with a collapsed and unproductive economy, with evident signs of wealth belonging to an elite that currently, especially between the years 2018 and 2021, has been ostentatiously purchasing real estate in exclusive Caracas neighborhoods, and in nature preserves (Galipán sector of El Ávila National Park and Los Roques Archipelago National Park)[24], building or remodeling sumptuous homes, inns, office buildings and shopping centers. Particularly among architects and interior decorators, one hears comments about payments on the order of hundreds of thousands of dollars per real estate unit, which are being made for remodeling and building homes, especially in Caracas, for high-ranking officers of the Armed Force.[25]

Meanwhile, the regime now has the option to conduct international negotiations by periodically drawing from its gold supply in order to execute another line of political economic action: the silent and illegal sale, without the approval of the National Assembly (NA), of the international reserves, held in gold bullion in the Central Bank of Venezuela (BCV) and in banks located abroad. The Maduro government can thus obtain funds that will allow it to provide, in a precarious way, supplies such as gasoline, which the country needs urgently (Infobae, 2020). In the years 2013 and 2019, investigations by the NA, the mass media and NGOs became known to the public. This had to do with gold bullion that had been officially shipped to Turkey using that country's airline, and it was reported, along with evidence, that the BCV had illegally shipped out 73.2 tons, 7.4 tons (Insightcrime.org

[19] https://www.milenio.com/internacional/latinoamerica/ruta-oro-venezolano-gobierno-convierte-billetes-lingotes

[20] One troy ounce equals 31.1034768 grams.

[21] https://www.preciooro.com/cotizacion-oro.html

[22] https://www.semana.com/internacional/articulo/cuanto-cayeron-los-ingresos-petroleros-de-venezuela-en-los-ultimos-anos/301902/

[23] http://transparencia.org.ve/oromortal/project/el-oro-venezolano-se-funde-entre-la-ilegalidad-y-la-muerte/ Accessed on 27 NOV 2020

[24] https://cronica.uno/construcciones-de-mansiones-en-galipan-avanzan-sin-respetar-el-plan-de-ordenamiento-del-parque-nacional-el-avila/ Accessed on 14 DEC 2020.

[25] Infobae América: Quiénes llevan una vida de lujo y confort con dólares cash en una Venezuela en la miseria y cómo lo hacen

2019) and 1.2 tons[26] of Venezuelan gold. Turkey, the United Arab Emirates and Uganda were the recipients or were otherwise involved. What is certain is that these obscure international sales as well as internal transactions for obtaining foreign currencies, in addition to all the mismanagement, have resulted in having the 372.9 tons of gold that were in the international reserves in 2011 dwindle down to 98 tons in August of 2020, including the 32 tons that are on deposit in the Bank of England (Reuters, 2020).

There is apparently much improvisation in the regime's mining policy and international transactions, with an apparently anarchic dynamic, questionable legal foundations and a reality characterized by mining with high environmental and socio-cultural impact, especially affecting protected natural areas and indigenous territories (protected by Law). But an objective and dispassionate analysis shows that the regime has been following a very well-designed strategic script. It starts with an intensive recruitment process, with populist demagogy, to quickly start mining activities, seeking to form an "army" of miners, together with private allies (who finance the execution of the works involved). From the beginning, people have their eyes set on the gold, whose history dates back to the mid-19th century, in the very same region that is today the heart of the MA, the El Callao-Cuyuní River basin corridor, where gold mining was at its peak by the beginning of the 20th century, with participation by European companies. In the case of diamonds, this goes back to the time of mining adventurers, who in the first decades of that century ventured into the southern part of Bolívar and who, in the middle of the upper Caroní and Cuyuní river basins, began to extract precious minerals and ended up founding towns in those previously wild and remote territories.

The challenge faced by the regime today is having to control mining activity amidst complex situations where there is a convergence of Venezuelan miners, experienced as well as beginners,[27] iincluding foreigners. That is how, shortly after the MA was created, in February of 2016, armed criminal groups emerged, the so-called "syndicates" led by "pranes," as criminal bosses released from Venezuela's prisons are known, along with their lieutenants and soldiers, some with prior experience in the area, especially in El Callao between 2011 and 2015, as well as drug traffickers. That is how a particular socio-cultural impact to informal mining areas deepened, along with prostitution and children evidently dropping out of school. At the top of the pyramid of control are the regime's politicians, particularly the state governor, active military personnel, and some multi-skilled "merchants" (gold traders). And to top things off, the regime has brought in, in a macabre outsourcing agreement, Colombian guerrilla groups consisting of the FARC and ELN, who act under political accords with the regime,[28] to help control the mining areas and to counter, whenever appropriate, other armed gangs that the regime itself had previously allowed to move in.

This has even been confirmed by the report published by the Office of the United Nations High Commissioner for Human Rights (UN, 2020), which states that "People who work in the Orinoco Mining Arc region in Venezuela are trapped in a generalized situation of labor exploitation and high levels of violence by criminal groups that control the mines in the area." This report states that criminal groups, known locally as "syndicates" (a term whose origin comes from the action of labor syndicates, or unions, that formerly operated in the basic industries of Ciudad Guayana and later evolved into violent mafia groups), exercise control over a large number of mining operations in the MA, through a system of corruption and bribery that includes commanders of the Venezuelan Armed Force. These groups "decide who enters or leaves the mining areas, impose rules, apply cruel physical punishments to those who break these rules and derive economic benefits from all activities in the mining areas, even resorting to extortion practices in exchange for protection."

[26] https://oroinformacion.com/el-oro-de-venezuela-sigue-saliendo-ilegalmente-hacia-turquia-a-traves-de-aerolineas-comerciales/ Accessed on 15 DEC 2020.

[27] A considerable number of miners have arrived at the mines from elsewhere in the country as a result of the Complex Humanitarian Crisis facing the country. Among them, one sees long lines of teachers who have quit their jobs as teachers in the states of Bolívar, Anzoátegui and Guárico, as well as other places in the country such as Valles del Tuy and the nation's capital, Caracas. They have started to work at the gold mines as a way to earn a living wage, trying to mitigate the effects of the high cost of living, and hyperinflation, that is drowning Venezuela's economy.

[28] For more details about this alliance between the government and the guerrilla groups, please consult our report on Yapacana National Park. https://sosorinoco.org/es/informes/la-mineria-aurifera-en-el-parque-nacional-yapacana-amazonas-venezolano-un-caso-de-extrema-urgencia-ambiental-y-geopolitica-nacional-e-internacional/

Migration to the mining areas of the MA has increased significantly in recent years. According to the report of the Office of the United Nations High Commissioner for Human Rights (UN, 2020), the interviewees reported that since 2016 there has been an increase in prostitution, sexual exploitation and trafficking in persons, including adolescents. They also indicated that criminal groups apply cruel punishments to those who do not comply with the imposed rules, which include severe beatings, shooting in the hands or mutilation of limbs and outright murder. The same report indicates that in the last four years acts of violence have been reported due to disputes over the control of mines, which have caused some 149 deaths. Security forces are known to be involved in some of these incidents. It is also noted that mercury poisoning seriously affects miners and criminal groups, since it is commonly used for isolating or separating the gold. In the same way, workers and the population residing in mining areas have been affected, as they breathe toxic gases emitted during the referred process (UN, 2020). Finally, it is emphasized that illegal mining violates the individual and collective rights of indigenous peoples, since it destroys their habitat and deprives them of control of their territories and means of subsistence (UN, 2020).

Suppressed titles and mining rights

With the execution of the MA, the changes that occurred in the matter of mining law in Venezuela in the period 2011-2016 became evident, especially after Hugo Chávez enacted, in the Council of Ministers, the Decree with the rank, value and force of Organic Law that Reserves for the State any Gold Exploration and Exploitation Activities, as well as activities related and ancillary to these (Decree No. 8.413, Official Gazette No. 39.759 of 16 September 2011, also known as the Gold Nationalization Law or Decree). This had a direct impact on modalities of exploration, extraction and use of mining resources, particularly on concessions, now cancelled or suppressed.

To understand the change caused by the entry into force of this decree, it is necessary to address the legal structural part and for this purpose we will rely on authors who have analyzed the subject, especially an article by attorney Alejandra Figueiras published in *Revista de Derecho Público.* The first thing to note is that, upon enactment of this normative document, known as the Gold Nationalization Decree, the ownership of the gold mines themselves was not altered, since all the mining deposits within the national territory belong to the Republic, are assets of the public domain, inalienable and imprescriptible, according to the Constitution (in following with Venezuela's long legal tradition for mining). The substantial modification introduced by this instrument with the rank of organic law consisted of exclusively reserving the exercise of mining activities to the State. According to the Mining Law, still in force, the exploration, extraction and use of mining resources shall be carried out by the National Executive directly, as well as by private sectors, to which concessions or authorizations will be granted. As a consequence of the aforementioned Decree, the primary and ancillary activities related to dealing in gold shall be carried out only through two channels: 1) The Republic, directly or through its public institutes, or companies of its property, or subsidiaries of this. 2) Joint Venture Companies, in which the Republic, or any of the aforementioned public bodies that have "control of its decisions and maintains a participation greater than fifty-five percent (55%) of the capital stock" (article 5 of the Decree). The primary activities are, for these purposes, the exploration and exploitation of gold mines and deposits and the related and ancillary activities, the storage, possession, benefit, transportation, circulation and internal and external commercialization of gold (Figueiras 2012). A third option was added in 2015, which we will describe later.

It should be taken into account that the methodology of the Gold Nationalization Decree is very similar to that used in 2007 for hydrocarbon exploration and exploitation activities, and the forced migration of mining concessions and contracts over to joint ventures (in that case, oil operations agreements). For the process of the migration of mining operations, the aforementioned Decree established certain deadlines within which the holders of concessions, contracts or authorizations relating to mines, at the time of the validity of the regulations

(published in September 2011), are to be summoned to negotiate, with a commission designated by the Venezuelan State, the conditions pertaining to the incorporation of the joint partnerships. After these periods have elapsed, the concessions, the authorizations for the exercise of small mining and the contracts for the exploration and exploitation of gold that existed as of that date, would expire, whether or not their holders agreed to the incorporation of a joint partnership or reached any agreement in that regard. “In the first case, the mining titles would expire by agreement between the parties, for the purposes of the migration; in the second, by right, as a result of the negotiation period having transpired without having reached an agreement.” (Figueiras, 2012).

As a reference, in the text of the Decree it was established as a form of compensation for the holders of mining rights that: “The percentage of the unamortized investments of the concessionaire or the beneficiaries of contracts for the exploration and exploitation of gold, on the goods whose ownership is transferred to the Republic, as a consequence of the expiration provided for in this Decree Law, shall be compensated according to their book value, provided that said investments have been duly notified to the competent body or entity, within the framework of the exploitation plan for the concession or contracts for the exploration and exploitation of gold.” (Article 16 of the Gold Nationalization Decree). Thus, following the application of this decree, there have been no concessions awarded relating to gold matters in Venezuela.

However, for the year 2015, the aforementioned regulations were subject to some modifications, the most significant being the incorporation of the so-called strategic minerals (diamonds, copper, silver, niobium and tantalum, the latter two known as coltan), which were now given the same treatment as gold-bearing ores (Figure 10). All these minerals came under the modality of exclusive use of the State directly or through the formation of joint ventures, with the State having majority control over the shares. This, embodied in Decree No. 2.165, published in Official Gazette No. 6.210 Extraordinary dated 30 December 2015, by means of which the “Decree with the Rank, Value and Force of Organic Law that Reserves for the State the Activities of Exploration and Exploitation of Gold and other Strategic Minerals.” In article 10 of this decree, a third form is added to the two modalities “concerning the exercise of mining activities” that were specified by the Decree of Nationalization of Gold: “... 3) Strategic alliances formed between the Republic and production units, socio-productive organizations, partnerships and other forms of production allowed by law, which will be oriented towards small mining operations, duly registered in the Unique Mining Registry, with prior authorization granted by the Ministry of the People’s Power with competence in mining matters.”

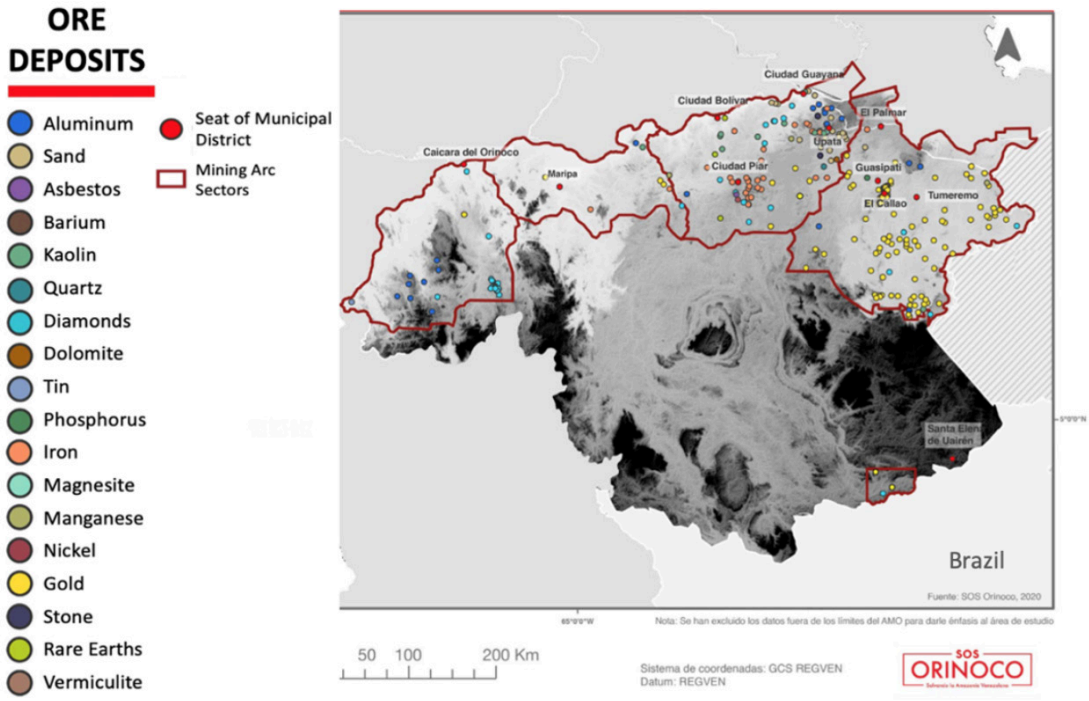


Figure 10. Location of metallic and non-metallic ore deposits identified in the state of Bolívar.
Source: USGS

In Decree No. 2.165, the last in this saga to nationalize mining activity, it is established that for the companies designated to carry out the activities defined therein, the competent Ministry will delimit an area for the exercise of primary activities for a maximum of 20 years, extendable for a maximum of 2 periods of up to 10 years each (Article 20). While small-scale mining is assigned an area of no greater than 25 hectares and the time stipulated for the activity will be established in the respective exploitation authorization, and cannot be more than 10 years, extendable for a maximum of two periods of 2 years each. (Article 23).

Another relevant aspect of this regulation, derived from Decree No. 8.413, is that the commercialization of gold is to be monopolized, and is assigned to public entities designated for this purpose. The State, in this way, obligates the producing companies to sell and deliver all the gold production to the Republic, through the Central Bank of Venezuela (BCV). Before that Decree (the Nationalization of Gold) entered into force, the producing companies were able to export a certain amount of gold, while selling part of it to the BCV. (Figueiras, 2012).

Thus, the Nicolás Maduro government established the essential "legal" basis for what has been the mining policy for the Mining Arc, establishing the supremacy of the State and the mechanisms of association with third parties, excluding the modality of concessions as a system for exploration and subsequent exploitation.

In this research we have generated maps of the mining plots within the MA and the type of mineral resources that are extracted in each one of them. We have also calculated the surface area of the plots of the Areas for Mining Use and Eco-Social Development (AUMDE) established by the Maduro regime by way of decree, within the Orinoco Mining Arc (Figure 11). There is little information on mining activity taking place there due to official secrecy, but what is evident and public, according to government sources themselves, is that small-scale miners are the Nation's gold suppliers,[29] which reflects the scarce activity by participating mining companies. This panorama contrasts with what was happening before the implementation of the Gold Nationalization Decree (September 2011).

[29] In 2018, the then minister, Victor Cano, said, "...From small-scale mining we have delivered 16.4 tons of gold to the Central Bank of Venezuela. We are following instructions from President Nicolás Maduro to begin in 23 areas that have been approved for mining in the Mining Arc, in order to push forward the Bolivarian Economic Agenda."

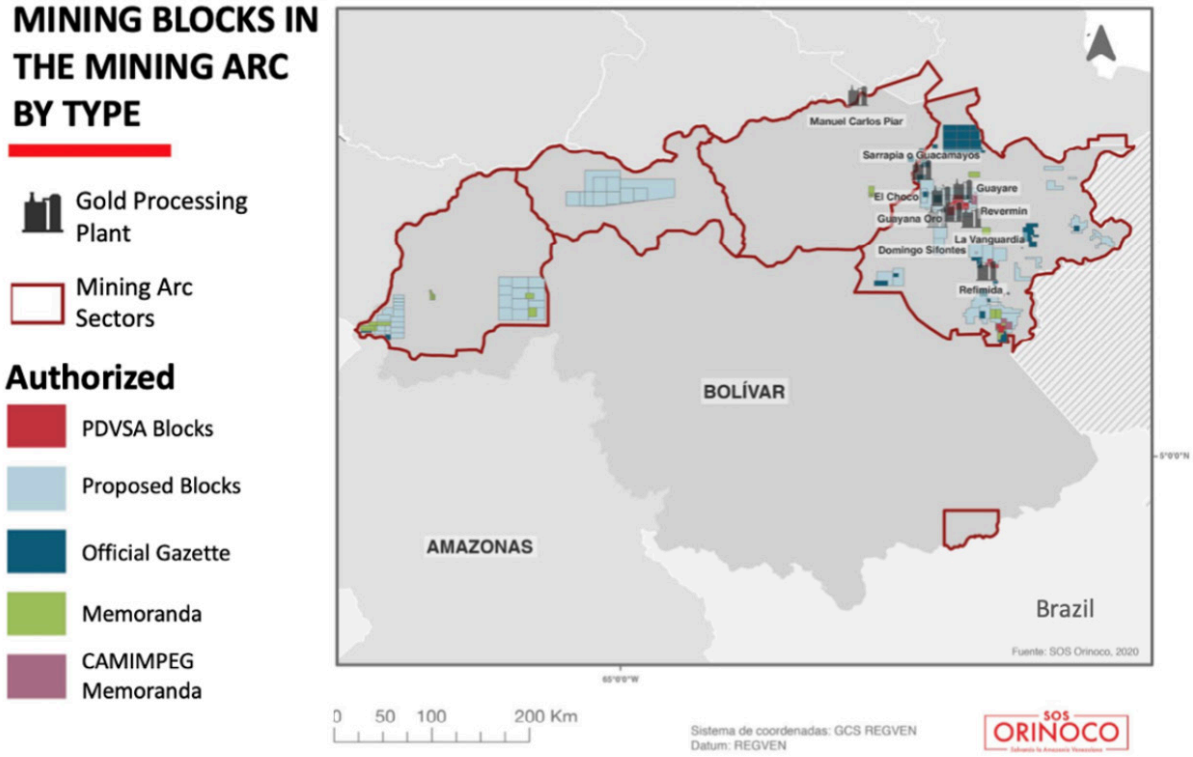


Figure 11. Location of mining blocks and plots based on current status of concession awards.
Source: SOSOrinoco.

Prior to that date there were concessions and the mining companies were active, they had a significant role within that economic field with payments to the Treasury (although since 2008 they have been gradually decreasing). By that time, almost all the multinational mining companies had left the country. Since then, in the gold and diamond areas of the state of Bolívar, the execution of mining operations by the so-called “small miners, also known as “informal miners” has predominated, and they act without having access to proper geological studies or plans for the exploration and exploitation of mines, much less environmental and sociocultural impact studies, as required by legal regulations. Incidentally, in the few cases where such documents exist, there is no form of public access to that documentation. This scenario was accentuated when the MA came into force, and this has been a turbulent and not very transparent process, despite the fact that the ministry overseeing the sector added a gateway for presenting mining projects on its website. In this context, the controls carried out by criminal groups, including the guerrilla groups, are intensified, and their modus operandi includes the collection of “vaccines” (protection money) from miners well as from all those who participate directly and indirectly in mining activities, for example suppliers of groceries or truck drivers, among others.

From the very moment the creation of the MA was announced, expectations were created for small miners concerning their ability to work at the mines without having problems with the State, given that the Ministry of the Environment, through its environmental watchdogs, had previously been restricting small-scale mining activity, and they were now being led to believe that they were now becoming “legal” miners. The mechanism offered by the Ministry of Ecological Mining (2016) consists of: 1) Encouraging miners to organize themselves into mining brigades, as established in the Decree for the Nationalization of Gold. 2) Having them register in the so-called Unique Mining Registry (RUM), also contemplated in Decree No. 8.413 of 2011. 3) Having them sign the so-called Strategic Alliance with the Government. 4) “Once the miner or mining company has signed the strategic alliance, they must then go to the Ministry for Eco-socialism to be issued their permits for mining projects.”

"We, at the Ministry of the Environment, basically grant two permits, as these are strategic minerals and it is a national policy, we grant one permit for occupation of the territory, which is granted over an area of 5 to 25 hectares, and one for having an effect on natural resources, specifically for the delimited area that will be affected by the related infrastructures for the mining project," thus stated, in an interview in October 2018, Johnny Sucre, the then representative of the Ministry of Eco-Socialism (MINEC), formerly the Ministry of the Environment, in the state of Bolívar.[30] In April 2019, Franklin Ramírez, who served as Vice Minister for Exploration and Eco-Mining Investments at the Ministry of Ecological Mining Development, after holding a meeting with MINEC officials stated that "with small mining, a methodology has been designed that allows compliance with all the procedures for obtaining permits for the occupation of territories, and for effects on natural resources. A plan for approaching this, has been agreed upon with the MINEC for proceeding with environmental impact studies and the consequent environmental impact permits. We have been doing this work by blocks, and through the people's organization that has been made available to us through the People's Mining Council, for the purpose of improving the environmental performance of mining organizations."[31] However, the aforementioned MINEC-Bolívar official, Johnny Sucre, pointed out in October 2018 that MINEC "... has granted more than 20 authorizations for mining activities in the MA, of which most pertain to strategic partnerships signed for the purpose of installing plants for processing gold-bearing residual sands using cyanide leaching technology."[32] Twenty authorizations is too low a number if we take into account the fact that the spokespersons from the People's Mining Council, an organization belonging to the "People's Power," an ally of the Maduro Government in the MA plan, have stated that they represent more than 100,000 miners from the state of Bolívar.[33] And if we take into account that gold production in the years 2017, 2018 and 2019 was 8.5 tons, 10.8 tons and 27.8 tons, respectively, all provided by the small-scale miners, since there is no doubt that this population is extracting gold mostly without environmental authorizations given the small area that the MINEC delimits for these cases in its administrative acts versus the high volume of gold-bearing ore that is being extracted. In other words, illegal mining prevails, in addition to the fact that it is not known whether there is any field supervision of the mining sites, in a region where the Areas Under the Special Administration Regime (ABRAE's) still exist and are supposed to enforce restrictions and regulation.

The third Minister of Ecological Mining Development, Víctor Cano, stated that 946 strategic alliances had been signed between the ministry and the small miners by May 2019.[34] When the Mining Arc strategy began in 2016, the Maduro government said that it would open the mining spectrum to private capital, announcing that more than 150 companies from 35 countries would participate to develop projects, forming joint ventures where 55% or more of the shares were to belong to the Republic, while private companies (which could be Venezuelan or foreign) were to own the rest of the shares.[35]

Always adhering to the principle that "the State never gives up mining rights, and maintains 100% of the ownership."[36] But the reality has been that few projects have been defined, or work has not been started on these project; far removed from these aforementioned numbers, for 2019 there were only 17 projects in partnership with private sectors and countries such as Turkey, Canada and Palestine, such that the number of mining plots that can be seen graphically on the maps does not necessarily reflect reality.

A separate case is that of the plots at Las Cristinas and Brisas, the most sought-after fields in the Guayana region, which were negotiated with the Canadian company Gold Reserve Inc., and their exploitation was agreed upon in association with the Venezuelan State, after Venezuela had lost the case in an international

[30] http://www.desarrollominero.gob.ve/category/noticias/page/18/ Accessed on 23 DEC 2020.

[31] http://www.desarrollominero.gob.ve/venezuela-fortalece-metodos-de-control-ambiental-a-empresas-mineras/ Accessed on 2 JAN 2021.

[32] http://www.desarrollominero.gob.ve/category/noticias/page/18/ Accessed on 23 DEC 2020.

[33] http://www.desarrollominero.gob.ve/mas-de-150-mil-mineros-apoyan-arco-minero-del-orinoco/ Accessed on 11 DEC 2020.

[34] https://www.vtv.gob.ve/1000-alianzas-arco-minero/ Accessed on 16 JAN 2021.

[35] http://transparencia.org.ve/oromortal/project/el-oro-venezolano-se-funde-entre-la-ilegalidad-y-la-muerte/ Accessed on 23 JUL 2020.

[36] http://www.desarrollominero.gob.ve/zona-de-desarrollo-estrategico-nacional-arco-minero-del-orinoco/ Accessed on 17 NOV 2020.

arbitration proceeding.[37] Starting in 2017, the "Empresa Mixta Ecosocialista Siembra Minera," was created, with 55% participation by the State and 45% by the transnational company. The joint venture plans to exploit more than 18,000 hectares of gold, silver and copper deposits in Area 4 of the Mining Arc over a period of 40 years.[38]

Other cases that became public and notorious (on radio and television channels) since the MA was announced, are those of two companies from China and one from Congo that were part of the integration of the joint ventures together with the Venezuelan State: CAMC Engineering Co. Ltd. and Yankuang Group Company Ltd, plus the Congolese company Afridian. The former was authorized to explore for and exploit coltan (columbite/tantalite) in a mining plot delimited by the State in the Cedeño municipal district, in Area 1. The latter, Yankuang Group, was allowed to deal with gold in the Sifontes municipality, Area 4. The African company signed a document of agreement for the mining activities related to coltan and diamonds in Area 1, and to gold in Area 4 of the MA[39] (Table 10).

Joint Enterprise or Partnership	Venezuelan Government Corporations	Joint Venture Partner (Country)	Type of Partnership	Mineral Resource	Purpose
Empresa Mixta Minera Ecosocialista Siembra Minera	Corporación Venezolana de Minería, S.A. (CVM)	Barbados Mining, Inc. / Gold Reserves, Inc. (Canada)	Joint Venture Partnership	Gold	To develop exploration, extraction and commercialization activities, and activities connected with gold deposits, in Gold Area 25, Sifontes municipal district, Area 4 of the MA.
Empresa Mixta Minera Ecosocialista Oro Azul	CVM	Supracal, C.A. (Venezuela)	Joint Venture Partnership	Coltan	To develop exploration, extraction and commercialization activities and, activities connected with coltan deposits, in Coltan Area 15, Cedeño municipal district, Area 1 of the MA.
Empresa Mixta Minera Ecosocialista Parguaza	CVM	Corporación Faoz, C.A. (Venezuela)	Joint Venture Partnership	Coltan	To develop exploration, extraction and commercialization activities and, activities connected with coltan deposits, in Coltan Area 14, Cedeño municipal district, Area 1 of the MA.
Empresa Mixta Al Quds	CVM	Sakan, C.A. (Palestine)	Joint Venture Partnership	Coltan	To develop exploration, extraction and commercialization activities and, activities connected with coltan deposits, in Coltan Area 7, Cedeño municipal district, Area 1 of the MA.
Empresa Mixta Biet Lahem	CVM	Comercializadora Orinoco River, C.A. (Palestine)	Joint Venture Partnership	Coltan	To develop exploration, extraction and commercialization activities and, activities connected with coltan deposits, in Coltan Area 8, Cedeño municipal district, Area 1 of the MA.

Table 10(a). Mining projects published as having been established in the Mining Arc.
Source: Ministry of the People's Power for Ecological Mining Development.

[37] https://sosorinoco.org/es/informes/cuyuni-corazon-de-imataca-epicentro-del-arco-minero-de-maduro/

[38] https://www.bnamericas.com/es/noticias/venezuela-y-gold-reserve-realizan-primera-reunion-de-directorio-de-empresa-conjunta-por-brisas1 Accessed on 27 JUN 2020

[39] https://www.youtube.com/watch?v=nUBWVMEVpBU

Joint Enterprise or Partnership	Venezuelan Government Corporations	Joint Venture Partner (Country)	Type of Partnership	Mineral Resource	Purpose
Empresa Mixta Sociedad Anónima Minera Binacional Turquía-Venezuela - Mibiturven, S.A.	Compañía General de Minería de Venezuela, C.A. (Minerven)	Marilyns Proje Yatirim, S.A. (Turkey)	Joint Venture Partnership	Gold	Exploration, extraction and commercialization activities and activities associated with gold deposits, in Areas AUMDE Area 2, AUMDE Area 3, and AUMDE Area 14, Sifontes municipal district, Area 4.
Strategic partnership for plant to concentrate coltan (columbite-tantalite)	CVM	Gold Marketing J-31582596-1 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Gold Marketing for development of activities associated with coltan deposits, Angostura municipal district, Area 2.
Strategic partnership for the exploration and commercialization of coltan	CVM	Black Stone Euroval, C.A. J-41129746-1 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Black Stone Euroval for development of exploration, extraction and commercialization activities and activities associated with coltan deposits, in Coltan Area 4, Cedeño municipal district, Area 1.
Strategic partnership for the exploration and commercialization of coltan	CVM	Calufer Minería, C.A. J-40963208-3 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Calufer Minería, C.A. for development of exploration, extraction and commercialization activities and activities associated with coltan, in Coltan Area 5, Cedeño municipal district, Area 1.
Strategic partnership for the exploration and commercialization of coltan	CVM	Comins de América, S.A. J-40996651-8 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Comins de América, S.A. for development of exploration, extraction and commercialization activities and activities associated with coltan (columbite-tantalite), in Coltan Area 3, located in Cedeño municipal district, Area 1.
Strategic partnership for the exploration and commercialization of coltan	CVM	Corporación Minarven GPS, C.A. J-40857659-7 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Corporación Minarven GPS, C.A. for development of exploration, extraction and commercialization activities and activities associated with coltan, in Coltan Area 10, Cedeño municipal district, Area 1.

Table 10(b). Mining projects published as having been established in the Mining Arc.
Source: Ministry of the People's Power for Ecological Mining Development.

Joint Enterprise or Partnership	Venezuelan Government Corporations	Joint Venture Partner (Country)	Type of Partnership	Mineral Resource	Purpose
Strategic partnership for the exploration and commercialization of coltan	CVM	Gold Marketing J-31582596-1 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Gold Marketing, C.A. for development of exploration, extraction and commercialization activities and activities associated with coltan deposits, in Coltan Area 9, Cedeño municipal district, state of Bolívar, Area 1.
Strategic partnership for the exploration and commercialization of coltan	CVM	Inversiones Lasca 21, C.A. J-40538144-2 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Inversiones Lasca 21, C.A. for development of exploration, extraction and commercialization activities and activities associated with coltan, in Coltan Area 12, Cedeño municipal district, Area 1.
Strategic partnership for the exploration and commercialization of coltan	CVM	Recycle Express, C.A. J-40377464-1 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Recycle Express, C.A. for development of exploration, extraction and commercialization activities and activities associated with coltan, in Coltan Area 2, located in Cedeño municipal district, Area 1.
Strategic partnership for the exploration and commercialization of coltan	CVM	Camimpeg, C.A. Corporación Minverca, C.A. J-40960515-9 (Venezuela)	Strategic Partnership	Coltan	Established through operating contract between CVM and Empresa Camimpeg, C.A. for development of exploration, extraction and commercialization activities and activities associated with coltan, in Coltan Area 13, located in Cedeño municipal district, Area 1.

Table 10(c). Mining projects published as having been established in the Mining Arc.
Source: Ministry of the People's Power for Ecological Mining Development.
http://www.desarrollominero.gob.ve/banco-de-proyectos-mineros-2/
Accessed on 24 May 2020

Of the 15 mining projects that the Ministry of the People's Power for Ecological Mining Development has made public on its website as being carried out in the "Mining Arc," only two have gold as a mineral resource. One of these projects has to do with the highly visible case pertaining to the incorporation of the Empresa Mixta Minera Ecosocialista Siembra Minera, which emerged in 2016 from the negotiations with the Canadian company Gold Reserve, Inc., through its subsidiary Barbados Mining, Inc., the State's counterpart being Corporación Venezolana de Minería, SA (CVM). Specifically, this relates to the Las Cristinas and Brisas mines, which according to the official mining zoning map belong to "Gold Area 25" in Sifontes municipal district, in Area 4 of the MA. The other gold project is related to the incorporation of the Empresa Mixta Sociedad Anónima Minera Binacional Turkey-Venezuela Mibiturven, SA, created with participation by the private company Marilyns Proje Yatirim, SA, which, according to the official source, is from Turkey, with the Venezuelan State's counterpart being Compañía General de Minería de Venezuela, CA (Minerven). This joint venture concentrates its mining activities in "areas declared for eco-social mining use" (AUME) (Decree No. 3.188 of 5 December 2017) No. 2, 3 and 14 in Sifontes municipal district, Area 4 of the MA.

Meanwhile, 13 of the aforementioned mining projects (86.6%) have coltan as a resource to be exploited.[40] It is important to note that these mineral resources, columbite and tantalite, known in their naturally combined forms as coltan, when compared to gold, are as of this date of lower value and in Venezuela they have only been exploited during the last 10 years, almost all done illegally. There is no expertise in its extraction and to date its commercialization has been done clandestinely through Colombia and other countries, without

[40] https://sosorinoco.org/en/reports/coltan-the-venezuelans-regime-smuggling-of-blue-gold-2020/

going through major processes or fiscal control. Given this and the State having knowledge of the existence of coltan deposits in the Mining Arc, the State is promoting its exploitation through its partnerships with mining companies, thus establishing it as an economic resource that would complement gold in conjunction with diamonds, copper and silver. Of the 13 coltan projects, 12 are located in Cedeño municipal district, Area 1 of the MA, and one in the Angostura municipal district, Area 2 of the MA.

According to information provided by local sources, those large-scale mine operators who have been able to remain in the area after enactment of the decree on the nationalization of gold (and the subsequent modifications of that rule[41]), have reached agreements with state entities, with criminal groups (called "Syndicates" and others), and with "small-scale miners", aimed at ensuring a limited percentage of participation in the extraction of gold. Some process their share of the gold ore in cyanide leaching plants, others resort to crushing and mercury amalgamation systems, although there are also gravimetric plants. This occurs especially in El Callao municipal district, where there are vein mines, where the gold is embedded in hard rock formations, with a long production history, located within Area or Block 4 of the MA.

It is a fact that most of the former concessions that contain alluvial gold are being exploited by small-scale miners directly, under the control of armed groups. In many of these mining operations (mainly the oldest ones), the gold ore is taken from the mining plots and delivered to be processed in the industrial plants created or enhanced for this purpose, in a controlled manner. At these recovery sites they use backhoes, payloaders and other machinery and later load trucks with the "gold sands" retrieved from the mining tails or tailings, left over from previous operations.

In the MA there is a group of gold processing plants, specifically in Area 4, which the government has established directly or in partnerships with private companies. By the year 2020, at least 13 hydrometallurgy plants using cyanide leaching had been identified (Figure 12), which the regime has had in practice as the central driving force of the Mining Arc strategy (namely mining), given that they capture and process gold ore that previously went to other regions (including the Essequibo Reclamation Zone and Brazil), but originating in this area that has the highest gold productivity in the country. According to official data, with our own calculations, the gold processing capacity in these 13 plants is approximately 2,628 kg per year, based on an average factor of 5 (that is to say, 5 grams of gold per ton of processed ore).

It is important to emphasize that the processing of gold by cyanide leaching also causes, just like mercury, a significant environmental impact, since it generates hazardous waste material in the spaces adjacent to the plants (about 50 hectares or more per plant) depending on the amount of gold ore being processed. These systems use dikes or storage ponds that are filled with sludge originating from the industrial leaching process (which includes heavy metals), many of which surpass their limits and pollute the ecosystems. This can be seen, via satellite images, in several of the plants located in El Callao municipal district, despite the fact that the information provided by the Ministry says that the plants recirculate sludge and some have extra environmental containment mechanisms.

[41] In December of 2011, certain articles of Decree No. 8.413 were modified by way of Decree No. 8.683, Official Gazette No. 6.063 Extraordinary of 15 December 2011. In the year 2014, there was further modification by way of Decree No. 1.395, Official Gazette No.6.150 Extraordinary of 18 November 2014. The last change to take place was in 2015, when Decree No. 2.165 was enacted and published in Official Gazette No. 40.819 of 30 December 2015, establishing its "Rank, Value and Force of an Organic Law that Reserves for the State Activities pertaining to the Exploration and Extraction of Gold and other Strategic Minerals."

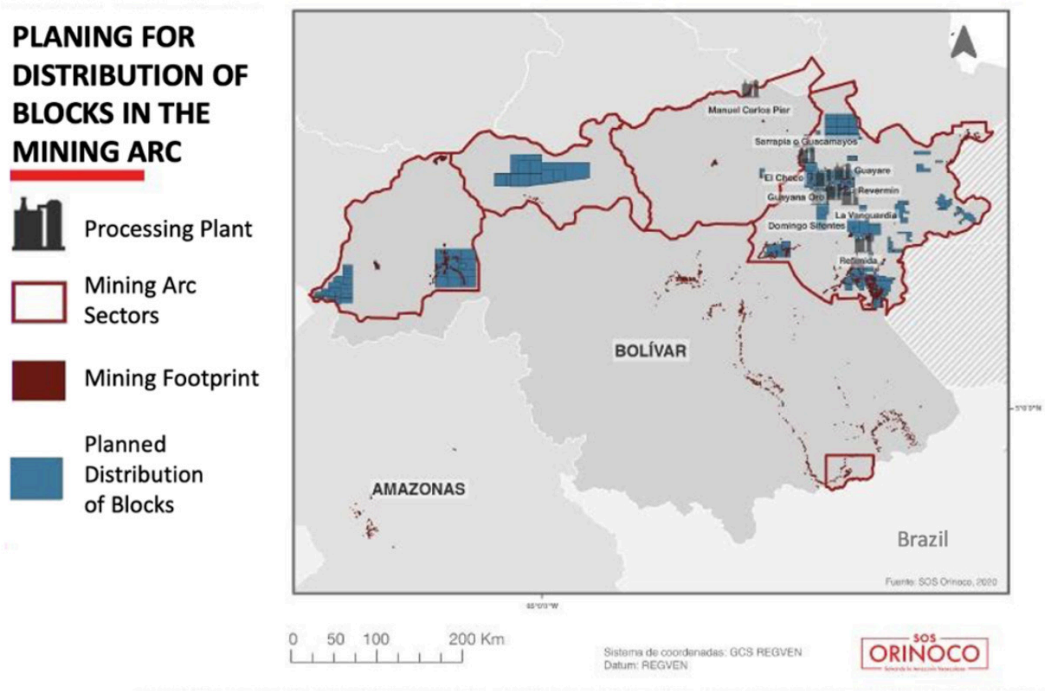


Figure 12. Location of mining blocks (former concessions) with respect to the location of ore deposits being extracted, as well as the processing plants.
Source: SOSOrinoco.

Enterprise	Sector	Municipal District	Coordinates	Source of Water for Processing the Ore
Domingo Sifontes Industrial Complex. The complex consists of 6 plants: Inversiones RPL; Invertrade; Corporación Petroglobal, C.A. J-40857535-3; Mipre; Inversiones y Rrepres Glenduard, C.A., J-40724718-2; Inversiones Oriente	Caratal Industrial Zone	El Callao	7° 20' 50" lat. N 61° 47' 55" long. W	Yuruari River
Manuel Piar Industrial Complex	Matanzas	Caroní	8°17' 45" lat. N 62° 47' 11" long. W	Caroní Rive River
Corporación Guayana Oro, J-40849141-9	Nacupay	El Callao	7°18' 54" lat. N 61° 50' 55" long. W	Yuruari River
Inversiones La Lucha, C.A., J-40767552-4	Nacupay	El Callao	7° 20' 59" lat. N 61° 48' 24" long. W	Yuruari River
Inversiones Guayare	Nacupay	El Callao	7° 20' 47" lat. N 61° 47' 22" long. W	Yuruari River
Refimina, C.A. J-40857535-3	El Dorado	Sifontes	6° 42' 53" lat. N 61° 38' 15" long. W	Cuyuní River
Servicios Mineros Grupo C6, J-40862726-4	Unknown	El Callao	Georeferencing in progress	Unknown
Inversiones Sarrapia, Técnicas y Procesos, C.A., J-40862316-1	Guacamayos Sector	Piar	Georeferencing in progress	Unknown

Table 11. Main processing plants in the Orinoco Mining Arc using cyanide for processing gold.
Source: Ministry of the People's Power for the Development of Ecological Mining.

NOTE: According to official data, with our own calculations, the gold processing capacity in these 13 plants is approximately 2,628 kg per year, applying an average of 5 (that is, 5 gr Au / ton processed material).

According to information provided by Jesús Coromoto Lugo, former mayor of El Callao municipal district, a position he held for 4 terms (until 2017), the gold processing mills and most of the cyanide leaching plants used to extract the precious metal are concentrated in that political-territorial unit (Figure 12 and Table 11). He stated, literally, that in the state of Bolívar "... there is total destruction, not only of its Yuruari River, which is a source of water for El Callao and Guasipati, but also of its entire trajectory and its tributaries. Now they're going to dredge 12 kilometers along that river. The upper echelons of government are in on this. Of the 31 cyanide plants that process sand in the southern part of the state of Bolívar, 25 are in El Callao. No hill is spared, no sand, no ore at the mills, that's why they haul the sand away, all of it, because they no longer have a way to process all the ore in their own plants. Over there we have, I reckon, about 800 mills in El Callao, about 300 "purchasing locations" and ... the Government controls all of this. Complete destruction in what is El Callao municipal district, and of course in other municipal districts, but I think on a smaller scale there."[42] Such information supports the fact that this geographic space is the strategic operational center of the Orinoco Mining Arc, given the historical importance of gold mining in this place, the continued existence to this day of ore deposits and especially the availability of an infrastructure that has been installed over the years by Minerven.

Although with the current boom pertaining to the search for gold-bearing sands or material that contains some gold, promoted by the State in its eagerness to obtain the largest possible volume of gold regardless of the repercussions, no space has been spared by all the mechanical excavations. Even schools[43] have been commandeered, all in order to transfer that material to be processed over at the plants. Most of the gold ore extracted in the MA arrives at El Callao, mainly from mines located within its municipal district, from neighboring municipal districts and from others that are to the southeast within the area covered by Decree No. 2.248 of 24 February 2016. Of the main gold processing sites, only the Manuel Piar Industrial Complex at Matanzas, located in Caroní municipal district, remains outside that jurisdiction; the Sarrapia plant, in Los Guacamayos, Piar municipal district; and the Refimina Plant, in El Dorado, Sifontes municipal district. El Callao is where most of the gold bullion is produced, and the rest of the ore is refined there, according to the official announcements that the pertinent ministry gave until 2019, before being transported by air to Caracas, to be deposited in the vaults of the BCV.

The former mayor warns about the serious environmental situation in El Callao and its river, the Yuruari, noting that currently there is a plan to dredge it (for mining purposes) along 12 km of its length without weighing the consequences.[44] He maintains that this will harm that water resource, already highly polluted, thus affecting the population of the seat of the municipal district, and downstream the people of Guasipati. He also points out an even more serious situation, the existence of approximately 800 gold processing mills and 300 gold purchasing sites operating in El Callao. That totally refutes the official discourse, reflected in the press releases published on the website of the Ministry of Ecological Mining Development, clashes with statements issued by the spokespersons of Maduro's Executive Office in that they point out that with the Mining Arc project there has been an environmental improvement in the system for obtaining gold. However, given the number of mills that process the gold ore by cyanide leaching or amalgamation with mercury (quicksilver), the proper job is not being done to stop the environmental pollution that affects people and the ecosystems, one of the most serious in the country. According to different studies carried out in the El Callao area, mercury contamination associated with gold processing is very high. Dr. Nereida Carrión, a research chemist and professor at the

[42] Verbal communication on 3 February 2021.

[43] http://old.correodelcaroni.com/ciudad/region/7495-habitantes-de-el-callao-denuncian-extraccion-de-tierra-con-mineral-aurifero-en-colegio-que-en-otrora-sirvio-para-desarrollo-agricola Accessed on 7 JAN 2021.

[44] National Assembly Member Américo De Grazia on 4 FEB 2021. https://twitter.com/AmericoDeGrazia/status/1357257097679888384

Central University of Venezuela who has dedicated no less than 20 years to studying the matter in this municipal district, states emphatically that studies carried out by thesis students whom she mentors and who evaluated 230 children from El Callao, ages 6 through 13, found that 38% of these children show the presence of mercury in their urine in concentrations greater than the reference values for normal unexposed people, as set by the World Health Organization (Carrión 2019).

Another thesis student that measured the concentration of mercury in the air of classrooms educational units found that 74% of these educational units showed concentrations above the reference value within the same range, which is 0.2 mg of mercury per cubic meter. “And the highest concentrations of mercury were found in schools where there are nearby processing mills, that is to say, there is a significant correlation between the levels of mercury in urine and blood samples and the distance between the child’s home and the mills, which means that this source of emissions affects mercury levels in children.” (Carrión, 2019). A third thesis student “determined that the mercury, both organic and inorganic, present in the soils exceeds the established limits, which are 70 to 300 mg of mercury per cubic meter of soil, that is, both the air and the soils have a high content of mercury, and also, as inorganic mercury it continuously evaporates from the ground into the environment.” (Carrión, 2019).

To a lesser extent, gold purchasing sites are also sources of mercury exposure, and the former mayor pointed out that there are about 300 such sites in El Callao. These merchants buy gold one gram at a time, or whatever amount small-scale miners will sell to them, but after some time when they have accumulated a certain amount, they melt down right there to further refine it, while using mercury as amalgamating agent, then they heat the resulting amalgamation to separate the gold further, at which time mercury vapors are produced. That gold obtained from this process is sold to wholesalers who then sell it to the entity that has been officially designated by the BCV.

Thus, it is necessary to eliminate these sources of mercury exposure, and seek solutions using appropriate technologies that do not generate the release of any mercury or sludge containing other heavy metals. At the same time, this must be done in a transparent manner with monitoring and follow-ups by independent scientific institutions and under guidelines and procedures controlled by whatever ministry happens to be in charge of environmental matters, including environmental and sociocultural impact studies, which would be accessible to anyone who wishes to consult them.

Chapter 3

River basins, ABRAE, and vegetation covers

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River basins, ABRAE, and vegetation covers

The Mining Arc covers mostly the northern part of Venezuela's Guayana region, in the lowlands, where the region's most densely populated centers are located, the epicenter of basic industries and where one sees the greatest loss of forest cover due to agricultural activity (Lozada, 2016). A characterization of the environmental impact of the Mining Arc would require a field evaluation of at least three main components: rivers, soil and vegetation cover, from a multitemporal perspective and following known methodological standards. Meanwhile, with information from remote sensors and the support of geographic information systems, it is possible to carry out a preliminary diagnosis based on the detection of the footprints created by mining activity and their spatial coincidence with the different variables under analysis.

Since 2018, SOSOrinoco has been mapping the "footprints" left behind by mining activity in the Venezuela's Amazonia and Guayana regions, up until now characterizing more than 69,000 hectares (which reaches 102,000 if we include mining activity in the Essequibo Reclamation Zone). Of all this mining activity, 46% takes place within the Mining Arc and most of it represents the extraction of alluvial gold as it is an activity that leaves an unequivocal pattern on the ground. (For more details read our Story Map).

Drainage basins and mining activity

Watersheds are functional units that prove to be interesting for analysis (Rosales-Hernández and García-Montero, 2018). In the Guayana region, the basins of rivers that are tributaries of the Orinoco are characterized by their high level of water production, their high degree of hydroelectric potential, and their high degree of forest cover and wealth of biodiversity (with many species that are only found in this region of the planet: endemism) and configure unique landscapes (Rosales-Hernández and García-Montero, 2018). However, the management of these spaces seems to be disjointed, which precipitates their degradation and the acceleration of erosion and deforestation processes, with a vulnerability further aggravated by legal and illegal mining activities (Paolini-Ruiz, 2013).

The Mining Arc encompasses a total of 18 hydrographic basins (Table 12), of which 6 have 100% of their area completely contained within the boundaries of the MA. It is evident that mining activity follows the waterways and directly affects them along 380 km of their lengths, with the Chikanan River being the one with the greatest concentration of mining activity. Downstream along rivers such as the Caura, mercury contamination has been detected 200 km from the original source of such contamination, however, the difference in the dynamics of the rivers and the complexity of the mercury methylation process makes it impossible to extrapolate this estimate (Covelli et al. 2001). Below, we will present a brief description of the situation in the river basins in each of the Blocks or Areas of the MA in relation to mining:

Mining activity in Area 1 has three objectives: coltan, mainly along the Parguaza River; diamonds, with most activity in the Guaniamo area; and bauxite at Los Pijiguaos, located in the Suapure River basin. The headwaters of this basin are located in the Serranía de Yutajé mountain range (border between the states of Amazonas and Bolívar), and it drains an area covering 8,000 km². Reports show 140 species of fish in this basin, which is territory belonging to the Piaroa and E'ñepa (Panare) peoples and others. Bauxite mining at Los Pijiguaos involves two processes that create an impact: open-pit mining and transportation. The open-pit mining leaves behind bare soils that are exposed to the area's intense rains, which results in the acceleration of erosive processes and the accumulation of sediments in the river (Luque et al. 2005)

Transportation needs justify adding infrastructure such as roads, which require the creation of embankments and cutting ditches, all of which contribute to the activation of erosion processes. On the embankments and other bare soil areas, the planting of vetiver (an exotic perennial grass) has been promoted to reduce erosion and absorb part of the aluminum (Luque et al. 2005).

In Area 2, the main mining activity is gold extraction, which directly affects the banks of the Caura River. This basin is of great relevance, and it covers approximately 45,000 km². The river has a length of more than 700 km, and it originates an altitude of more than 2,000 meters atop the Jaua and Sarisariñama tepui formations (flat top mountains). It is an area recognized for its biodiversity, hosting 17% of the flora and 32% of the wildlife species that have been catalogued for Venezuela. The basin consists mainly of territory belonging to the Ye'kwana and Sanema peoples, but there are also populations of the Hoti, Ka'riña, Hivi and Pemón ethnic groups. Starting in the year 2000, gold mining operations became evident in the basin, with greater intensity along the Yuduwani River, a situation that drew the attention of the indigenous peoples for whom the main source of animal protein comes from fish, which they feared might become contaminated. When analyzing the mercury concentration in fish, as well as in women and girls, it was shown that all the fish samples showed mean values above that suggested by the WHO and that 92% of the women exceeded the mercury concentration value of 2mg/kg established by the WHO, and it was also observed the women being analyzed showed some degree of mercury contamination, despite the fact that they lived 200 km from the mining sites (Perez and Perera, 2012). This activity affects the ability of indigenous populations to provide themselves with water and food. Furthermore, it diminishes the potential for attracting tourism to the basin as the mining activity deteriorates the natural settings by polluting and modifying the physicochemical properties of the watercourse.

In Area 3 the impact is related to the development of infrastructure for the extraction, processing and transfer of iron ore, as well as the extraction of alluvial gold, especially through the use of mining rafts on the rivers. The surface of the Aro River basin is 14,500 km² and this is where Cerro Bolívar, the largest iron deposit in the country, is located. For its part, the basin of the Caroní River, the largest tributary of the Orinoco, occupies an area of more than 92,000 km² (10% of the nation's territory), and has the greatest hydroelectric potential, a great ecological uniqueness and extensive forest coverage. The alluvial mining that is practiced uses motor pumps to break up the soil as well as to retrieve the detached material by way of suction hoses, in a process that undermines the riverbed and affects the riparian forests. Sand, kaolin and diamonds are also mined in this block.

Area 4 has the highest number of reported mineral deposits, 174 of the 450 in the USGS[45] database for Bolívar, mostly gold. There is information on mining operations since 1853, on the banks of the Yuruari River. The first mining company, the Venezolana del Yuruari was founded in 1860 and began operations 2 years later. Area 4 is where gold mining activity has the greatest extension, intensity and impact, and directly affects the basin of the Cuyuní River, which then flows into the Essequibo River (SOS ORINOCO 2020). In this region, the performance of different gold extraction practices has been documented: manual, rafts, hydraulic monitors, small galleries, industrial galleries, and industrial surface excavation, with gallery and excavation being the methods that generate the least impact as they occupy a relatively reduced surface area. (Lozada and Ernesto 2000).

The Icabarú Special Block affects the basin of the Icabarú River, a very important tributary of the Caroní River. The main mining activity is the extraction of alluvial gold, as reflected in our recent publication (SOS ORINOCO 2020) in which we show that mining went from being dispersed and small-scale to being one of the largest mining centers in the region, one that threatens the country's hydroelectric potential, and which exposes indigenous and Criollo communities to violence.

[45] United States Geological Survey

The analysis of the mining footprint through remote sensors has some limitations: many mines are small (≤ 1 hectare) and are not always detectable, others are underground and some satellite images do not show the entire ground surface due to different degrees of cloud cover, high spatial resolution images were not available for the desired dates and locations. Therefore, it is important to complement the analysis with a field check, consultation with local informants and a special reading of existing publications. The total impacted area (mining footprint) that is presented below may be underestimated, so it is necessary to continue mapping and move forward with the definition of indicators:

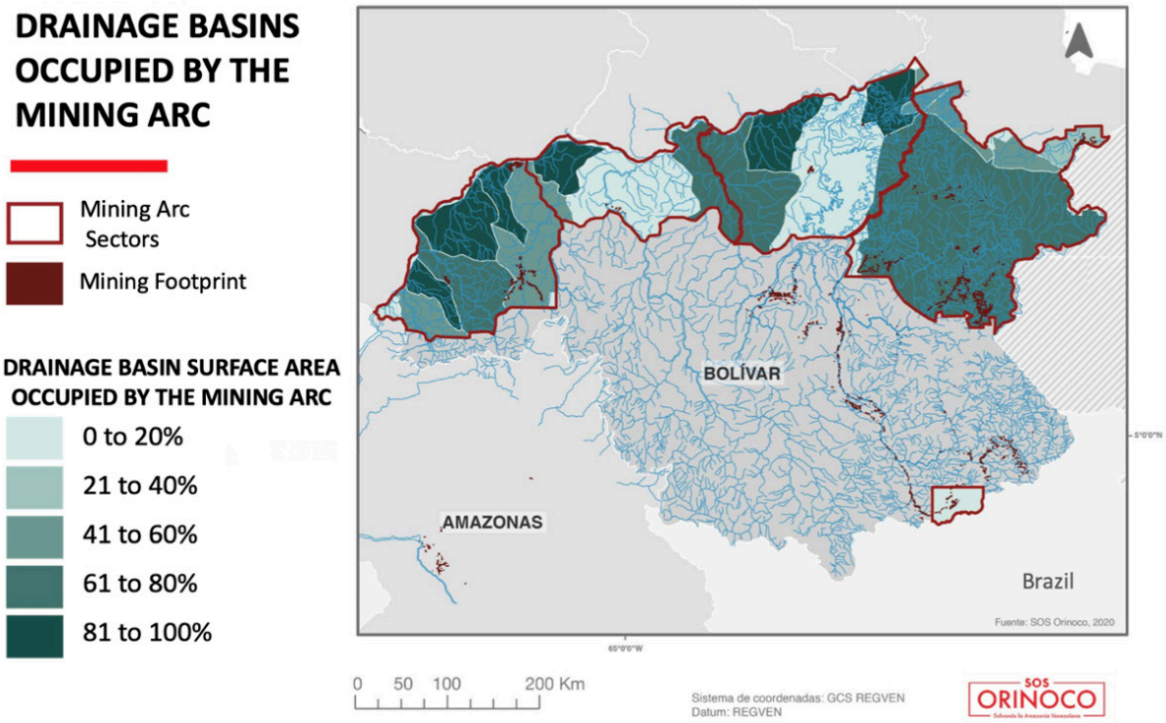


Figure 13. Drainage basins occupied by the Mining Arc and the mining footprints found in each of them.
Source: Official data layer from IGSB, as modified by SOSOrinoco

River Basin	Surface Area of Basin Affected (hectares)
Upata	38
Caroní	4,434
Cuyuní	28,227
Caura	317
Suapure	924
Cuchivero	4,371
Caño San Felipe	1,823
Icabarú	4,045
TOTAL	**40,817**

Table 12. Surface area affected by mining operations, In different drainage basins in the Mining Arc.
Source: SIGOT data base.

Perturbations resulting from mining activity are leading to the destruction of soils by the direct action of the excavation, which results in a decrease in the content of organic matter and nutrients such as nitrogen and phosphorus (Couic et al. 2018). This unleashes erosion and landslides processes that are activated and will continue unless proper management measures are taken or the mining activity ceases (Mosquera et al., 2016). In addition, a percentage of the mercury (Hg) used for amalgamation reaches freshwater systems, where it is transported downstream and accumulated by the biota in the area (García-Sánchez et al. 2006). Hence the importance of mapping the mines and the need to monitor these bodies of water.

The pollution of bodies of water decreases when the source of the contamination is contained or eliminated. In the case of “mining mercury,” it is necessary that its use be terminated so that it is no longer discharged into the environment, thus allowing remediation measures to take effect (Santschi et al. 2017).

Additionally, the reduction of mercury discharges into the environment has beneficial effects by reducing the impact of methylmercury on fish, decreasing the exposure of the area's inhabitants to pollutants, and thus having a positive impact on the health of humans and the ecosystem (Poulin and Gibb, 2008).

The elimination of Hg discharges into the environment must be accompanied by programs to replace current amalgamation techniques using new methodologies (leaching, magnets, direct gold smelting and borax amalgamation). However, this is not an easy task, since these alternative techniques are not exempt from social and environmental problems as well (Zolnikov and Ortiz, 2018). Additionally, any measures to eliminate the use of Hg in mining must be accompanied by socio-economic incentives to avoid a reversal by miners (Zolnikov and Ortiz, 2018).

If Hg discharges into the environment are ended, the process of restoring the ecosystem can begin. This can occur naturally, without any human intervention (Zhang et al. 2010) or strategies can be applied to accelerate this process (Parks and Hamilton, 1987; Hylander and Goodsite, 2006). The study by Zhang et al. (2010) determined the recovery rate of China's Songhua River, where chlor-alkali plants stopped discharging Hg into the river after having done so for 30 years of, concentrations of this metal have decreased by 90% in the water as well as in sediments and in the fish. However, they warn that a total elimination of mercury will take many years; it may even take up to a century. To speed up the recovery process, there are techniques such as dredging the sediments and disposing of the contaminated material, as well as the process of sediment resuspension, which appears to be more effective and less expensive (Parks and Hamilton, 1987).

The restoration of a freshwater system must be accompanied by the recovery of nearby soils, since these areas may later release Hg into rivers and lakes during periods of flooding. These actions require the coordinated efforts of environmental authorities and specialists in restoration in conjunction with investment in such strategies by mining companies and associations, aimed at conducting a diagnosis and establishing prioritized recovery areas where the activity is regulated and organized.

For Venezuela's Guayana region, given that the mining activity taking place within the Mining Arc is affecting different natural areas, we consider it to be a priority that action be taken in the drainage basins receiving the most impact, namely the Caroní, Icabarú, Cuyuní and Cuchivero river basins. Mining activity must be eliminated in all nature preserves, and must be confined to areas that show the most activity and cause the most deterioration. Mining activity must also be subjected to a process of evaluation and supervision that would establish plans for dealing with compensation and restoration matters.

Areas Under Special Administrative Control (ABRAE)

In the Organic Law for Territorial Organization (1983) and in various ordinary laws, a system of legal concepts has been established that allows for the application of a special legal jurisdiction over certain territorial spaces, in order to achieve specific territorial planning objectives, all of which lie within the framework of a logic shaped by ecological relevance, ecological fragility, geopolitics, economics and strategic interests, etc. These have been designated as Areas Under Special Administrative Control (ABRAE) and there are at least 21 categories that can be grouped into 3 subsets: (1) ABRAE for strictly protective, scientific, educational and recreational purposes; (2) ABRAE for protective purposes through regulated uses, and (3) ABRAE for production and geostrategic purposes.

The state of Bolívar is of high geopolitical and geostrategic relevance, not only because of its long borders with Brazil and the Essequibo Reclamation Zone, but also because it has the largest water reserves and hydroelectric potential in the country. It represents 26% of the nation's territory, is home to a good part of the indigenous peoples and has natural beauties that have earned the state worldwide recognition. All of these characteristics motivated previous governments, during the democratic years, to create the following ABRAE's: one "water reserve"; three "wooded areas under protection"; eight "forest reserves"; three "national parks"; eight "natural monuments", one "wildlife refuge"; two "protective zones"; one "border security zone" and five "security zones". All of these totaled 18,270,000 hectares (excluding spatial overlaps between them), representing 78% of the state's surface area. These calculations are presented despite variations resulting from the enactment of the Organic Law on the Fresh Water and Biodiversity Mega-Reserve of the Southern Orinoco and the Amazon, which was voted upon unanimously by the National Assembly, which is the National Legislative Power of the Bolivarian Republic of Venezuela, on November 27, 2018. However, this will be the subject of another report by SOSOrinoco. Therefore, given these circumstances, all of the analysis on the ABRAE's presented here will refer to the situation of the ABRAE's prior to enactment of this Organic Law.

Despite the large number of ABRAE's and their relevance, only three have implemented their respective Management and Land Use Regulation Plan (PORU) which is what determines the detailed territorial organization (zoning) and gives specific guidelines for management and land use, and must be reviewed or updated every 5 years (Table 13). Canaima National Park has its own PORU, but only for the eastern sector of the park. Therefore, in this sense, it is incomplete and certainly outdated.

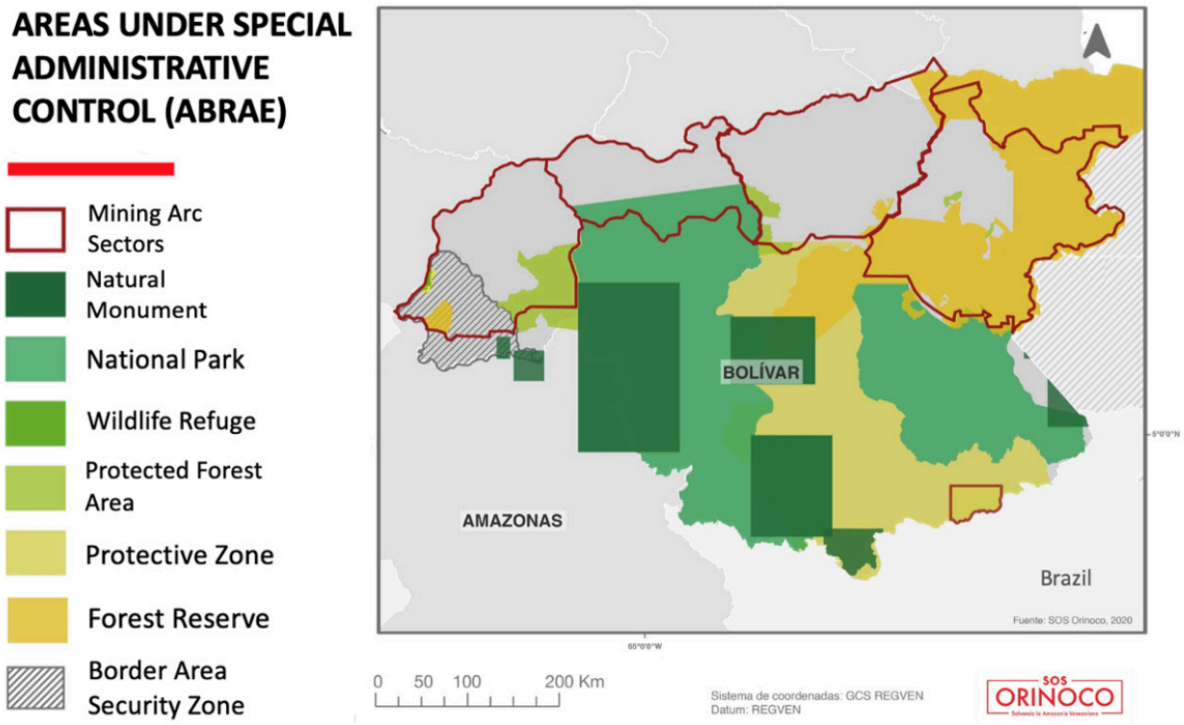


Figure 14. Map of Areas Under Special Administrative Control (ABRAE), demarcated as such in the state of Bolívar.
Source: Official data layer from IGSB, as modified by SOSOrinoco.

Figure 14 shows these ABRAE in the state of Bolívar, but with the intention of showing those that overlap with the Mining Arc. The “security” and “border security” zones occupy a large part of the state of Bolívar and this figure depicts only the section that is superimposed on the MA so as to facilitate the visualization of the rest of the ABRAE.

Identification of Specific Category		Location (State)	Surface Area (Hectares)	Has a Plan for Territorial Organization and Land Use Regulations (PORU) been implemented?
Type of ABRAE	**Name**			
Protected Forest Area	Caño Blanco	Bolívar	20,000	NO
	Chivapure-Cuchivero	Bolívar	620,133	NO
	El Choco	Bolívar	15,000	NO
	Fundo Flamerich	Bolívar	19,196	NO
	Fundo Paisolandia	Bolívar	8,100	NO
	San Francisco de la Paragua	Bolívar	67,000	NO
	Santa Marta	Bolívar	38,516	NO
Natural Monument	Serranía Yutajé-Corocoro	Amazonas and Bolívar	210,000	NO
	Chain of Eastern Tepui Formations: Llu (Tramen) Tepui Karaurín Tepui Uei Tepui Yuruaní Tepui Kukenán (Mataui) Tepui Wadakapiapué Tepui	Bolívar	250,000	NO
	Cerro Guaiquinima	Bolívar	170,000	NO
	Cerro Ichum and Cerro Guanacoco	Bolívar	90,000	NO
	Cerro Venamo	Bolívar	7,500	NO
	Sierra Maigualida	Bolívar	260,000	NO
	Sierra Marutani	Bolívar	267,500	NO
National Park	Canaima	Bolívar	3,000,000	**YES**
	Caura (includes the pre-existing Jaua Sarisariñama National Park in its interior)	Bolívar	7,533,952	NO

Table 13 (a). List of ABRAE in the State of Bolívar prior to the Organic Law on the Mega-Reserve.
Source: SIGOT database.

Identification of Specific Category		Location (State)	Surface Area (Hectares)	Has a Plan for Territorial Organization and Land Use Regulations (PORU) been implemented?
Type of ABRAE	**Name**			
Forest Reserve	El Dorado-Tumeremo	Bolívar	78,993	NO
	El Frío	Bolívar	65,000	NO
	La Paragua	Bolívar	782,000	NO
	Parguaza River	Bolívar	65,700	NO
	San Pedro	Bolívar	757,400	NO
	Imataca	Bolívar and Delta Amacuro	3,749,941	**YES**
Wildlife Reserve	La Tortuga Arrau	Apure and Bolívar	17,431	**YES**
National Hydropower Reserve	Icabarú River	Bolívar	49,444	NO
Protective Zone	La Tortuga Arrau	Apure and Bolívar	9,856	**YES**
	Southern Part of the State of Bolívar	Bolívar	7,262,358	NO
Security Zone	Command Headquarters of the River Forces and José Tomás Machado Naval Base	Bolívar	248	NO
	Antonio José de Sucre Hydroelectric Power Plant (Macagua Dam)	Bolívar	1,229	NO
	Francisco de Miranda Hydroelectric Power Plant (Caruachi Dam)	Bolívar	3,364	NO
	Manuel Piar Hydroelectric Power Plant (Tocoma Dam)	Bolívar	2,682	NO
	Simón Bolívar Hydroelectric Power Plant (Guri Dam)	Bolívar	82,976	NO
Border Area Security Zone	Border Area Security Zone for the State of Bolívar	Bolívar	7,710,615	NO

Table 13 (b). List of ABRAE in the State of Bolívar prior to the Organic Law on the Mega-Reserve.
Source: SIGOT database.

The Mining Arc overlaps only 2% of the surface area of the ABRAE in the State of Bolívar, these being Caura National Park, Imataca Forest Reserve (IFR), El Dorado-Tumeremo FR, San Pedro FR, and the Border Area Security Zone of the State of Bolívar (see Table 14).

ABRAE	Name	Objective	Surface Area of Mining Footprint (Hectares)	Mining Arc Area
National Park	Caura	To protect the biodiversity and restore the integrity of the ecosystems.	318	Area 2
Forest Reserve	El Dorado-Tumeremo	To make use of the natural resources following the principle of sustainability, seeking compatibility with the uses designated for the use of forests, conservation of the biologic diversity and the permanence of the various peoples.	823	Area 4
Forest Reserve	San Pedro	To make use of the natural resources following the principle of sustainability, seeking compatibility with the uses designated for the use of forests, conservation of the biologic diversity and the permanence of the various peoples.	3,325	Area 4
Forest Reserve	Imataca	To make use of the natural resources following the principle of sustainability, seeking compatibility with the uses designated for the use of forests, conservation of the biologic diversity and the permanence of the various peoples.	24,090	Area 4
Border Area Security Zone	State of Bolívar	Safeguarding sovereignty.	1,227	Area 1
Protective Zone	Sothern Part of the State of Bolívar	Regulation of uses in pursuit of the interests of geopolitics, hydropower potential, scenic beauty and ecological fragility.	12,624	Special Icabarú Block

Table 14. Mining impact (the mining footprint) on the total surface area of the ABRAE's, in places where the Mining Arc overlaps.
Source: SOSOrinoco

Unfortunately, mining is not the only pressure that threatens the fulfillment of the conservation and sustainable management objectives of these ABRAE's (Lozada, 2017 and RAISG, 2020). Mining activity is added to changes in land use due to farming and cattle raising activities, which drive the main transformations and the loss of forest cover in the area (Lozada, 2017 and RAISG, 2020). This situation reflects the limited environmental management capacity of the national, regional and local authorities, as well as the inability or lack of interest by the Eco-Socialism and Defense Ministries in guaranteeing the uses established for these natural areas with respect to their conservation, sustainable management of the resources, sovereignty and autonomy (Lozada 2017).

Vegetation cover and land use

Blocks 1, 2, 3 and 4 of the MA are located in the region described physiographically as a Northern Peneplain, consisting of 2 types of landscape, the northwestern and northeastern foothills, where one can distinguish reliefs consisting of knolls and low hills, the Orinoco flood plains and gallery forests.

In the northwestern foothills, one finds Blocks 1, 2, plus a small portion of Block 3, overlapping the drainage basins of the Villacoa, Suapure, Parguaza and Cuchivero rivers. In this landscape we find 4 characteristics of interest: (1) the Orinoco alluvial plain, which is host to open and shrubby savannas, where extensive livestock activity has been developed historically, as well as subsistence and semi-commercial practices, even though

the soils are sandy, acidic and not very fertile; (2) the presence of bauxitic laterites, which are of interest to the aluminum industry and where the Los Pijiguaos mining complex is very active; (3) inselbergs, or mountain-islands, rising from the river and dome-shaped granite outcrops overlooking the savannas, all of which are visible from the highway that runs from Ciudad Bolívar to Puerto Ayacucho by way of Caicara del Orinoco; (4) the lower elevations of the Sierra Maigualida and Sierra La Cerbatana mountain ranges, between 600 and 800 meters above sea level. (Muñoz-Ospino, 2007-2010).

In blocks 4 and 5, where the highest gold activity is currently taking place, are located the lower basins of the Caroní, Cuyuní and El Aro rivers, as well as the Imataca and Nuria mountains. The main characteristics of this landscape are: (1) the alluvial plains, where in addition to open and shrubby savannas, there are riparian forests and large overflow lagoons; (2) low seismic risk, conducive building infrastructure and providing good conditions for habitation, and here one finds the two largest cities in the state in terms of surface area and population density, as well as the CVG industrial complex and the Guri, Caruachi and Macagua hydroelectric projects; (3) it has a relatively good forest potential, with extensive and continuous patches of humid tropical forest, which provide protection for the drainage basins and are home to a great diversity of species of flora and wildlife, and it is for this reason that the hydroelectric plans for La Paragua, San Pedro and El Frío were decreed, with a view toward their future use; (4) mechanized annual crops, corn being the main commodity, as well as extensive cattle raising, especially in the San Francisco de la Paragua sector; (5) various and numerous deposits of metallic and non-metallic minerals. In the Sierra de Nuria mountains there is a belt consisting of green rock outcrops with resource reserves such as gold, copper, silver, vanadium and diamonds (Muñoz-Ospino, 2007-2010). We carried out a diachronic analysis to show the changes in vegetation cover within the Mining Arc at 4 moments in time in the years 2000, 2005, 2010, 2015 and 2020. This analysis focused on the supervised classification of 7 classes of coverage and land use based on Landsat satellite images, using the Random Forest algorithm as a classifying method and the Google Earth Engine and QGis software as tools for data processing and visualization.

The spatial analysis aimed to observe the changes in forest cover; and therefore, the defined classification categories focused on the main drivers of change and types of vegetation cover: forests, herbaceous vegetation and savannas, agricultural activity, mining activity, intervened or anthropized areas, urban and industrial areas, bodies of water. The validation points used for defining the categories were obtained through the interpretation of high spatial resolution satellite images, and in consultation with local experts.

After the classification, it was observed that the category with the largest extension within the MA in 2000 consists of forest, occupying 59% of the Mining Arc's area, followed by "agricultural spaces" and "herbaceous and shrub vegetation", with 15 and 14% respectively (Table 15). This classification coincides with the different spatial analyzes that have been carried out in the area, which specify that most of the forest area was subjected to various degrees of intervention, ranging from low to high, during the last century, and that ever-increasing farming and cattle raising activity has been contributing to its decrease, especially starting in the 1960's (Pacheco, 2014; Raisg, 2015 and Lozada, 2017).

	2000	2005	2010	2015	2020
Intervened or Anthropized Areas	6,310	7,517	7,515	8,447	7,789
Bodies of Water	6.416	6,333	5,917	5,887	6,179
Agricultural Activity	16,970	16,523	17,133	15,609	19,732
Urban and Industrial Areas	232	231	251	229	238
Mining Activity	259	263	285	244	356
Herbaceous Vegetation and Savannas	15,007	16,203	16,061	17,149	16,879
Forest	66,345	64,574	64,252	64,503	60,834

Table 15. Surface area (km^2) of each space that has been categorized for analysis as to land use and area occupied between the years 2000 and 2020, inside the Mining Arc.
Source: SOSOrinoco

When calculating the changes in coverage per five-year period, it was observed that mining activity has tripled over the last five years, yet infrastructure development shows a tendency to decrease, while agricultural activity and the intervened areas have doubled (images showing a pattern of agricultural intervention are not very clear, yet one observes an herbaceous mosaic with bare soil and possible agricultural activity). During the course of these changes, 7,796 km² of the forest area was lost, a third of it between 2015 and 2020 (Table 16).

Year	Loss of Forest Area (km^2)
2005	1,415
2010	1,768
2015	1,835
2020	2,778
TOTAL	**7,796**

Table 16. Total loss of forest area recorded at 5-year intervals, inside the Mining Arc.
Source: SOSOrinoco

The main driver of changes in forest cover continues to be agricultural activity, which generates a cumulative pattern. What is observed in the remote sensors at a given moment may represent the trace of an activity that occurred years ago and generated a transformation in the landscape, or the trace of an activity that was recently abandoned, but it may also be the trace of an activity currently in progress (as of image date). These changes were observed in the floodplains of the Orinoco and the adjacent foothills in Block 2 as well as to the north and throughout the urban corridor of Block 3, as well as to the north of the Serranía de Imataca mountains in Block 4 (Figure 15).

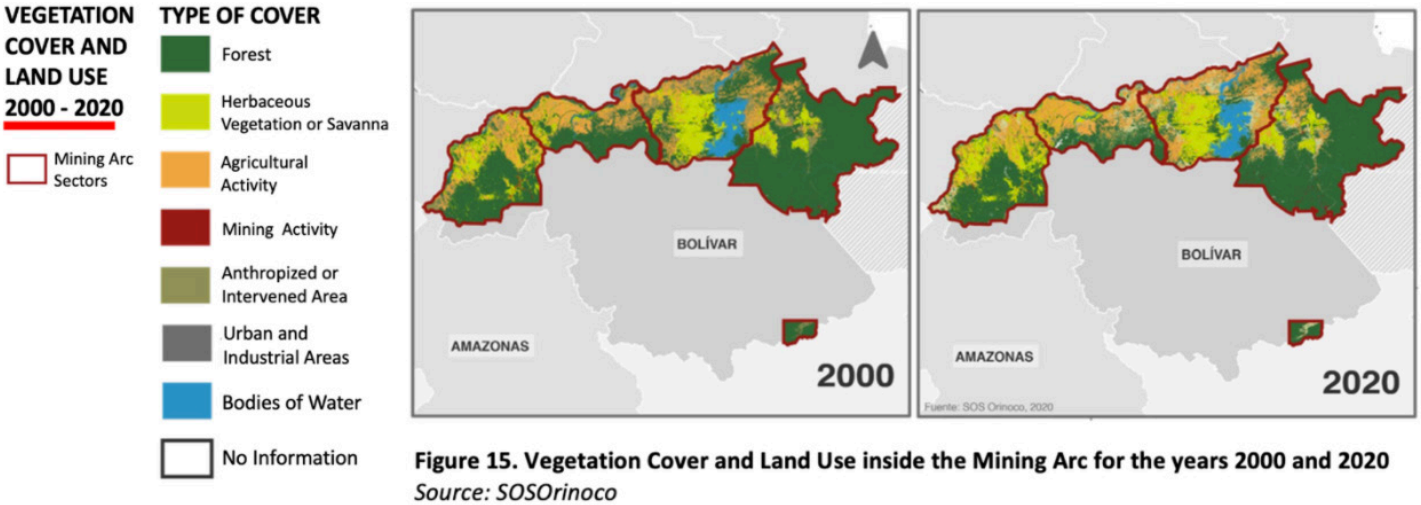


Figure 15. Vegetation Cover and Land Use inside the Mining Arc for the years 2000 and 2020
Source: SOSOrinoco

Mining activity is not the main driver of change in the vegetation cover, but it is interesting and worrisome that more than half of the almost 213 km² affected by mining occurred in the last 10 years, obviously due to the pro-mining policies of the Chávez-Maduro regime, which have promoted mining activity throughout the area south of the Orinoco (Transparencia Venezuela, 2019; Clima 21 and Todos por el Futuro, 2020). Most mining activity is concentrated and has expanded mainly in the southern part of Block 4, in the heart of the Imataca Forest Reserve, on the periphery of the towns of El Callao and Las Claritas, contaminating and causing sedimentation in the basin of the Cuyuní River (SOS ORINOCO 2020). It was also observed how in Block 5 (the Special Icabarú Block) mining and infrastructure are expanding, coinciding with the prominence Icabarú has taken in the last 8 years as a mining focus (SOS ORINOCO 2020).

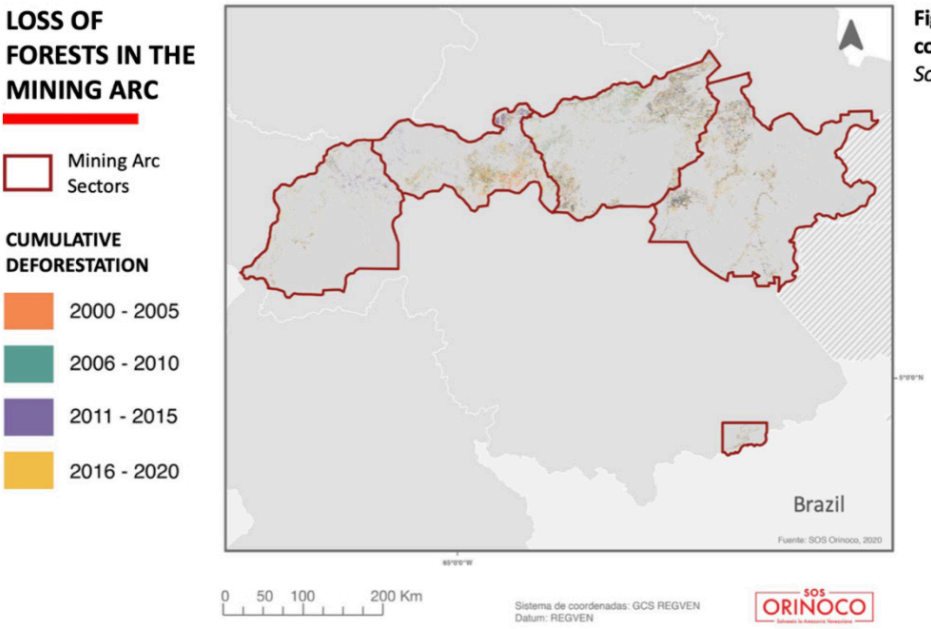


Figure 16. Net loss of forest cover in the Mining Arc.
Source: SOSOrinoco

Figure 16 gives a spatial idea of where the forest loss occurred in each of the analyzed periods (accumulated loss) between 2000 and 2020. There, the forest pixels that passed to another type of cover in each period are highlighted.

The loss of forest (Figure 16) and changes in coverage and use are not translating into an improvement in the quality of life for local communities, or an increase in the nation's wealth, nor an enhancement of its sovereignty; on the contrary, it represents the loss of our natural and cultural capital wealth.

Chapter 4

Violence

Chapter 4

Violence

This chapter analyzes data collected for the years 2018 and 2019 by the Commission for Human Rights and Citizenship (CODEHCIU 2020) from press information, and also georeferenced by SOS ORINOCO.

The main acts of violence identified in the MA during the years 2018 and 2019 were grouped into the categories shown in table 17. First of all, homicides (murder of males or females) stand out with 137 cases, an increase of 36% in the year 2019 when compared to 2018. Secondly, femicides[46] (homicides where the victim is a woman) stand out, with 34 cases), followed by generic acts of violence (all others different from the specific categories indicated in the table, where "physical violence" stands out), with 22 cases and rapes, lewd acts and sexual abuse, with 32 cases. (CODEHCIU, 2020).

CATEGORY	ACTS OF VIOLENCE	NUMBER OF CASES		TOTAL	MINING ARC AREAS				
		2018	2019	(2018 - 2019)	Area 1	Area 2	Area 3	Area 4	Area 5
Murders	Murder	58	79	137	3	6	80	47	1
Extrajudicial killings	Extrajudicial killings (committed by authorities)	9	1	10	0	0	8	2	0
Total Murders		67	80	147	3	6	88	49	1
Disappearances	The victims disappeared	2	0	2	0	0	2	0	0
Arbitrary detention	Arbitrary detentions no legal justification	0	1	1	0	0	1	0	0
Femicides	Active femicide	13	5	18	2	0	13	3	0
	Passive femicide	9	7	16	1	0	12	3	0
Total Femicides		22	12	34	3	0	25	6	0
Infanticides	Infanticide	2	1	3	0	0	3	0	0
Buried alive	Victims buried alive at the mine16	2	0	2	0	0	0	2	0
Sexual assaults	Rape, lascivious acts and sexual abuse	16	16	32	0	0	30	2	0
Acts of violence	Victim attacked with cut-and-thrust weapon	7	0	7	0	0	7	0	0
	Attempted robbery	5	0	5	0	0	5	0	0
	Human trafficking	2	0	2	0	0	2	0	0
	Physical violence	5	17	22	0	0	19	3	0
	Psychologic violence	0	2	2	0	0	2	0	0
	Attempted femicide	8	4	12	0	0	9	2	0
Total Acts of Violence		27	23	50	0	0	35	3	0

Table17. Acts of violence in the Mining Arc (2018-2019).
Source: CODEHCIU (2020).

[46] Without entering into any arguments over the semantic difference between feminicide and femicide, for purposes of this report, we will simply refer to this as being homicides perpetrated against women. https://elderecho.com/el-femicidio-y-el-feminicidio

In relation to the location of the cases of violence within the MA, Table 15 and Figure 17 show that Block 3 accounts for the highest number of cases with 193, or 71% of all cases; followed by Block 4 with 24%.

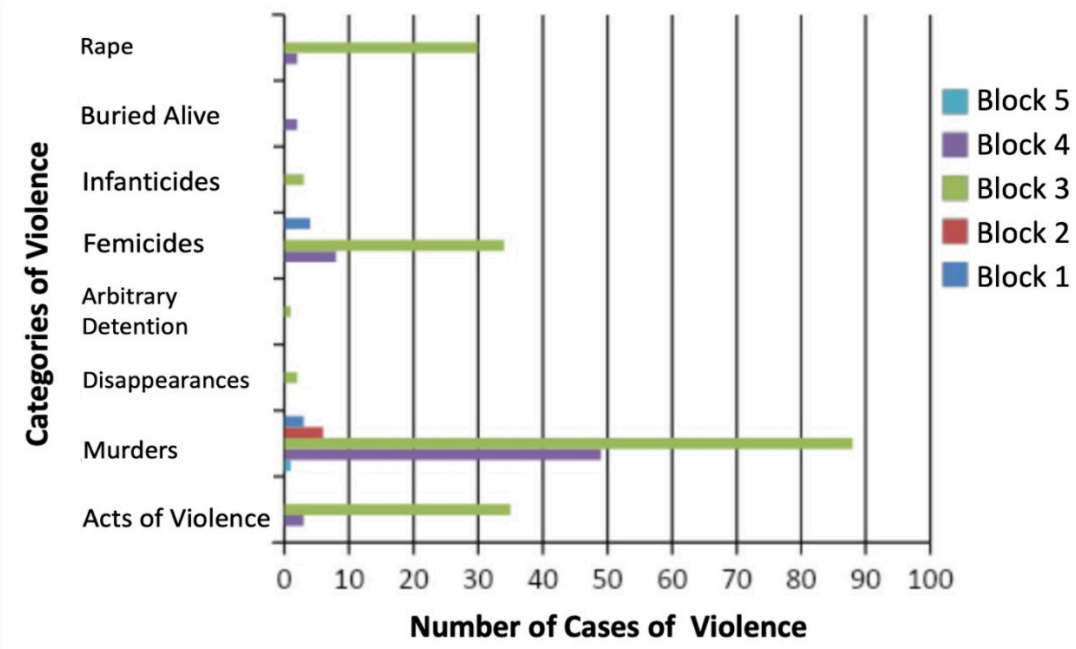


Figure 17. Location of acts of violence in the Mining Arc (2018-2019.
Source: CODEHCIU (2020).

If we analyze the predominant acts of violence in the different MA blocks, it can be seen that murders occupy the first place in Block 3 with 46% of the total, followed by violent actions and femicides (both with 18%), and finally rape, lewd acts and sexual abuse (15%). This means that Block 3 (Negra Hipólita) is considered to be the one with the most violence in all the MA blocks. On the other hand, it is important to emphasize that in Block 4, even though it represents only a quarter of the total cases of violence in the entire MA, murders represent 75% of the total cases of violence in this block, followed of femicides (12%).

With regard to the spatial distribution of cases of violence, a Kernel[47] density, or heat map was prepared in order to determine the density or concentration of acts of violence in the MA during the 2018-2019 period. For this, the cases of violence (number of cases) were interpolated, and weighted by the distance or radius of influence between them.

In this way, it was possible to have a spatial vision identifying the areas with the highest concentration of acts of violence and their relationship with mining activity.

Figure 18 shows that the highest concentration is observed in Blocks 3 and 4. In Block 3, the concentration of cases of violence occurs towards the extreme northern part of the block, where high and medium population densities predominate, coinciding with the highest populated centers (Ciudad Bolívar and Ciudad Guayana). In Block 4 this concentration is distributed in its central portion and along the Troncal 10 highway, with nuclei of medium and low densities.

[47] https://www.cursosgis.com/heatmap-o-mapas-de-calor-con-qgis/

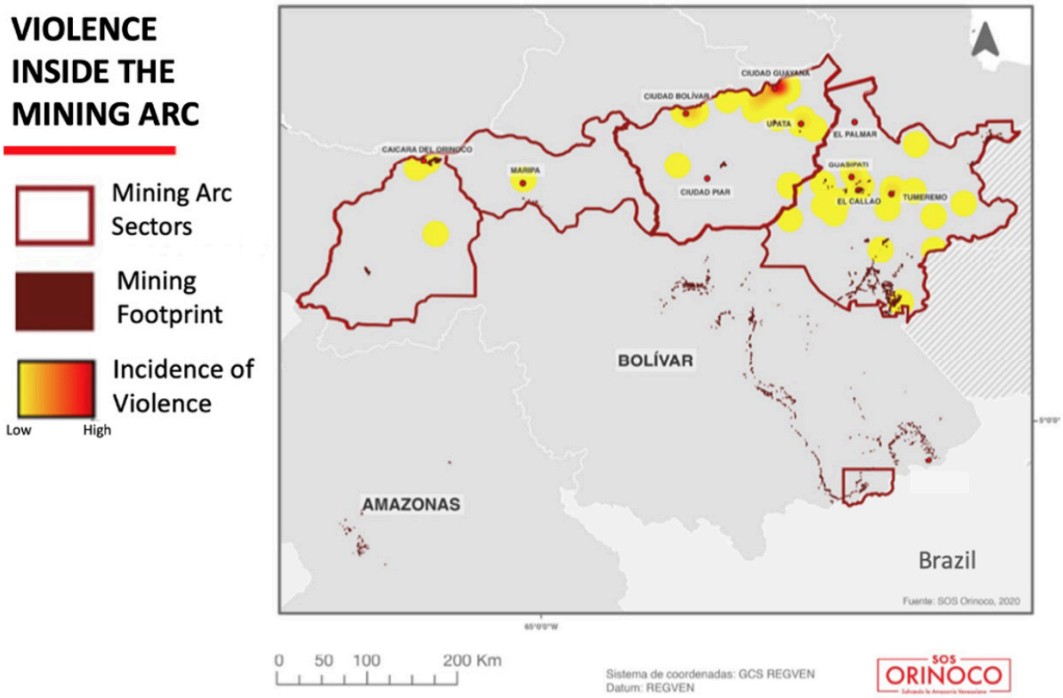


Figure 18. Incidence of acts of violence inside the Mining Arc (2018-2019).
Source: Data from CODEHCIU mapped by VE260 and modified by SOSOrinoco.

It is very likely that the acts of violence that occur in the MA are also related to mining activity. As can be seen in Figure 19, a part of the area affected by acts of violence in Block 4, represented by the density of cases of violence, is close to or within the mining footprint. In Las Claritas, El Dorado and the San Miguel Mining Camp, the acts of violence that occur within or in the vicinity of the mining footprints are of low density. On the other hand, it was observed that the acts of violence that occur in localities such as El Callao, Las Yaguas and in their vicinity show low and medium degrees of incidence.

ACTS OF VIOLENCE AND MINING ACTIVITY

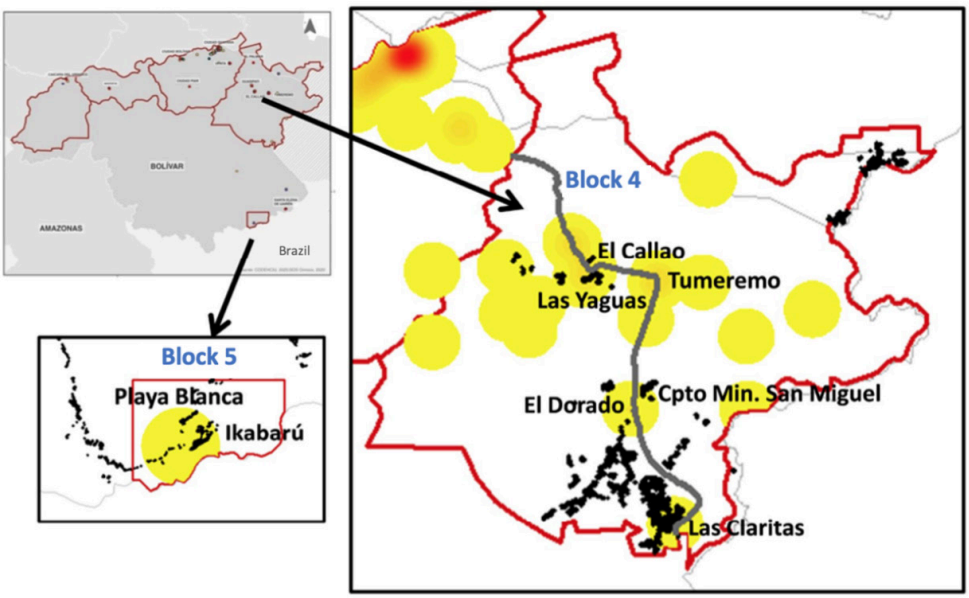


Figure 19. Acts of violence and mining activity in the Mining Arc (2018-2019.
Source: CODEHCIU data base mapped by VE260 and modified by SOSOrinoco.

SOS ORINOCO Salvando la Amazonía Venezolana

Another important factor to analyze related to violence in the MA refers to the presence of irregular armed groups and Venezuelan military personnel (Figures 20 and 21). According to CODEHCIU (2020), Colombian armed groups, such as the “dissidents” of the Revolutionary Armed Forces of Colombia (FARC), maintain alliances with members of the Bolivarian National Guard (GNB), through the payment of “rent” that enable these armed groups to establish their camps and carry out mining activities. CODEHCIU (2020), also refers to confrontations between the FARC and local mafias known as “syndicates,” as well as alliances established between the FARC and Brazilian criminal groups, such as Comando Vermelho, for drug and gold trafficking along roads leading to Brazil.

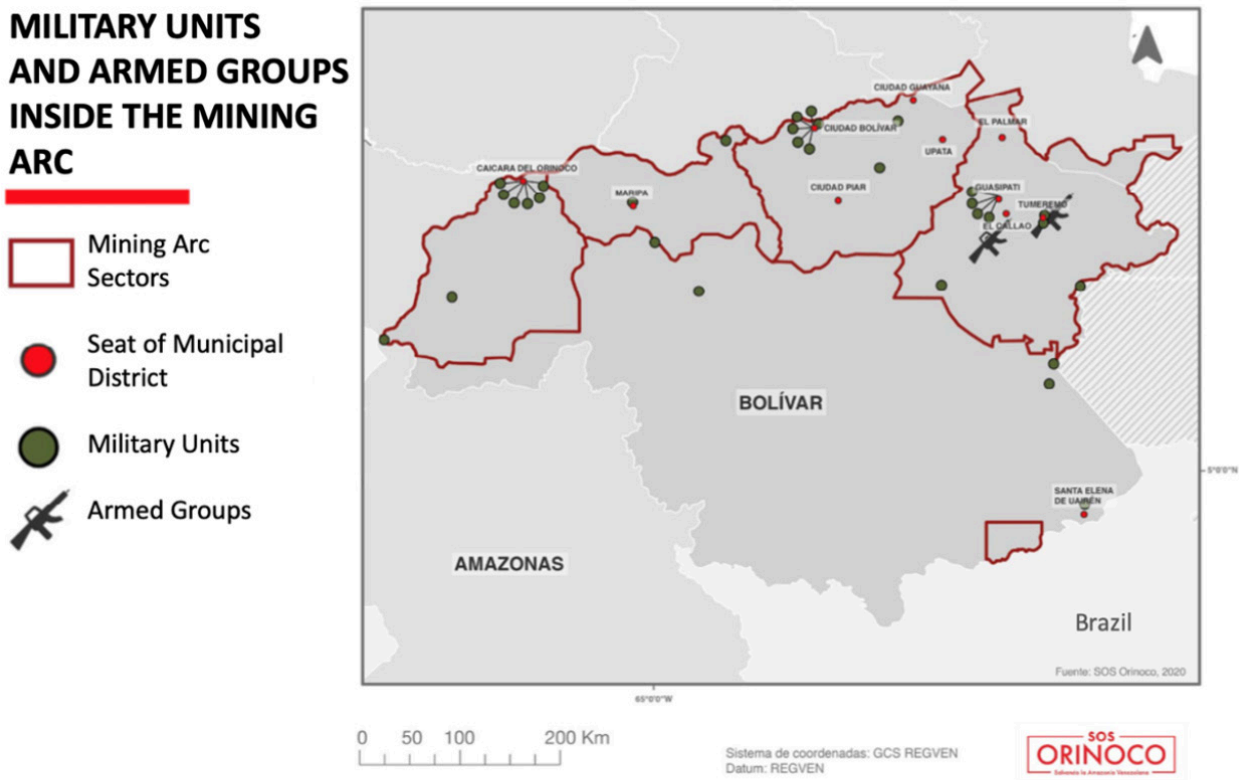


Figure 20. Armed Groups and Military Units inside the Mining Arc.
Source: A revision of the data base prepared by VE360 and modified by SOSOrinoco.

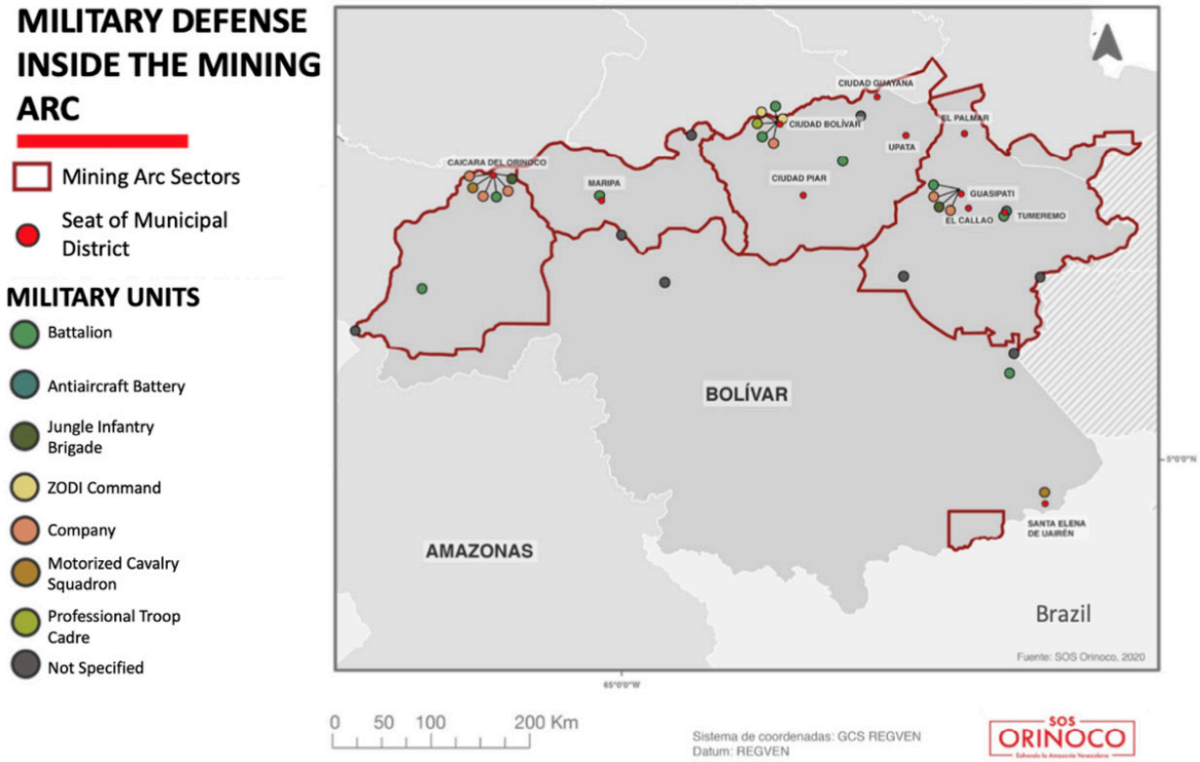


Figure 21. Location of military posts.
Source: a revision of data bases prepared by VE360 and modified by SOSOrinoco.

The National Liberation Army (ELN), originating in Colombia, exercises control over some of the mines in the state of Bolívar and the MA, where they participate in the extraction and commercialization of minerals, or collect “taxes” to allow third parties to extract mining material. Although it has been observed that there is a relationship between this guerrilla group and the Bolivarian National Guard (GNB), both groups have had clashes over control of mining territories. The capture of the ELN’s Eastern Front commander, Luis Felipe Ortega Bernal, alias “Throat” in 2018, triggered a confrontation between the military and guerrillas that left four GNB dead. However, the ELN and the dissident group from the FARC continue to control illegal mining in the state of Bolívar and drug routes leading to the Atlantic (Insight Crime, 2019).

Chapter 5

Public health

Chapter 5

Public health

Since at least 2015, Venezuela has been going through an unprecedented "complex humanitarian emergency." The collapse of the public health system has brought about the re-emergence of diseases that had previously been controlled or eradicated. Along with the rise in the levels of poverty and malnutrition, as well as the collapse of basic services, the effects on health have become massive, causing physical and mental damage and a significant increase in mortality (maternal, neonatal, infant, etc.) (Acción Solidaria et al., 2018; Provea, 2018). One consequence of this humanitarian emergency has been the intensification of population movements within the country as well as to other countries, causing public health problems in neighboring nations that have had to implement humanitarian emergency responses to care for countless groups of people from Venezuela, many of them with health and nutrition problems.

This extreme social, political and economic crisis has fueled an unprecedented increase in illegal mining in the southern part of the country. Tens of thousands of people, coming from all regions of the country, have mobilized towards the MA seeking an economic alternative that would help them to survive. This mining boom and the exacerbated increase in the mining population, which is characterized by the establishment of highly precarious settlements, without access to drinking water or minimal sanitary conditions, and the lack of health services, constitute high risk factors for the transmission of infectious diseases. Meanwhile, the high mobility of the mining population from their areas of origin to the mines, and vice versa, constitutes an epidemiological risk factor that has exacerbated the contagion and spread of emerging and re-emerging diseases, not only in mining areas, but also throughout the country, as we will see below with the examples of measles, diphtheria and malaria.

Additionally, there is severe official censorship of epidemiological information, as well as a bureaucratic practice of undercounting and underreporting many of the pathologies, all of which makes it difficult to access health information from the realm the MA and throughout the country (Ágredo, 2020; Clisánchez, 2020).

Measles[48]

Beginning in 1994, when the countries of the Western Hemisphere that are committed to the goal of interrupting the autochthonous transmission of measles at the beginning of the 21st century, and after 22 years of efforts that involved extensive administration of the measles, mumps and rubella vaccines, in September 2016 the Pan American Health Organization (PAHO)/World Organization Health (WHO) declared the Western Hemisphere as the first measles-free region (PAHO/WHO, 2016a).

In December of the same year (2016) Venezuela received a certificate in recognition of the Elimination of Measles, Rubella and Congenital Rubella Syndrome (PAHO/WHO, 2016b), however, in June 2017 a new measles outbreak began. In Venezuela, the spread of wild-type measles was interrupted in February 2007 after a massive vaccination campaign was conducted following the 2001 and 2006 outbreaks (Paniz-Mondolfi et al., 2019).

[48] Measles is a highly contagious viral disease that can cause severe health problems, including pneumonia, brain swelling, and even death; fortunately, this disease is preventable by vaccination. Severe cases are more common in young children that are malnourished. In populations with high levels of malnutrition, and who do not receive adequate health care, measles causes death in 3 to 6% of cases. It can also cause serious complications in pregnant women, and can cause miscarriage or premature delivery. Those who recover from measles become immune for life. Measles occurs during epidemic outbreaks, with a contagion rate of close to 100% in the unvaccinated. Whenever a case appears, the degree to which a significant outbreak will develop depends directly on the vaccination rate among the population and the preventive measures that are being carried out.

According to the Pan American Health Organization (PAHO), the disease reappeared in 2017 during that year's epidemiological week 26 (June 25 to July 1) in Caroní municipal district, in the state of Bolívar. Until January 2018, 82% of confirmed cases were reported in the state of Bolívar, although cases were also reported in eight other states, with the epicenter of the outbreak being Bolívar's Caroní municipal district. The spread of the virus to other geographic areas was explained by PAHO as a consequence of the high number of people migrating as a result of the formal and informal economic activity related to mining and commercial activity. The group most affected among the confirmed cases were those under age 5, with 59% of confirmed cases, followed by the group consisting of ages 6 to 15, with 30% of confirmed cases (PAHO/WHO, 2018a).

The measles outbreak that began in Venezuela spread to neighboring countries such as Colombia and Brazil, and then continued to spread to Ecuador, Peru, Chile and Argentina, as a result of the flow of Venezuelan refugees carrying the virus (Marcano and Valverde, 2020). The abandonment of prevention programs, and more specifically, the low immunization coverage using the trivalent MMR vaccine, which protects against measles, mumps and rubella (German measles), caused the reappearance of this disease (Idem; Lima, 2020).

As part of their collaboration, PAHO/WHO supported the Ministry of Health in the implementation of a National Rapid Response Plan to interrupt the spread of the virus, which included vaccination drives, epidemiological surveillance, searching and investigating cases, and training health personnel. More than 6 million doses of measles, mumps and rubella (MMR) and measles/rubella (MR) vaccines were made available to increase vaccination coverage in children and adolescents with a view to interrupting the spread of the virus (PAHO/WHO, 2018b).

The PAHO also expressed concern that "indigenous peoples living in the Venezuelan border area are extremely vulnerable to epidemic diseases. Of particular concern are the Waraos, who live in the border areas between Venezuela and Guyana and who are now migrating to northern Brazil, as well as the Wayú people who live in the border areas between Venezuela and Colombia, and the Yanomami who live in areas along the border between Venezuela and Brazil." (PAHO/WHO, 2018c).

The measles epidemic in Venezuela lasted from June 2017 to August 2019. In total, 7,054 cases were confirmed (727 in 2017, 5,779 in 2018 and 548 in 2019), including 84 deaths: 2 in 2017 (in Bolívar), 79 in 2018 (37 in Delta Amacuro, 27 in Amazonas, 9 in Miranda, 4 in the Capital District, 1 in Bolívar and 1 in Vargas) and 3 in 2019 (in Zulia) (PAHO/WHO, 2020b; SVSP-RDEN, 2019). Of the total deaths, 62 were from indigenous groups (35 in Delta Amacuro, all from Warao communities; and 27 in Amazonas, 26 being from Sanema communities and 1 person from the Yanomami people), corresponding to 74% of the deceased.

Although the link between the start of the measles outbreak and mining activity in the state of Bolívar was clearly identified by the PAHO, the lack of data on the occurrence of cases makes it difficult to map the incidence of the outbreak within the realm of the MA.

Diphteria[49]

Diphtheria is an acute infectious disease, which was considered eliminated in Venezuela starting in 1990[50], until its reappearance in 2016 in Sifontes municipal district, in the state of Bolívar. Below is a list of the main events related to the diphtheria outbreak:

[49] Diphtheria is an infectious disease caused by the bacteria *Corynebacterium diphtheria*, which mainly infects the throat and upper respiratory tract, and produces a toxin that affects other organs. The disease has an acute onset and the main features are a sore throat, low fever, and swollen glands in the neck, and the toxin can, in severe cases, cause myocarditis or peripheral neuropathy. Diphtheria toxin causes a membrane of dead tissue to build up over the throat and tonsils, making it difficult to breathe and swallow. The disease is transmitted through direct physical contact or inhalation of aerosolized secretions from the cough or sneeze of infected individuals. Diphtheria vaccination has drastically reduced diphtheria mortality and morbidity, however diphtheria remains a major child health problem in countries with poor vaccination coverage (PAHO/WHO, n.d.).

[50] With the exception of one case in 1992 and another in 2005. http://ais.paho.org/phip/viz/im_vaccinepreventablediseases.as

- September 17, 2016: The National Network in Defense of Epidemiology (RDEN) and the Venezuelan Public Health Society (SVSP) published unofficial information on three suspected cases of diphtheria in children who had died a few days after showing symptoms. The cases apparently occurred in a community located at kilometer marker 88, in Sifontes municipal district, in the state of Bolívar, at the epicenter of the largest focus of illegal mining within the MA (RDEN-SVSP, 2016a).

- They also recommended that the health authorities inform the population and the medical community about the possible outbreak of diphtheria in the state of Bolívar, provide treatment and medical attention to patients, and begin to vaccinate the child population in the outbreak area as soon as possible (Idem).

- 26 September 2016: The RDEN and SVSP reported that the place of origin of the cases was at kilometer marker 33, at San Antonio de Roscio, a Pemón indigenous community in Sifontes municipal district. In addition, they reviewed unofficial information on the increase in illnesses and deaths, apparently among the Pemón indigenous population of Sifontes municipal district, where the possible diphtheria outbreak was added to the serious malaria epidemic (RDEN-SVSP, 2016b).

- 27 September 2016: Francisco Rangel Gómez, governor of the state of Bolívar, made a statement in reference to the existence of reports of diphtheria cases in some areas of Sifontes municipal district (SVSP-RDEN, n.d.).

- 5 October 2016: The RDEN and the SVSP published a call for attention regarding the silence of the health authorities, urging them to report on the situation and to issue guidelines for epidemiological surveillance, preventive measures, control and monitoring of diphtheria at healthcare facilities (Idem).

- Various news media had been reporting more than 17 presumed deaths from diphtheria that had occurred in Sifontes and Caroní municipal districts. They pointed out that the Ministry of the People's Power for Health (MPPS) had first suspected the presence of the disease in April, also that in June there were already confirmed cases and that in July PCR tests for diphtheria had been carried out on three deceased persons from Tumeremo, which were positive. However, the news media pointed out that the health authorities had not given out any information on the subject so as to avoid a public outrage (Idem).

- 11 October 2016: Luisana Melo, Minister of the People's Power for Health (MPPS), declared that the reappearance of diphtheria was merely limited to a problem of a regional nature in the state of Bolívar, which was already under control, with a total of 78 suspected cases of which only four were confirmed, including two deaths. The General Office of Epidemiology sent to the Regional Offices an epidemiological alert on diphtheria accompanied with the guidelines to be followed for case management (SVSP-RDEN, 2016a).

- According to the RDEN and the SVSP, Minister Melo tried to minimize the magnitude of the epidemic and deliberately omitted information on the scarce availability of medicines necessary for the treatment of diphtheria cases, as well as on the extremely low vaccination coverage in the state of Bolívar and other jurisdictions in the country. These were determining factors for the reappearance of the disease, and placed these jurisdictions at risk from the eventual advance of the epidemic outbreak (Idem).

- 26 September 2016: The RDEN and SVSP reported that the place of origin of the cases was at kilometer marker 33, at San Antonio de Roscio, a Pemón indigenous community in Sifontes municipal district. In addition, they reviewed unofficial information on the increase in illnesses and deaths, apparently among the Pemón indigenous population of Sifontes municipal district, where the possible diphtheria outbreak was added to the serious malaria epidemic (RDEN-SVSP, 2016b).

- They also drew attention to the lack of information in the PAHO Epidemiological Alerts concerning the reappearance of diphtheria in Venezuela. They also reported on the insufficient supply of vaccines and medicines necessary for treating cases in the country.

- 27 November 2016: The RDEN and SVSP reported that the epidemic had increased rapidly in number of cases (between 200 and 300) and had spread from Bolívar to six other states in the country, with autochthonous cases, and one death in the Apure state. The spread of the epidemic was due to the mobilization of people who worked in mining areas and constantly moved to other states. The organizations reiterated their call for the MPPS to break the official silence, declare the epidemiological alert, inform and guide the population and start a massive vaccination campaign at the national level (SVSP-RDEN, 2016c)

- 16 December 2016: the PAHO included information on Venezuela in the epidemiological report on diphtheria (PAHO/WHO, 2016c).

- According to the PAHO, the diphtheria outbreak in Venezuela began in July of 2016, and as of August of 2020, there had been 1,790 cases confirmed, including 294 deaths: 58 cases (including 17 deaths) in 2016; 786 cases (including 103 deaths) in 2017; 775 cases (including 151 deaths) in 2018; 166 cases (including 21 deaths) in 2019; and 5 cases (including 2 deaths) in 2020 (PAHO/WHO, 2020a).

The diphtheria outbreak began in the epicenter of the largest focus of illegal mining within the MA, in Sifontes municipality, in the state of Bolívar. The main risk factors associated with the outbreak were the low immunization coverage in the area, the precarious living conditions in the mining areas, the lack of access to healthcare services equipped to care for the cases, and the intense mobility of the mining population, which facilitated the spread of the outbreak to the rest of the country. The lack of specific data on the distribution of cases makes it difficult to map the incidence of the outbreak within the realm of the MA.

Malaria[51]

Malaria continues to be the most prevalent parasitic disease in the world. About half of the world's population is at risk of malaria, especially those living in low-income countries. In 2019 an estimated 229 million cases and 409,000 deaths occurred, mostly among children under age 5 on the African continent. However, over the past two decades the global response to malaria has had an unprecedented success in controlling the disease. During the 2000 to 2019 period, global mortality from malaria was reduced by 60%, and 21 countries had eliminated the disease (WHO, 2020).

In the Western Hemisphere, malaria cases were reduced by 40% (from 1.5 to 0.9 million) and the incidence of cases by 57% (from 14 to 6 cases per 1,000 inhabitants at risk) between the years 2000 and 2019. Malaria deaths were reduced by 39% (from 909 to 551) and the mortality incidence rate by 50% (from 0.8 to 0.4) (WHO, 2020).

[51] Malaria or malaria is a disease caused by parasites of the genus *Plasmodium,* transmitted by the bite of female mosquitoes of the genus Anopheles. The *Plasmodia* species that infect humans are *Plasmodium falciparum, P. vivax, P. ovale,* and *P. malariae.* The clinical manifestations of the disease are characterized by acute or chronic febrile syndrome, anemia, spleen complications, and hepatomegaly. Serious complications and fatal cases are more frequent in *P. falciparum* infections. If these are not treated in time, they can result in kidney and brain complications, and even death. The parasites *P. vivax* and *P. falciparum* are the most common, while *P. malariae* and *P. ovale* are lesser-known parasites. In the Western Hemisphere, infections by *P. vivax* and *P. falciparum* predominate; *P. malariae* is confined to certain areas of Africa and the Western Hemisphere, while *P. ovale* is found in some areas of West Africa, the Western Pacific, and Asia. Malaria is preventable and curable. Diagnosis of the disease is made by examining blood samples under a microscope, where the parasite is detected within the red blood cells. Rapid diagnostic tests have also been developed. Chloroquine is the most used treatment in most countries for the treatment of uncomplicated *P. vivax,* however, *P. falciparum* has developed resistance to this drug, and currently a combination therapy with artemisinin derivatives is applied, as the main treatment against this parasite. Among the preventive measures, the use of mosquito nets impregnated with long-lasting insecticide and indoor spraying of insecticides is recommended. These measures result in reducing the risk of bites by infected mosquito (PAHO/WHO (no date); Wide, Moreno, and Noya, 2011). More information available at: https://www.who.int/news-room/fact-sheets/detail/malaria

In Venezuela

Within this panorama of advances in the world, Venezuela has been the great exception, showing an unprecedented increase in the disease, to the point that according to the 2017 World Malaria Report, Venezuela was one of the four countries, along with Nigeria, South Sudan and Yemen, that were under alert status (WHO, 2017[52]). In 2000, Venezuela confirmed 29,736 cases (PAHO/WHO, 2019a), but reached 398,285 in 2019 (WHO, 2020), which is equivalent to an increase of 1,239% in twenty years (Figure 22). Currently, Venezuela reports 53% of cases, and more than 70% of deaths from malaria in the Western Hemisphere (Idem).

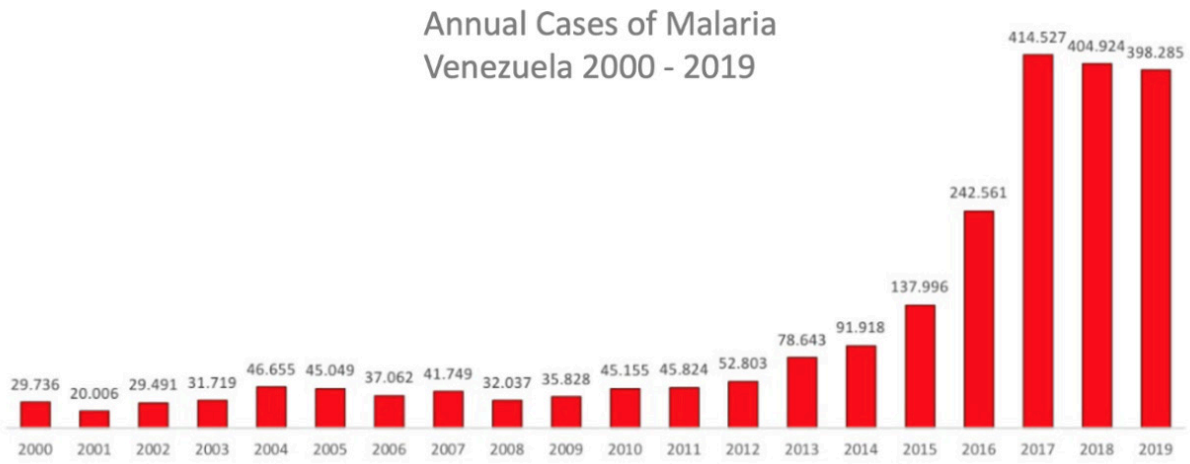


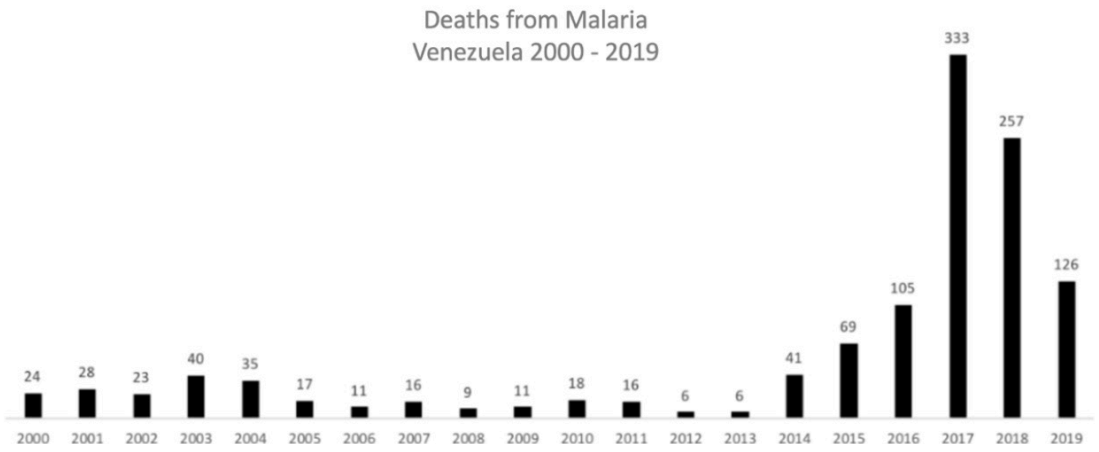
Figure 22. New cases of malaria in Venezuela 2000-2019.
Source: PAHO/WHO.

In Figure 22 one can see how from 2013 there was a vertiginous rise in cases, exceeding 414,000 in 2017, and a slight decrease in 2018 and 2019. Figure 23 shows a similar trend in the number of deaths, with an exponential increase between 2014 and 2017, when 333 deaths were reported, and a reduction in deaths in 2018 and 2019.

In Venezuela, malaria does not escape the official censorship of epidemiological information. Since 2016, no official epidemiological bulletins have been published and the weekly malaria report has not circulated since October 2014 (Villegas and Torres, 2019). The data available to the public pertains to the partial data provided by the MPPS to the PAHO/WHO, which is strictly limited to those classified as “new cases,” thus hiding relapses and upsurges,[53] as well as unreported and unregistered cases (ANM et al., 2018; Oletta, 2020). It is estimated that new cases represent close to half of the total of real cases, and the omission represents between 40% and 50% of cases added to the national statistics (Oletta, 2020; Villegas and Torres, 2019). The data for this report come from official sources, obtained through informal channels.

[52] This situation constitutes a setback taking us back several decades, given that by the mid 20th century, Venezuela had developed the best malaria control program in tropical regions, becoming the first country to appear in the World Health Organization’s Malaria Eradication Registration in 1961.

[53] A relapse is any case that occurs within the period of 30 days following the conclusion of receiving antimalarial treatment due to infection by P. vivax. Recrudescence refers to those infections confirmed 30 days following the last infection reported as a new case for P. falciparum and P. Malariae. (Wide, Moreno and Noya, 2011).



The WHO reported in 2017 that it was supporting an emergency response to malaria in Venezuela, highlighting the health risks associated with the ongoing humanitarian crisis (WHO, 2017). In 2018, it warned that our country had the highest increase in cases in the world due to the drastic reduction in antimalaria campaigns (EFE, 2018). The cases have spread almost throughout the entire nation, affecting 20 of the 24 nation's states in 2019. The increase in cases, according to the PAHO, "is mainly linked to people that have become infected in the mining areas of the state of Bolívar and have migrated to other areas of the country where the ecosystems are prone to the spread of malaria, as well as to the scarcity or the unaffordable price of antimalarial drugs and the weakening of vector control programs." (PAHO, 2018c). The increase in cases in border areas and the export of cases to Brazil, Colombia, Guyana, Trinidad and Tobago, Suriname, Ecuador, Argentina, Chile and other countries, resulting from the flow of Venezuelan migrants and refugees, increases the risk of an outbreak that could affect the entire region (Grillet et al., 2019; Villegas and Torres, 2019).

Several elements further complicate the situation, such as the presence of strains that are resistant to antimalarial medications, the reintroduction of local contagions into areas that were previously free of malaria, including urban and peri-urban areas, the increase in cases in pregnant women and children, with serious consequences for maternal and child health and the lack of adequate treatment, which generates a continuous increase in contagion, relapses, and mortality related to malaria (Oletta, 2020; PAHO, 2018c; Villegas and Torres, 2019).

Multiple combined factors have created the conditions for the uncontrolled increase in the malaria epidemic. According to Villegas and Torres (2019), among the main reasons is the reduced expenditure in resources, which affects the shortage of antimalarial drugs, diagnostic tools, mosquito nets treated with insecticides, logistical limitations, and lack of access to health services in endemic areas; in addition to the expansion of mining and other illegal activities in the southern part of the country, internal migration, and the inadequate prioritization of the interventions implemented by the Malaria Program.

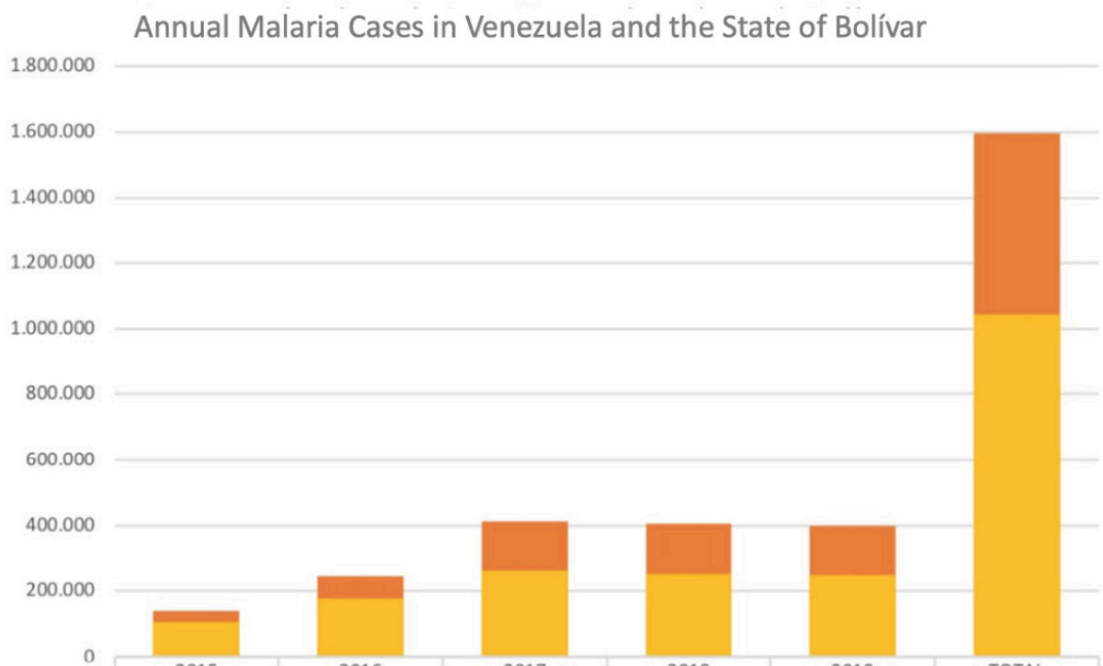
According to Noya, there are three main factors that explain the expansion and increase of malaria in the country. First, the boom in illegal mining in the state of Bolívar, which is promoted by the national government, and which led to the arrival of tens of thousands of miners who have caused deforestation, live in camps under unsanitary conditions and are exposed to the transmission of malaria, thus creating conditions for the proliferation of mosquito breeding sites in the settling ponds alongside the mines. Miners become infected with malaria in the state of Bolívar and carry malaria to their places of origin throughout the country. According to Noya, "it is impossible to control malaria as long as the anarchy that currently exists in the entire mining area

persists, where the epicenter is Sifontes municipal district, in the state of Bolívar." A second factor has been the dismantling of the MPPS's Office of Environmental Health, which has weakened surveillance and control systems for malaria and other vector-borne diseases. Thirdly, there is the shortage of drugs for the treatment of the different types of malaria, which explains both the increase in malaria cases and the large number of deaths, due to the lack of treatment for severe cases (OVS- CENDES, 2016).

In the State of Bolívar

Historically, the state of Bolívar has been a malaria endemic region, and where total elimination was never achieved. Even Dr. Gabaldón, architect of the national antimalarial control program, considered that eradication was impossible in the southern part of the country, due to the peculiarities of the area. Starting in 1983, when Venezuela experienced an upsurge in malaria, the state of Bolívar was identified as the main area of malaria contagion in the country. Even then, the increase in mining activity was recognized as the main cause, together with the decrease in the budget for malaria control and surveillance programs, and the importation of cases from neighboring countries (Sandoval de Mora, 1997).

The unprecedented increase in illegal mining in recent years, especially in the state of Bolívar, as a result of the national economic debacle and the promotion of mining activity in the MA, has been accompanied by a growth in malaria cases. Between 2015 and 2019, there were 1,598,293 registered cases in the country, of which 1,044,860 (65.4%) occurred in the state of Bolívar (Figure 24).



	2015	2016	2017	2018	2019	TOTAL
Venezuela	137.996	242.561	414.527	404.924	398.285	1.598.293
State of Bolívar	106.853	177.619	261.322	251.366	247.700	1.044.860
% Cases Bolívar	77,4%	73,2%	63%	62,1%	62,2%	65,4%

Figure 24. Annual Cases of Malaria in Venezuela and the State of Bolívar
Source: PAHO/WHO and General Office of Environmental Health of the Ministry of the People's Power for Health.

During the 2015-2019 period, the parasitic formula for malaria originating in the state of Bolívar was *Plasmodium vivax* 71.1%, *Plasmodium falciparum* 21.1%, *Plasmodium malariae* 0.001% and 7.8% mixed infections *(P. vivax + P. falciparum).*

The distribution of malaria in the state of Bolívar shows high variability among the different municipal districts and parishes (Table 18 and Figure 24). The proportion of the total cases by municipal district between the years 2015 and 2019 indicates that Sifontes municipal district, with 560,385 cases, represents 53.6% of the total cases of the state, equivalent to 35% at the national level. It is followed in order of magnitude by El Callao, Angostura, Cedeño, Caroní, Sucre, Gran Sabana, Piar, Heres, Roscio and Padre Pedro Chien municipal districts. 84.4% of the cases were registered in 5 municipal districts: Sifontes, El Callao, Angostura, Cedeño and Caroní. However, at the parish level, the malaria hotspots in Bolívar can be identified in greater detail (cf. Grillet et al., 2020). San Isidro parish, in Sifontes municipal district, with 425,087 cases between 2015 and 2019, accounts for 40.9% of the cases in the entire state during that period. It is followed by El Callao parish, which is the seat of El Callao municipal district, with 11.5% of the cases; and in third place is Dalla Costa parish, in Sifontes municipal district with 11.2%. The three parishes account for 63.6% of the cases in the state of Bolívar.

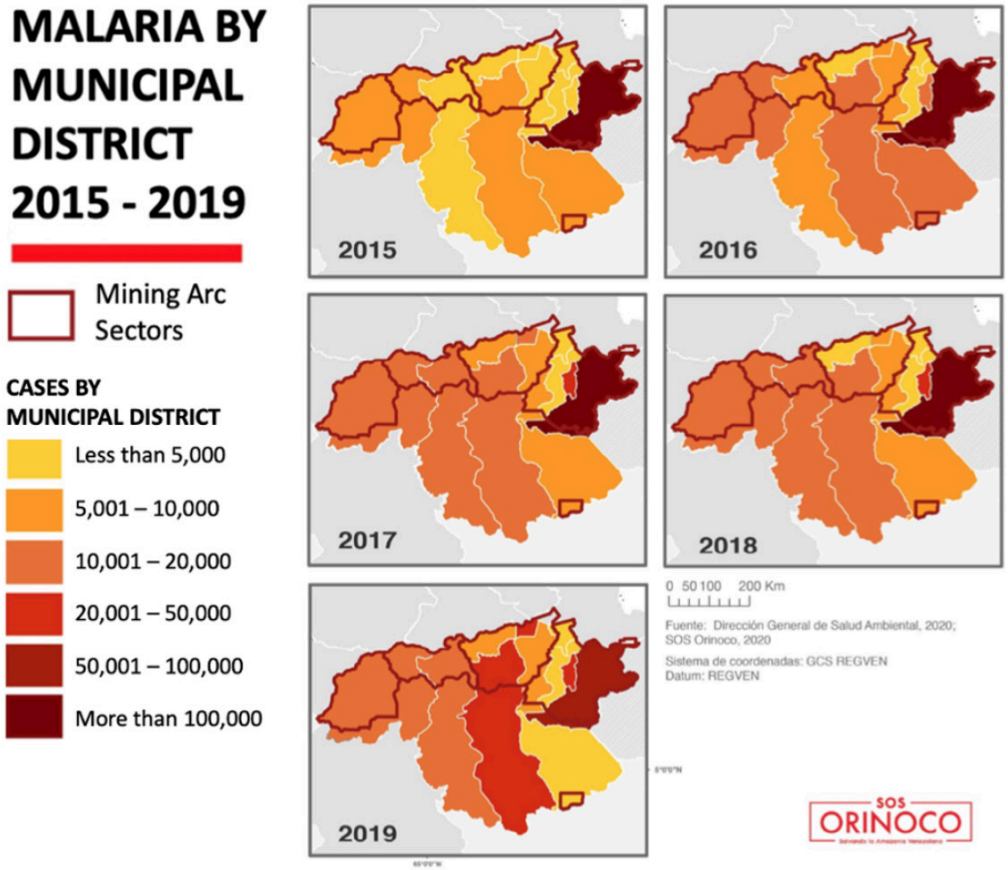


Figure 25. Annual cases of malaria by municipal district.
Source: Georeferencing of data conducted by SOSOrinoco based on information available From the General Office of Environmental Health (DGSA).

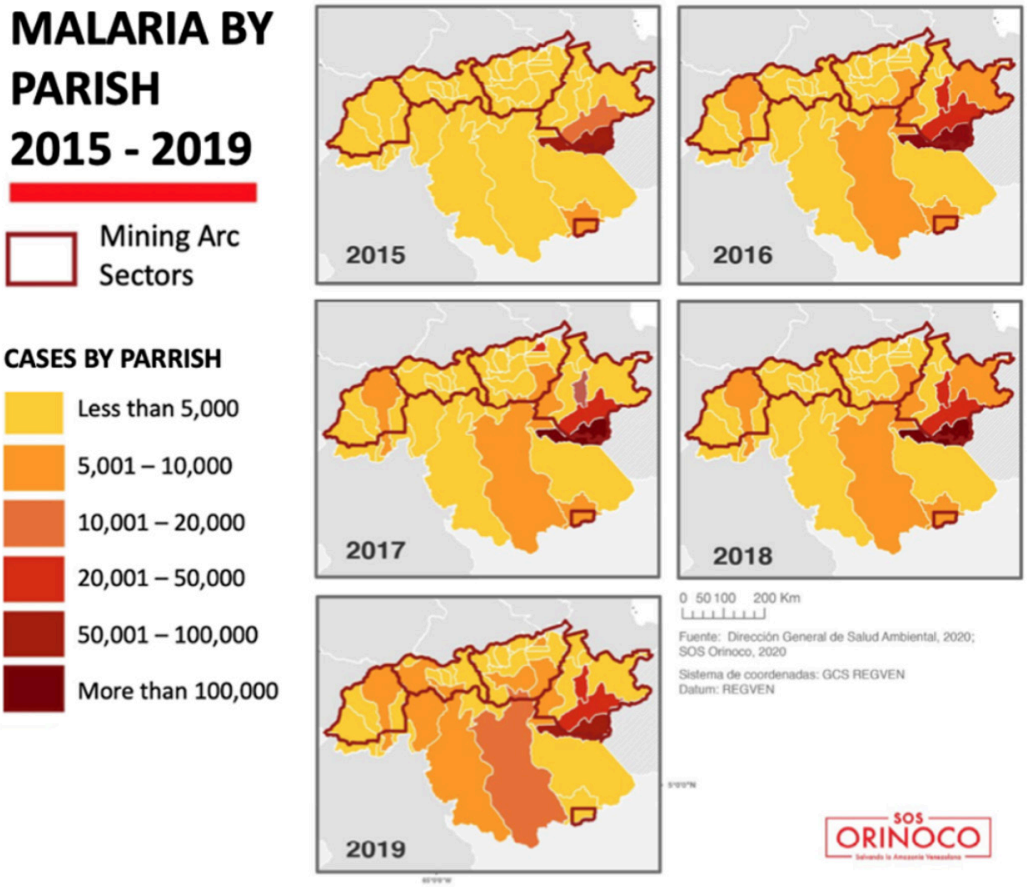


Figure 26.Annual cases of malaria by parish.
Source: Georeferencing of data conducted by SOSOrinoco based on information available from the General Office of Environmental Health (DGSA).

Municipal Districts	2015	2016	2017	2018	2019	Total	%
Sifontes	71,934	102,543	140,481	150,069	95,358	560,385	53.6
El Callao	4,462	11,135	38,230	27,933	38,085	119,905	11.5
Angostura	7,254	11,250	11,338	15,394	26,042	71,278	6.8
Cedeño	6,898	11,727	14,600	15,234	17,868	66,327	6.3
Caroní	922	8,178	17,789	8,857	28,093	63,639	6.1
Sucre	3,820	8,944	13,628	12,974	19,064	58,430	5.6
Gran Sabana	8,350	15,662	8,996	8,094	4,882	45,984	4.4
Piar	2,427	5,447	9,509	6,576	9,158	33,117	3.2
Heres	412	2,231	5,436	4,583	6,672	19,334	1.9
Roscio	374	502	959	1,228	1,103	4,165	0.4
Padre Pedro Chien	0	0	356	564	1,376	2,296	0.2
State of Bolívar	**106,853**	**117,619**	**261,322**	**251,366**	**247,700**	**1,044,860**	**100.0**

Table 18. Malaria cases in the State of Bolívar between 2015 and 2019.
Source: Ministry of the People's Power for Health - General Office of Environmental Health.

Approximately 25% of the infections acquired in Bolívar were diagnosed in other states of the country, due to the high mobility of people that work at the mines and other activities associated with the mining areas (providers of goods and services) and frequently return to their homes or places of origin, while carrying the parasite. The annual parasite incidence (API) per 1,000 inhabitants[54] by municipal districts in the state of Bolívar between the years 2015 and 2017[55] (Figure 27, Figure 28), allows us to appreciate the trend towards an extreme increase in malaria risk in municipal districts such as Sifontes, where the API exceeded 2,000 cases confirmed per year per thousand inhabitants;[56] El Callao municipal district with an API greater than 1,500, Sucre with more than 500, Gran Sabana and Angostura with more than 200, and Cedeño with more than 100, just to mention the highest. The API is the best indicator of changes in the trend of the disease, and it is the most frequently used measure in surveillance systems and in the evaluation of the effectiveness of control measures. In Venezuela, the IPA is used to stratify risk areas into five categories: very high, high, medium, low and no risk.[57] It is important to note that areas with API's greater than 50 are considered to be at very high risk of malaria transmission, according to the MPPS standards.

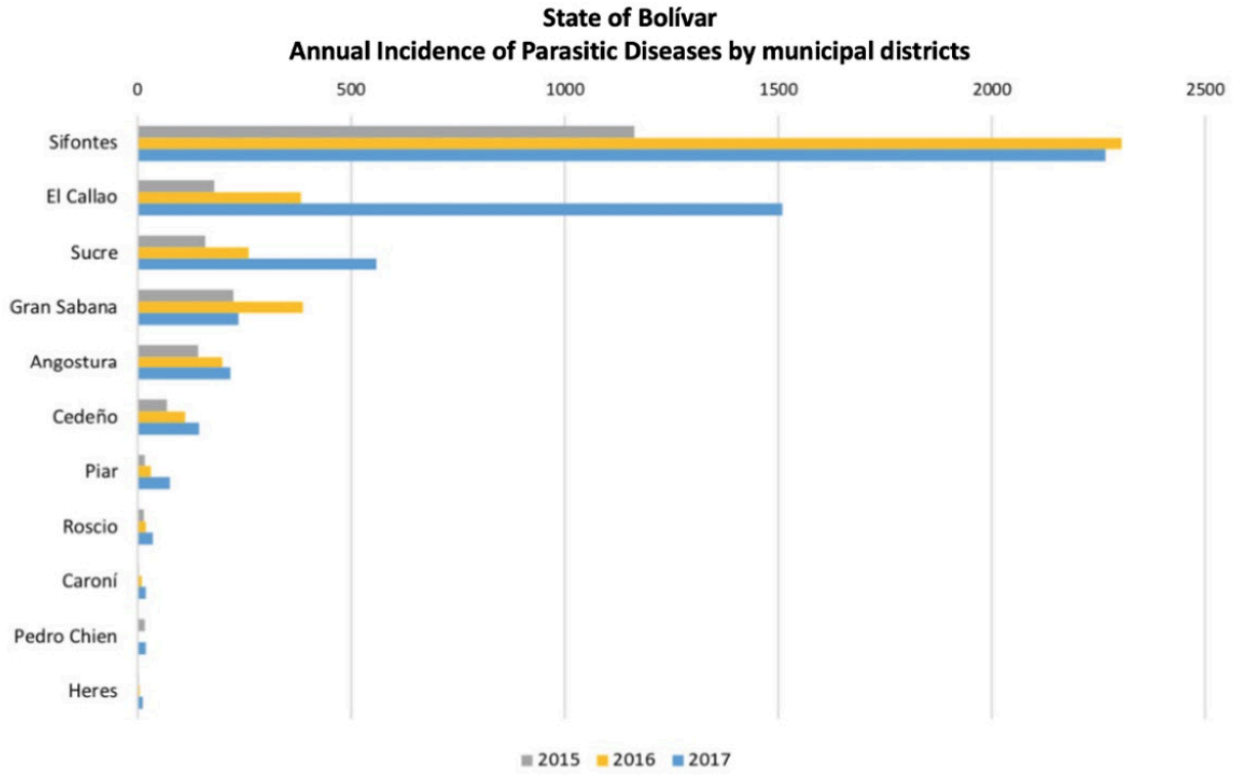


Figure 27. Annual incidence of parasitic diseases per 1,000 inhabitants in the municipal districts of the State of Bolívar.
Source: PAHO/WHO.

[54] The number of malaria cases confirmed microscopically during one year from among 1,000 persons subjected to surveillance (Wide, Moreno and Noya, 2011).

[55] This API for the year 2017 is the most up-to-date that is available at the PAHO/WHO website.

[56] In short, this means that every inhabitant of Sifontes municipal district is at risk of becoming infected with malaria at least twice a year.

[57] Very High-Risk means ≥ 50; High-Risk means ≥ 10 and <50; Medium-Risk means ≥ 5 and <10; Low-Risk means < 5; No Risk means = 0.

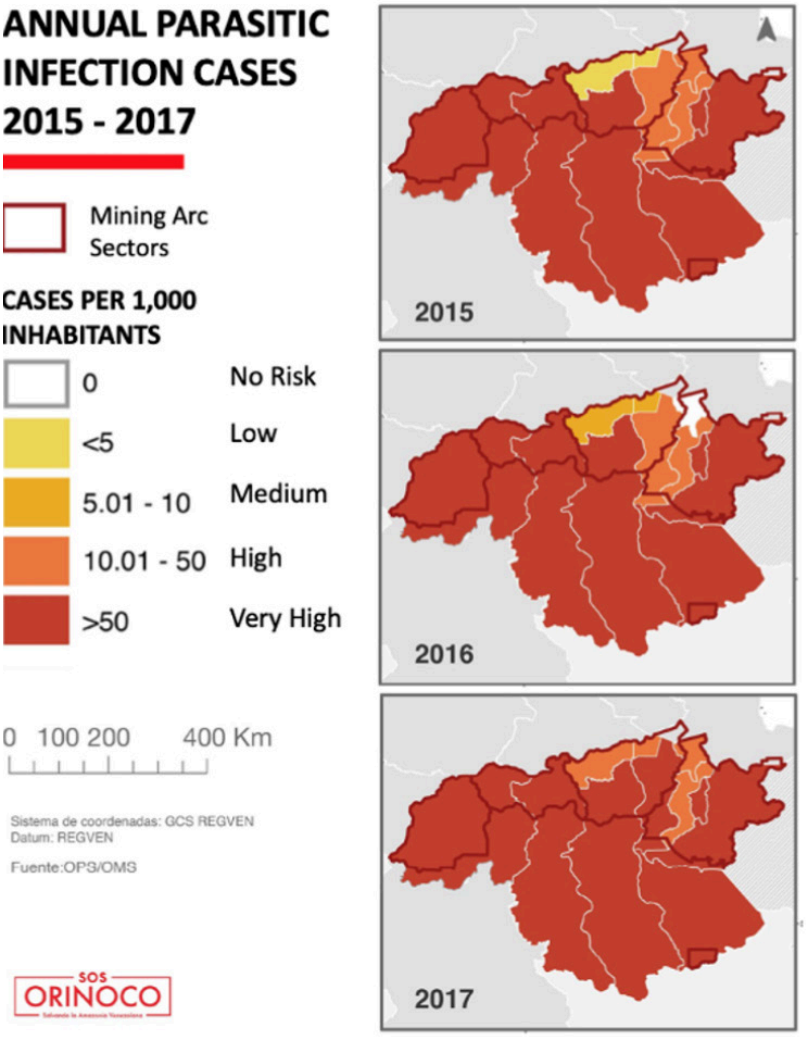


Figure 28. Classification of municipal districts in the State of Bolívar with respect to annual parasitic infection cases per 1,000 inhabitants.
Source: OPS/OMS.

Between 2017 and 2019, there was a slight decrease of 5.2% in new malaria cases in the state of Bolívar and 3.9% at the national level (Figure 24). This is fundamentally due to the actions of prevention, diagnosis and treatment of malaria, as well as vector control, developed in support of the National Malaria Program by the NGO Doctors Without Borders (MSF, 2020), present in Sifontes municipal district, and the International Committee of the Red Cross in El Callao (ICRC, 2019), in addition to the PAHO (PAHO Venezuela, 2019). The number of cases in 2020 is expected to decrease even more in the state of Bolívar and at the national level, due to the impact of the Covid-19 pandemic and the generalized shortage of gasoline, which have affected the mobility of the mining population.

In the Orinoco Mining Arc

Based on the data relating to malaria cases diagnosed in the state of Bolívar and registered by the Regional Office of Environmental Health of that state,[58] cases were mapped out by locality for the years 2016, 2017 and 2018. According to this mapping, 94% of the cases reported in the state of Bolívar occurred within the MA and only 6% of the cases occurred outside the MA (Table 19). Within the MA, 67% of the cases had become infected in Area 4 (Josefa Camejo Block), 15% in Area 3 (Negra Hipólita Block), 7% in 2 (Manuelita Sáenz Block), 4% in Area 1 (Juana la Avanzadora Block) and 2% in the Icabarú Special Block (Table 19).

[58] These data do not include cases of infection that occurred in the state of Bolívar but were diagnosed in other states in the nation, which accounts for approximately 25% of the cases. Therefore, the total number of cases is less than what was previously represented by the data in this report.

Mining Arc (MA)	2016	2017	2018	Total	%
Area 1	4,072	7,461	7,461	19,597	3.8
Area 2	8,549	14,170	14,170	36,311	7.0
Area 3	20,505	37,071	37,071	75,964	14.6
Area 4	84,087	135,791	135,791	350,552	67.4
Icabarú Block	4,441	2,238	2,238	8,447	1.6
MA	121,654	196,731	196,731	490,871	94.4
Non-MA	11,253	8,489	8,489	28,986	5.6
TOTAL	**132,907**	**205,220**	**205,220**	**519,857**	**100.0**

Table 19. Distribution of malaria cases in the Mining Arc.
Source: Prepared by the authors based on data from the Office of Environmental Health of the State of Bolívar.

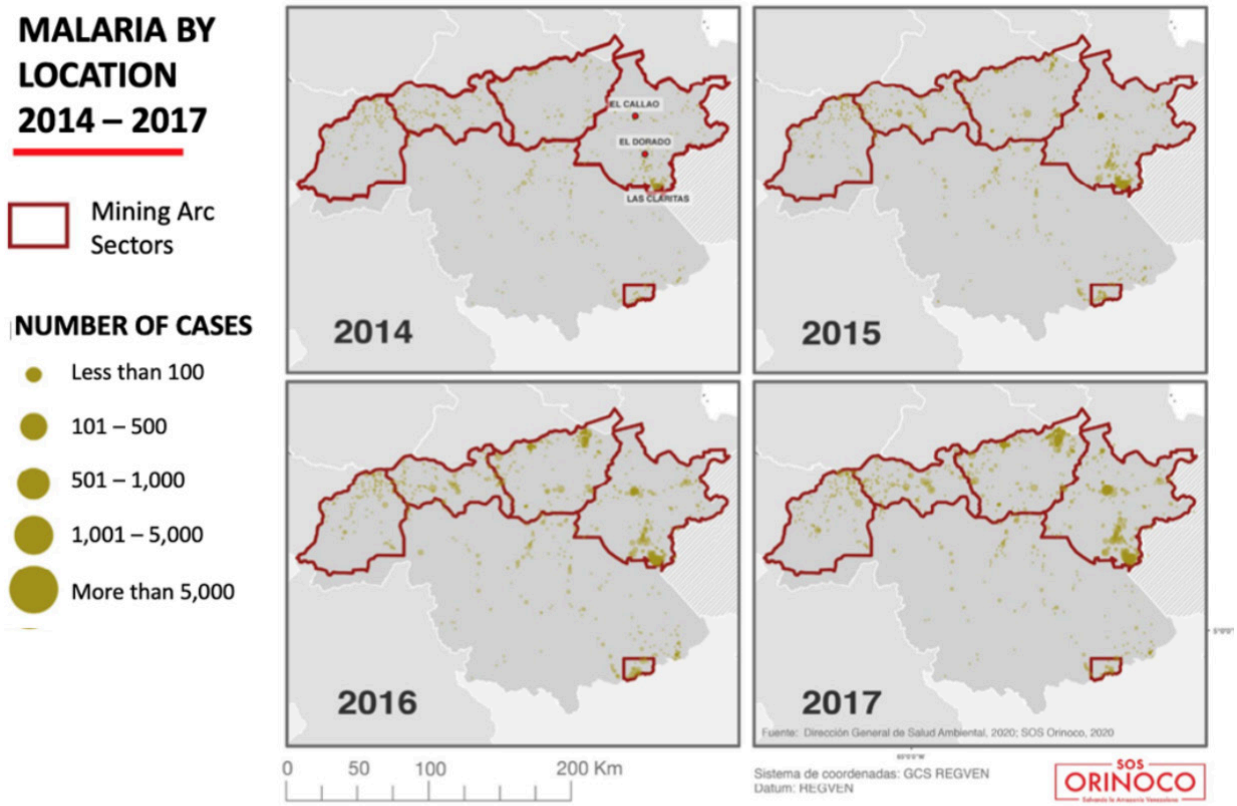


Figure 29. Cumulative cases of malaria at the local level for the years 2014-2017.
Source: Data georeferenced by VE360 based on information available the General Office of Environmental Health of the State of Bolívar.

Figure 29 shows the growing proliferation of localities with significant numbers of new cases of malaria throughout the state of Bolívar, from 2014 to 2017, which was the year with the highest number of cases. One can also observe the increase in cases resulting from the reintroduction of local contagion in areas that were previously free of malaria, including urban and peri-urban areas, with a huge increase in new cases, even in the state's larger cities, such as Ciudad Guayana, Ciudad Bolívar, and Caicara del Orinoco, but especially in the mining areas of El Callao, El Dorado and Las Claritas. Figure 30 shows the accumulation of cases according to locality between 2015 and 2018, where the enormous number of cases associated with the mining footprint can be seen, mostly concentrated in Sifontes, Gran Sabana and Angostura municipal districts, in the Caroní, La Paragua and Cuyuní river basins. Likewise, one can see the large number of accumulated cases in the northern part of the state, associated with urban, peri-urban and rural areas, where malaria is being introduced into areas that were once free of the disease.

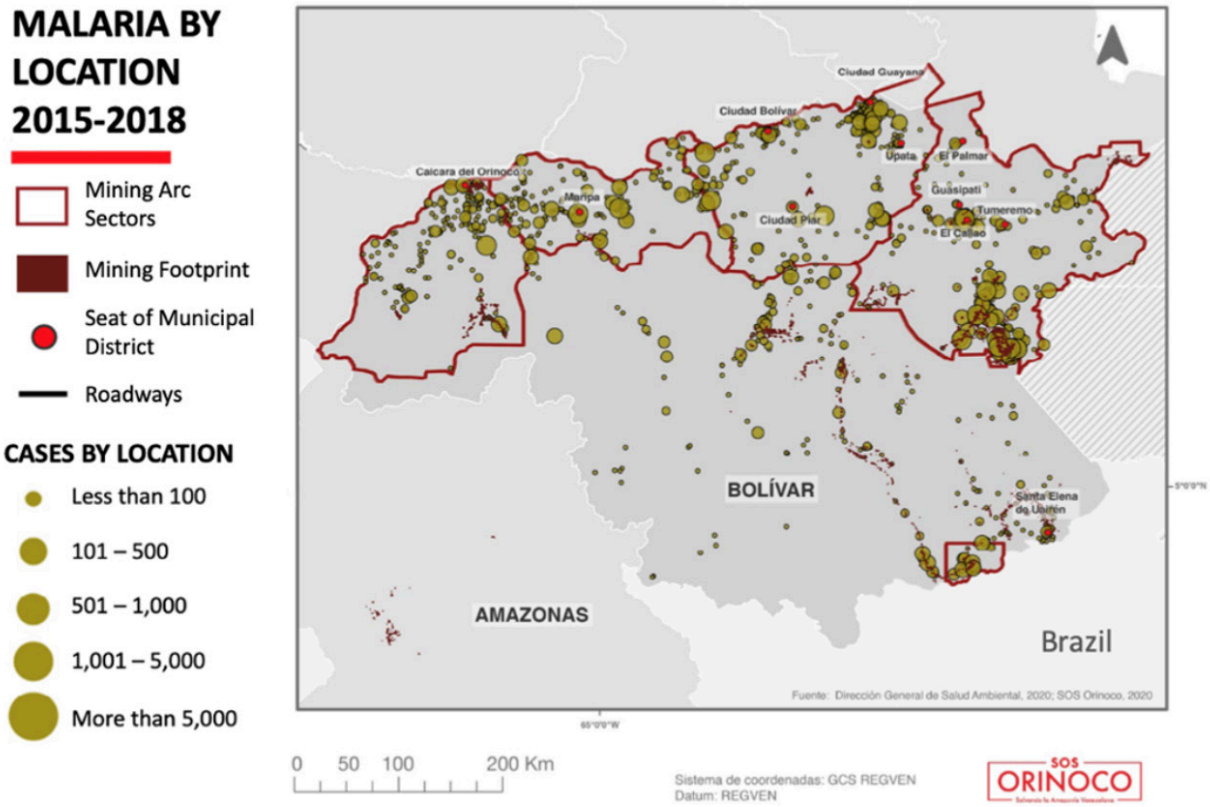


Figure 30. Cumulative cases of malaria by locations between 2015 and 2018.
Source: Data georeferenced by VE360 based on information available from the Regional Office of Environmental Health of the State of Bolívar.

Chapter 6

Mercury

Chapter 6

Mercury

Mercury (chemical symbol Hg), also known as quicksilver, is a silvery heavy metal, and is a liquid under normal conditions. Mercury easily combines with gold, forming an amalgam, and this characteristic leads to its use in mining operations for separating the gold from other minerals. When the amalgam is subjected to heat the mercury evaporates, leaving behind solid gold. The vaporized Mercury then goes into the atmosphere, where it can remain for up to two years, but it eventually falls back to the ground where it can combine with organic materials, or run off into streams, rivers, lakes, and oceans. In the aquatic environment, elemental mercury can become attached to sediments or be transported by currents. Some of the mercury remains dissolved in the water. Microorganisms in aquatic systems can transform elemental mercury into methylmercury, an organometallic compound that is more toxic than pure mercury, even at low doses. Methylmercury becomes part of the aquatic food chain, where it bioaccumulates and biomagnifies, and can be transported by migratory species (Weinberg, n.d.).

Mercury and most of its compounds are extremely harmful to human health, in its elemental (metallic) form, as well as in inorganic compounds (for example, mercuric chloride), and in organic compounds (methyl mercury and ethyl mercury) (PAHO/WHO, n.d.). Entry of mercury into the human body can occur through respiratory, digestive and transcutaneous routes (Ramírez, 2008). The toxicity of mercury and its compounds mainly affects the nervous system, the kidneys and the cardiovascular system. The nervous system is particularly sensitive to mercury. Methylmercury and metallic mercury vapors are very dangerous because they reach the brain quickly. Exposure to high levels of mercury, in any of its forms, can permanently damage the brain and the kidneys. It affects the development of the fetus, causing brain damage, mental retardation, blindness, seizures, and the inability to speak. Children can develop problems with their nervous and digestive systems, as well as suffer kidney damage. Adults may show symptoms such as irritability, shyness, tremors, changes in vision or hearing, and memory problems (Weinberg, n.d.). Inhalation of mercury vapors can have harmful effects on the nervous, digestive, and immune systems, as well as on the lungs and kidneys, and can cause death (WHO, 2013).

Despite the fact that possession, storage and transportation of mercury is prohibited in Venezuela (RBV, 2016), mercury is used massively in mining areas in the southern part of the country, especially in the MA, where it arrives from Colombia, the Essequibo Reclamation Zone, and other countries, through a lucrative illicit trade from which smugglers, police officers and military officials profit (Valverde, 2020). This is one of the many incongruities by a government that prohibits the use of mercury, yet promotes mining that depends almost exclusively on this element. In 2005 it was estimated that in Venezuela 10 to 30 tons of mercury were released annually into the environment (Veiga et al., 2005). However, due to the large increase in activity in recent years, this figure must now be much higher. Mercury contamination in Venezuela's Guayana region is a public health problem recognized as such for more than 25 years (Red ARA, 2013), and according to ecologist Alejandro Álvarez, "the greatest tragedy in the Orinoco Mining Arc is the mercury contamination." (Alvarenga, 2019). However, this is also a health and environmental problem of great importance worldwide. For this reason, in 2013 the international community adopted the Minamata Convention on Mercury, under the auspices of the United Nations Environment Program (UNEP), which seeks to regulate the entire life cycle of mercury in order to reduce emissions and anthropogenic releases, including the use of mercury in artisanal and small-scale gold mining, which is the activity that generates almost 38% of global emissions and is the main source of emissions in South America (Stankiewicz, 2020). Venezuela signed, but has yet not ratified, this international agreement, which entered into force in 2017.

In Venezuela, the limits for determining the toxic levels in personnel exposed to mercury contamination were defined, through a resolution of the Ministry of Health and Social Development (MSDS, 1999). The values follow the guidelines established by the WHO, observing the differences between exposed and unexposed personnel, based on levels in blood, urine and hair samples (Table 20).

Type of Mercury Compound	Personnel	Blood	Urine	Hair
Inorganic Mercury	Exposed	15 µg/L	35 µg/g creatinine 50 µg/L	
	Non-Exposed	< 1 µg/L	< 5 µg/g creatinine	
Organic Mercury	Exposed	100 µg/L		
	Non-Exposed	< 10 µg/L		
Total Mercury	Exposed			6 µg/g

Table 20. Limits established in Venezuela for maximum exposure to mercury.
Source: Ministry of Health and Social Development, 1999.

The inhabitants of the MA and other areas in the southern part of the country are being exposed to different forms of mercury contamination. The mining population is directly exposed due to the unprotected manipulation of elemental (metallic) mercury that is used to capture the gold particles that have been extracted from rivers and alluvial mines using gold miners' pans, or inclined sluice boxes, known locally as tames at mechanized or semi-mechanized mines and onboard dredging barges or rafts. Mercury traders and other people, are also highly exposed. Workers in the gold refining mills where vein gold ore is processed use elemental mercury to separate the gold from the crushed rock. In the processing of mercury-gold amalgams, workers and others are exposed to conditions where vaporized mercury is inhaled. Likewise, in places that buy and sell gold, and in goldsmith workshops, where the gold coming from the mines is again melted and further refined. In mining areas and around processing mills, soils may contain high levels of residual mercury, which also passes into the atmosphere as vapor. The inhabitants of the areas surrounding the mines, as well as people living further away, are exposed by drinking water that has been contaminated by dissolved mercury. However, the most common and widespread form of mercury poisoning comes from eating fish that has been contaminated with methylmercury, which can even be found in supposedly contamination-free areas, long distances from the mining areas.

Numerous investigations carried out by national universities and state institutions since the eighties have shown the serious contamination situation in the environment as well as in the health of some populations in the area. A review of documents pertaining to research on environmental and human exposure to mercury in Venezuela published between 2004 and 2008 (Rojas, 2010) concluded that the most studied area was the mining area of the state of Bolívar. Studies on Hg-associated signs and symptoms identified neurological symptoms as being commonly observed. Gold mining remains a significant risk of mercury exposure for humans, not only for the miners themselves, but for the general population, and for fishermen and their families, and further evaluation and epidemiological studies are required to characterize the risk of mercury exposure for the population. Studies show that the mining areas of the state of Bolívar are among the worst sources of mercury contamination in the world.

An evaluation carried out in 2005 on the technical and health aspects of artisanal and small-scale miners in Block B of El Callao, estimated the annual production in the area at 1 to 2 tons of gold per year. In the process, a large amount of mercury is released into the environment, and it is estimated that, just in Block B, between 2 and 4 tons are lost per year, and in all of El Callao levels could reach 12 tons per year. The level of mercury poisoning in gold miners and mill workers, and in the surrounding communities in Block B is one of the most serious in the world. The overall mean total urine Hg concentration was 104.59 µg Hg/g creatinine. Approximately 61.7% of the individuals sampled have Hg levels in their urine above the alert level of 5 µg/g creatinine, 38.3% of the individuals have Hg levels above the action level (20 µg/g creatinine), 20.6% above the maximum of 50 µg/g creatinine recommended by the WHO, and 15% above 100 µg/g creatinine, which is the level at which neurological symptoms are very likely. The situation with miners and mill workers is dramatic as 30% and 79% of miners and mill workers respectively have Hg in their urine above the action level and 52% of mill workers have levels above 100 µg/g of creatinine. Additionally, about 14.6% of mill workers have shown extremely high mercury concentrations in their urine, ranging from 1,221 to 3,260 µg Hg/g creatinine. This result allows us to generalize that more than 90% of mill workers have Hg levels in their urine above the alert level. Signs of severe poisoning and neurological damage were detected in a large majority of those directly involved in the smelting process, as well as in people living near the mills (Veiga et al., 2005). At the time of the study there were 28 mills in Block B, but ten years later they had increased to 150 (Zerpa, 2013).

A report by Zerpa (2013) shows the high frequency of health conditions due to mercury poisoning among the inhabitants of El Callao. The list includes chronic allergies, lung damage, kidney, respiratory and heart failure, as well problem pregnancies, children with Down syndrome, autism and other forms of cognitive impairment, as well as children with motor disabilities, deafness and other physical disabilities.

Álvarez and Rojas (2006) carried out a study in two Pemón indigenous communities, El Casabe and El Plomo, located on the banks of the La Paragua and Caroní rivers respectively, in whose vicinity gold is extracted using rafts floating on the rivers. 52% of the hair samples from El Casabe and 37% from El Plomo showed values above 6 µg/g, the risk limit value for the exposed population, and much higher than the 2 µg/g recommended as a limit for people not exposed. The group of women of reproductive age (12-44 years) presented significantly higher figures, compared to that of men, including those working at the mines. In both populations, the average urine mercury concentration was low, but a higher proportion of miners showed figures above the recommended values, due to the handling of metallic mercury. Symptoms associated with mercury poisoning and the occurrence of miscarriages were also identified, but the results were not conclusive regarding these aspects.

García-Sánchez, Contreras, Adams and Santos (2006) measured mercury vapor emissions from highly contaminated soils in mining areas at El Callao, finding flow values with a range between 0.65 - 420.1 $\mu g\ m^{-2}\ h^{-1}$ nd an average flow range during the daytime hours of 9.1 - 239.2$\mu g\ m^{-2}\ h^{-1}$, which represent higher values than world averages by five orders of magnitude, but similar to measurements from sites that are highly contaminated with mercury, such as chlor-alkali plants or polymetallic mining districts. These results demonstrate that mercury-contaminated soils can be important sources of emissions into the atmosphere, as well as being a threat to ecosystems and human health.

García-Sánchez, Contreras, Adams and Santos (2008) recorded high Hg concentrations of up to 4.60 µg /L in surface water samples from rivers, streams, mining ponds and springs in the Cuyuní River basin. These values are three orders of magnitude higher than normal values in the world (0.003–0.005 µg /L). Furthermore, the Hg content in river water is two orders of magnitude higher than the US Environmental Protection Agency guidelines for aquatic life, and the concentration in drinking water exceeds the WHO-recommended value. Mercury concentration in edible tissue of carnivorous fish species showed a higher Hg concentration (range 0.32–1.92 mg/kg) than herbivorous species (range 0.12–0.46 mg/kg). Carnivorous species present a high potential risk to the health of local populations, since they exceed the established limit of 0.5 mg/kg for food.

The last evaluation carried out in the area was requested in 2010 by the Kuyujani indigenous organization (which brings together the Ye'kwana and Sanema indigenous communities of the Caura River), the La Salle Foundation for Natural Sciences and the Society for the Conservation of Wildlife, to study mercury contamination in the area's fish, which are essential in their diet. The investigation determined that the fish contain mercury values of up to 1.8 µg/g, well above the safe limit for occasional fish consumers (0.5 µg/g) according to the WHO. A second study was carried out between 2011 and 2012, showing that there is a high level of mercury contamination among the inhabitants of the lower and upper Caura River. Hair samples from 152 girls and women from 5 communities (three Ye'kwana and two Sanema) living along the Caura and Erebato rivers were analyzed, finding that 92% of the analyzed samples exceeded 2 µg/g, with 36.8% of the studied group having more than 10 µg/g, and 7.2% of the total having 10 times more mercury than the mean value (Pérez et al., 2012).

These and other investigations reliably demonstrate the severity and extent of the problem of mercury contamination and its effects on the populations of the state of Bolívar. The increase in mining activity and the intensive use of mercury in recent years, especially since the creation of the MA, have probably generated an even greater resurgence of one of the most serious, and invisible, public health problems in the country. It is a matter of concern that new studies have not been conducted to determine the current scope of the situation, and that the health authorities have not taken measures to care for the health of the affected population. The adoption of comprehensive policies to address this serious problem represents an urgent challenge, one that cannot be tabled, for the conservation of the ecosystems of Venezuela's Guayana region, as well as the protection of the human rights to life, health and a healthy environment for the inhabitants of the region and future generations.

Conclusions

Conclusions

Most of the population that inhabits the state of Bolívar lives within the MA, accounting for around 95% of its total population (1,635,000 inhabitants), distributed among 429 populated centers, in addition to 14 indigenous peoples that make up 34% of the indigenous communities in this state.

Economic activity in the region has undergone a significant deterioration due to the policies of the current regime, which is responsible for the collapse of production and the closure of vital enterprises, such as the basic subsidiaries of the state-owned Corporación Venezolana de Guayana (CVG), which produced, prior to the current regime's rise to power, 100% of the primary aluminum, 90% of the steel, 100% of the gold, 63% of products from forest plantations and 90% of the iron ore.

Currently, illegal gold mining constitutes perhaps the main economic activity and one of the main sources of revenue for the government. It was found that activities related to smuggling, human trafficking, and labor and sexual exploitation (including children and adolescents), as well as other illicit activities carried out by organized crime groups, are a byproduct of this mining activity.

With regard to basic services and equipment, it can be stated that the pre-existing road network, inside the MA, represents an important aspect of the transportation system that links the main populated centers of this region locally, and also connects internationally with Brazil and Colombia. In addition, an apparently efficient network of airports and runways is in operation, through which significant amounts of illegally extracted mining material and other illegal goods are transported, and are then distributed to other national and international destinations.

The educational centers located in the MA are, for the most part, in very poor condition and devoid of services and supplies. In addition, it is important to highlight that a large part of the teaching staff and students have abandoned their educational activities in order to work in the informal economy associated with mining, or work directly in the mines.

In the context of the MA's strategy, the scarce and minimal activity of formal mining has been corroborated in this study, which is reduced to specific cases carried out by the government in association with the Canadian company Gold Reserve in plots located at Las Cristinas and Brisas, as well as a score of projects in partnerships with private companies, almost all in Area/ Block 4 of the Mining Arc. In the rest of the mining areas, informal, small- or medium-scale mining prevails, mostly illegal, or of doubtful legality, especially for obtaining gold, and this mining is controlled by armed organizations (irregular or informal), whose production in large part is captured by the government structure that makes use of industrial plants for processing and isolating the gold, and these plants constitute one of the fundamental pillars of the MA.

In environmental matters, the drainage basins of the MA of greatest concern pertain to the Caura, Aro, Caroní and Cuyuní river basins. Research shows high levels of mercury contamination in the soil, air, bodies of water and sediments, with high levels of methylmercury bioaccumulation in the fish, mercury levels above safe limits among inhabitants of mining towns and indigenous communities, and a high prevalence of health problems due to mercury poisoning.

In this sense, it is necessary to delve deeper by sampling the waters, sediments and fish, in order to determine the degree of exposure to methylmercury, as well as by evaluating the physical-chemical conditions in order to estimate the costs and requirements for remediation.

Mercury contamination associated with gold mining in the MA is one of the most serious, and invisible, public health problems in the country. In Venezuela, 10 to 30 tons of mercury are released annually into the environment, mostly in the MA. The level of mercury poisoning in gold miners and mill workers and in communities around El Callao is one of the highest in the world, with reports of severe poisoning and neurological damage. None of this is being addressed by the health authorities, nor is it being detected by the competent international organizations.

The ABRAE most affected by mining activity within the MA involve the Forest Reserves. Among these, the Imataca Forest Reserve stands out for its extremely high biodiversity value (high degree of endemism of flora as well as the great wealth of fauna), as well as for its forestry potential.

The activity with the highest incidence in loss of forests in the MA is agriculture. Between the years 2000 and 2020, 7,796 km² of forest cover have been lost. In the last five years, mining activity has expanded significantly in the northeastern peneplain of Venezuela's Guayana region, with the surroundings of El Callao and Las Claritas being the main foci, affecting the Imataca mountain range and the Cuyuní River basin, mostly within the Imataca Forest Reserve. In this sense, it is necessary to establish actions of containment and confinement regarding mining activity, so as to avoid its expansion beyond current limits.

As for the acts of violence that occur in the state of Bolívar, these are mainly concentrated (94%) in the MA, and are linked to the most densely populated centers in the region (Ciudad Bolívar and Ciudad Guayana) and to mining activity in the sectors of Las Claritas, El Dorado, San Miguel Mining Camp, El Callao, Las Yaguas and their vicinity.

With regard to public health, the results showed that healthcare services in the MA are severely deteriorated, with a shortage of personnel and funding. This is reflected in the low vaccination coverage, the inability to control public health problems and the reappearance of epidemic diseases that had since been eradicated, such as measles and diphtheria. The latter reappeared after 25 years, killing children in mining and indigenous populations in Sifontes municipal district. However, its occurrence was ignored and minimized by the Minister of Health, who did not take the necessary measures to control the outbreak.

Meanwhile, the high mobility of the mining population in the MA has promoted the contagion and spread of emerging and re-emerging diseases, such as diphtheria, throughout the country and to other countries in the region. Its increase, together with the lack of healthcare services, constitutes a high-risk factor for the contagion of infectious diseases.

Regarding malaria, Venezuela showed the highest increase in cases in the world, equivalent to 1,239% during the last twenty years, exceeding 400,000 cases annually since 2017, representing 53% of cases in the hemisphere and accounting for more 70% of the deaths from malaria. Likewise, between 2015 and 2019, 65% of the cases nationwide occurred in the state of Bolívar. Of this total, 94% occurred within the scope of the MA. The increase in cases is mainly linked to the high rates of infection in the mining areas of the MA, the migration of infected people from the mining areas to other parts of the country, the shortage of antimalarial drugs and the weakening of vector control programs, and increased mining activity.

Mercury contamination is a serious, severe and widespread problem for the entire region. The increase in mining activity and the intensive use of mercury in recent years, especially since the creation of the MA, have probably generated an even greater resurgence of one of the most serious, yet invisible, public health problems in the country. The adoption of comprehensive policies for the treatment of this serious problem represents an urgent and unpostponable challenge for the conservation of the ecosystems of Venezuela's Guayana region, as well as the protection of the human rights to life, health and a healthy environment for the inhabitants of the region and future generations.

Final considerations

Final considerations

The Mining Arc decree marked a milestone in Venezuela's mining history. However, its legal content has no direct causal relationship with what would happen after the year 2016. Instead, the direct causes would have to be found in the new mining policy that the government deployed with the new set of regulations that the regime established under the so-called Gold Law of 2011.[54] This resulted in a radical change in the relationship between individuals and the State with respect to gold mining activity. From this moment on, the regime tried to establish new arrangements that would allow it to have more direct and faster access to the gold, all of which were unsuccessful until it found a key: informalize mining in order to promote an increase in production units, under an apparent anarchy, which the regime would later agglutinate by installing a narrow "funnel" into which most of the produced gold would have to go, meaning the hands of the government's authorized agents. With the installation of numerous cyanidation plants and raw material processors, and after managing to get most of the mining operators to direct their raw material to these plants, the government was able to get its hands on a very high proportion of the illegal gold mining product.

The current state of the social and environmental variables considered in this study are undoubtedly a consequence of the Mining Arc. However, the physical infrastructure variables were in existence prior to the enactment of the Mining Arc decree, and even prior to 1999, before the Chavista regime: there were roads, security facilities, educational facilities, airports, industries, hydroelectric plants, etc. The only infrastructure that may have any relation to the policies of the MA may be the airfields (the proliferation of mines, especially in the periphery of the MA, likewise leads to the proliferation of airfields), and the industrial plants for processing the gold ore; everything else was pre-existent. What was not pre-existent was the deterioration and collapse of all that infrastructure, but the existence itself is all the work of governments prior to 1999, something that still persists to this day despite the deterioration. We have not detected any evidence that the Mining Arc has had a positive impact or has had any positive reinvestment in terms of infrastructure, neither there nor in any other part of the country.

Regarding the variables of health and violence, it is possible to establish a relationship between the deterioration of both variables and the increase in mining activity and therefore with the establishment of the MA. We already know that the mining culture, as it is known in Venezuela, is one where violence is an inherent factor, given the absence of the rule of law, and the promotion by the government of criminal actors as a factor for control of the entire activity. Meanwhile, we know that anarchy in the mining activity leads to an increase in malaria and other diseases transmitted by entomological vectors (some of which we have not analyzed here, such as Zika, chikungunya or dengue) that are favored by the proliferation of stagnant bodies of water (mud puddles, etc.) generated by alluvial mining, as well as by the crowded and unsanitary conditions that are inherent in this type of mining activity.

Likewise, diseases associated with the mismanagement of mercury and toxic waste from mining activity, even more so within the framework of the existing anarchy, are obviously increased due to the proliferation of mining activity. We have not detected any evidence that the Mining Arc has generated any benefits to improve social investment in terms of health, education, services or security, within this space.

[59] The "Gold Law of 2011" is the common name given to the Organic Law that Reserves for the State the Activities pertaining to Exploration and Extraction of Gold, as well as ancillary activities connected thereto." (Decree No. 8.413, Official Gazette No. 39.759 of 16 September 2011). It is also known as the Law or Decree on the Nationalization of Gold.

We are faced with a government that, confronted with the fall in oil revenues and the collapse of its oil industry, was unable to find another alternative, in the short, medium or long term, other than that of turning to mining, especially gold, for its profitability, ease and relative low investment, immediacy of marketability and little traceability. This source of income, which is not income for the Treasury but for the actors who control the mine, had to be exploited any way they could. Although there was a criminal plot revolving around informal mining before 2016, it gathered strength and increased to unsuspected levels. Now, it has new actors such as the Colombian guerrilla groups, operating under agreements with the political-military sector. Obviously, these authorizations and agreements to delegate control of mining activity to foreign organized armed groups is absolutely illegal from every point of view. This obvious illegality, as well as the illegality of disregarding previously granted mining rights without due compensation, are the product of a de facto, unwritten political decision, and in fact, this is what has happened. Therefore, we can affirm that the apparent chaos that exists, and the entire situation of illegality that surrounds the mining activity, defines the fundamental character of the MA as a "policy," which in turn obeys a factual need that they know cannot be recognized in the field of legal formality.

The regime's mining policy, the actual one, has at least three fundamental components: (a) the control of the day-to-day production, at the hands of organized crime groups consisting of civilians: rule by the pranes (released convicts that were once bosses while in prison), syndicates, gangs; and of paramilitaries: guerrilla groups, collectives, etc.) that ensure, effectively and informally, the delivery of resources at the hands of political agents; (b) disregard for and violation of previous legally granted or acquired mining rights (concessions, contracts, etc.), in order to promote informality; and (c) the general supervision and command of the system at the hands of active military personnel, making use of the institutional means of the Armed Force, who ultimately share the obtained earnings with the civilian political sector without obeying the chains of command. These three factors define the Mining Arc.

Therefore, the Mining Arc is nothing more than a policy based on an informalization at all levels, where there are no environmental regulations, where there is no formal issuance of permits, where there is no official inspection, and where there are no public services. The only thing that exists is an efficient system implemented by the irregular armed groups, which resolves disputes between miners, and maintains a certain balance between mafias that have taken over and split the territory among themselves, but where they all guarantee that a high proportion of the gold extracted arrives at the hands of the senior leaders of the structure implemented by the regime, which is ultimately military.

The Orinoco Mining Arc is the label that the Maduro regime has placed on a policy of promoting an (apparent) mining "anarchy," mainly focused on gold, which appears to have a defined geographical framework, but which in reality reaches all of southern Venezuela, including the state of Amazonas, and even further, to the rest of the country. It is a policy of expansion, overflow and intensification of mining activity that is operationally controlled by irregular armed groups, local and foreign, in agreement with the government. The apparent anarchy, which is confusing and seems complex, operates under a very simple mechanism: "bottlenecks" or "funnels" are established and structured to the point of brutal and unrestricted violence exerted by the armed groups, who efficiently intercept and capture an important proportion of the flow of gold and money, and channel it, after collecting their participatory share, towards the civil and military representatives of the regime's upper hierarchy.

As a policy, and not as a program or project, the Mining Arc has no formal structure or geographical limits; it does not comply with mining or environmental laws, or laws of any kind. It does not generate technical studies based on geology, or on environmental concerns, and even less so on the social considerations. It has not produced a single reliable and independent socio-environmental impact study, which is required by the Constitution.

The Mining Arc does not show any ethical considerations regarding its social and cultural impacts: it promotes prostitution, slave labor, child labor, and socially disrupts the indigenous peoples. The only “indigenous resistance” that has existed is the resistance against the Mining Arc, but which has been subdued to the point of violence through massacres that have occurred in recent years, where the victims have been indigenous people who had become miners, as well as the indigenous people who have been protesting against mining, the result being that they have been forced to co-participate in mining agreements whose terms have been dictated by the regime. Instances of attempts at indigenous self-government have imploded and have been reorganized around government control and acceptance of co-participation in mining. Indigenous communities have been encouraged to clash against each other for reasons that are tribal (ancestral rivalries), economic (pro-miners versus anti-miners), religious (Catholics versus Evangelicals), and political (ruling party versus opposition), catalyzed by the fear of violence from the regime on the one hand, and government handout of cash and gifts as enticements, all happening amidst a humanitarian crisis unprecedented in the country’s history, leaving the indigenous people, most of whom are semi-acculturated to the Criollo world, without any kind of defense.

In short, the Mining Arc represents an essential policy for the regime, structured around an intricate web of organized crime, managed by the high levels of the Chavista-Madurista political spheres of power, and further at the top, by the Venezuelan military leadership. It is a policy that has deepened and expanded the old unsustainable reliance on extractive industries and the rentier state, elevating them to unprecedented levels. The Mining Arc is the arrogant and defiant public manifestation of the will of a failed state to survive at the expense of looting the heritage of the Venezuelan nation.

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