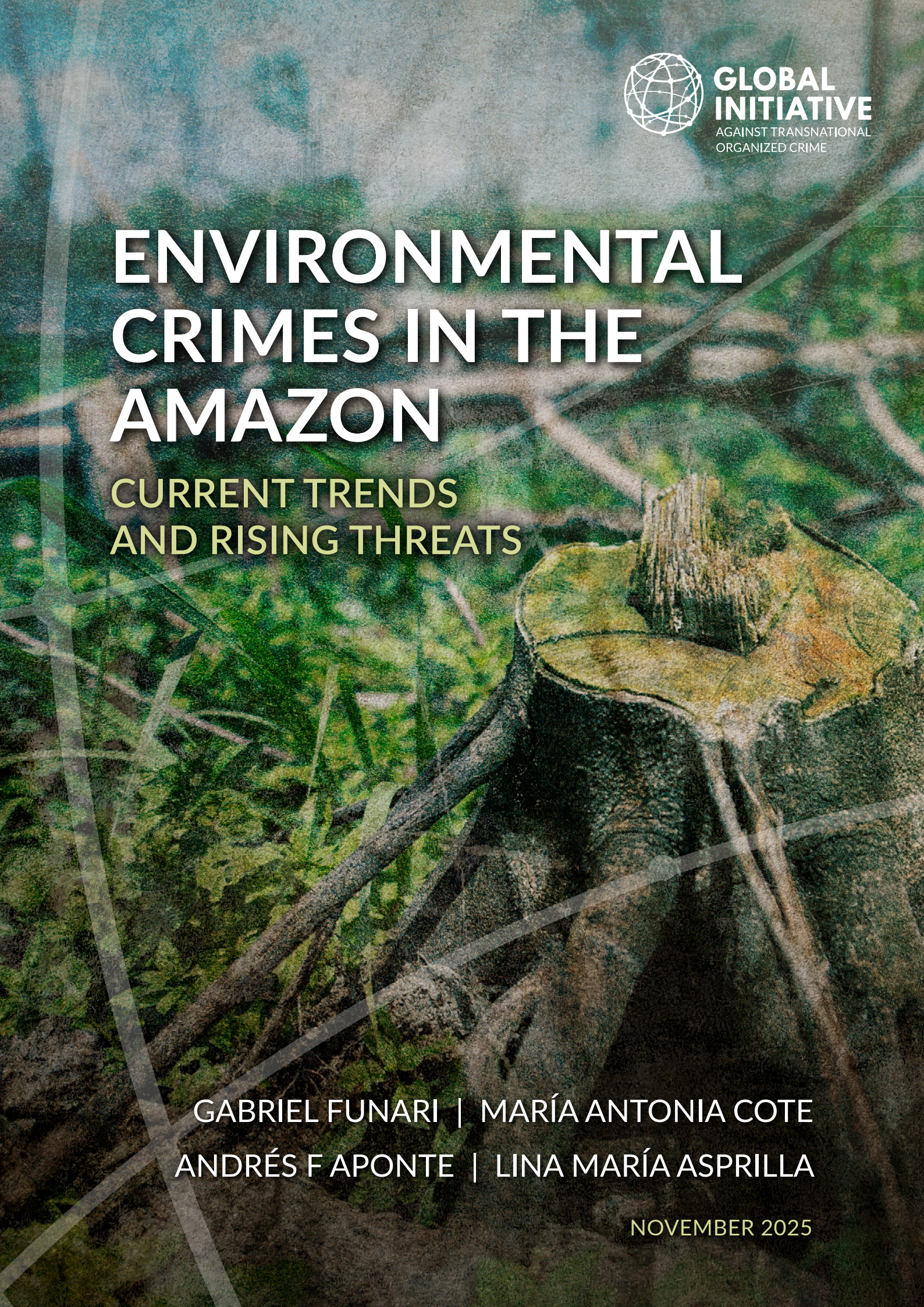

GLOBAL INITIATIVE
AGAINST TRANSNATIONAL ORGANIZED CRIME

ENVIRONMENTAL CRIMES IN THE AMAZON

CURRENT TRENDS AND RISING THREATS

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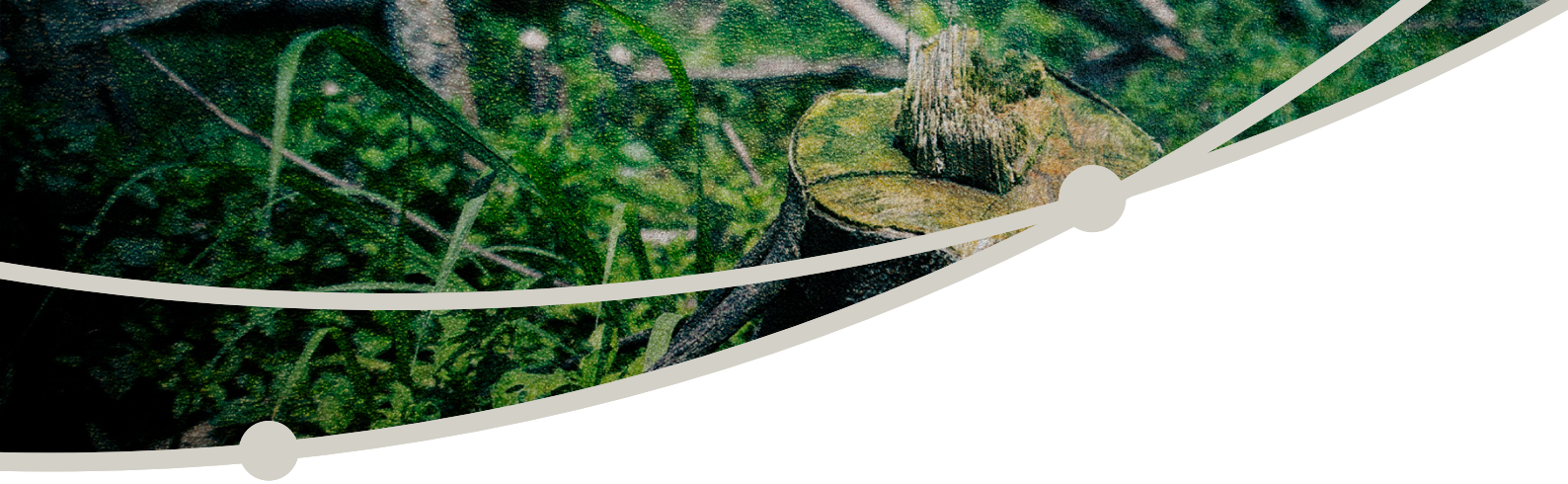
ACRONYMS AND ABBREVIATIONS

ASGM	Artisinal and small-scale gold mining
CV	Comando Vermelho
DETER	Real-Time Deforestation Detection System
EMC	Estado Mayor Central
ELN	National Liberation Army
FARC	Revolutionary Armed Forces of Colombia
IBAMA	Brazilian Institute of the Environment and Renewable Natural Resources
OMA	Orinoco Mining Arc
PCC	Primeiro Comando da Capital
PRODES	Satellite Monitoring Programme for Deforestation in the Legal Amazon
UNIMIL	National Unit Against Illegal Mining and Antiterrorism – Colombia



EXECUTIVE SUMMARY

Environmental crimes are at the forefront of ecological and humanitarian challenges facing the Amazon. They cause massive biodiversity loss and violence, and empower transnational criminal groups to amplify their revenue streams and govern communities across the region. This report provides an overview of the current trends and rising threats related to two of the major environmental crimes currently afflicting the Amazon: illegal gold mining and deforestation. These activities are becoming increasingly interconnected, creating hotspots of criminal activity throughout the Amazon Basin.[1]

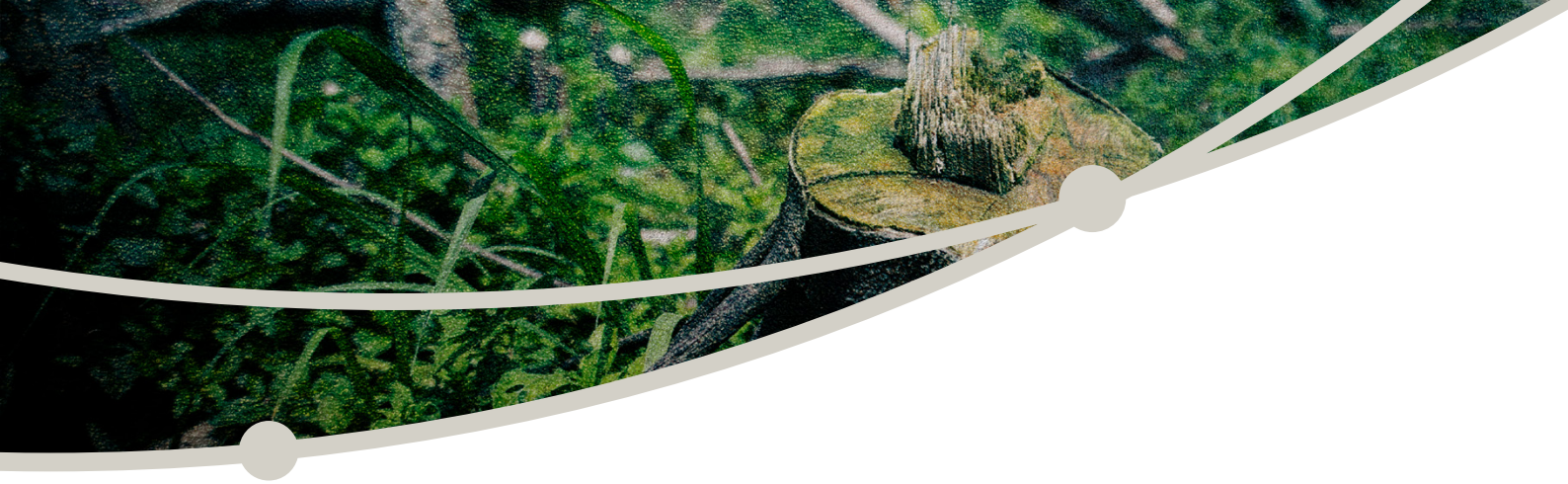
Illicit gold mining, in particular, has vastly expanded across the region over the past decade, leading to devastating environmental harms and rising violence. The report examines the networks and operational structures of illegal logging and illicit gold mining activities in the Amazon. It also identifies the major hotspots for these illicit trades and analyzes current institutional responses that are seeking to combat these illicit economies.

When it comes to illicit gold mining, a key trend identified in the report is the increased infiltration of transnational criminal groups in this sector. With record international gold prices and a low-accountability context throughout the Amazon, organized crime groups that had previously focused on drug trafficking in the Amazon are increasingly targeting the gold trade. To more effectively combat illegal mining, there is a need for cross-border information sharing regarding gold supply chains and the mining equipment and supplies used, particularly mercury.

The report also identifies major deforestation hotspots. These include Colombia's Guaviare region in the so-called 'Arc of Deforestation' and the Brazilian states of Pará, Mato Grosso, Rondonia and Acre, as well as the BR-319 highway. Notably, the report finds that criminal organizations have infiltrated state carbon credit markets and developed new deforestation techniques that allow them to evade government detection, including through the use of satellites and aerial imagery to identify hotspots, restrictions on credit access and the formalization of deforested land. The report also notes large-scale operations to tackle deforestation by the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) and federal law enforcement, as well as Colombia's Containment Plans, which link peace policies with environmental issues and offer economic incentives to local populations to act as forest protectors.

The report concludes with a summary of the findings and a discussion of potential policy solutions to refine government responses to environmental crimes in the Amazon. These include adapting cross-border cooperation measures through continuous intelligence sharing procedures. It is also imperative for international partners and countries of the rainforest region to place greater emphasis on combatting illicit financial flows that sustain environmental crimes in the region. The report also calls for interventions that can effectively map and dismantle supply chains of illegal mining precursors such as mercury, as well as for the establishment of stricter regulatory frameworks for carbon credit markets, which are emerging as key conduits for the financial expansion of transnational organized crime in the Amazon.

The report relies primarily on original research undertaken by the Global Initiative Against Transnational Organized Crime (GI-TOC) on illicit economies in the Amazon region. It also draws on secondary source including media clippings, reports by multilateral organizations and think tanks, and government data on deforestation and mining.



ILLEGAL MINING

Illegal gold mining is one of the most pervasive criminal markets in the Amazon, with more than 4 000 illegal mines identified across the region in 2023.[2] It is estimated that the number of people involved in this market is likely in the six figures.[3] Several factors drive the gold rush in the Amazon, but the profitability of gold is a primary reason; global gold prices hit a record high of US$3 500 per ounce in 2025[4] and they are expected to continue rising.[5] Gold is appealing to criminal groups who are looking to diversify their income streams and increase their profits, particularly as it is considered an alternative revenue source for coca-based economies and an avenue for laundering drug trade profits through mining operations or gold-buying schemes.

Country	Extent of mining districts (hectares)	Annual exports in 2023 (tonnes)	Trade value (USD billion)
Bolivia	281 564	46.6	2.43
Brazil	No data	61.45	4.01
Colombia	1 128 241	62.7	2.9
Ecuador	7 495	27.4	1.40
Peru	25 000 000	405	11.30
Suriname	No data	48.9	1.18
Venezuela	1 118 437	75	No data

FIGURE 1 Mining districts and annual gold production in 2023, by country.

SOURCE: Latin American countries' criminal ecosystems, private briefing for the UK government; UN COMTRADE

Hotspots

Illegal mining is widespread throughout the Amazon. The main hotspots include the Yanomami indigenous territory and the Tapajós River Valley in Brazil, Madre de Dios and the Loreto region in Peru, the Arco Minero del Orinoco in Venezuela and the Ecuadorian Amazon.

Illegal gold mining and illegal logging are also significant issues across the Guyana Shield, which includes Guyana, Suriname and French Guiana.[6] In Guyana, where gold mining has long been an economic backbone, artisanal and small-scale gold mining (ASGM) accounts for 88 per cent of the country's

officially reported gold production, according to a 2022 Guyana Extractive Industries Transparency Initiative report.[7] However, the extent and effect of illegal mining in the region are not well documented. Further research is needed to better understand the illegal gold mining industry and its supply chains across the Guyana Shield, although these specific areas are not recognized as hotspots.

FIGURE 2 Illegal mining hotspots in the Amazon.

SOURCE: Based on data from the Monitoring of the Andes Amazon Program, https://www.maapprogram.org/illegal-gold-mining-amazon/

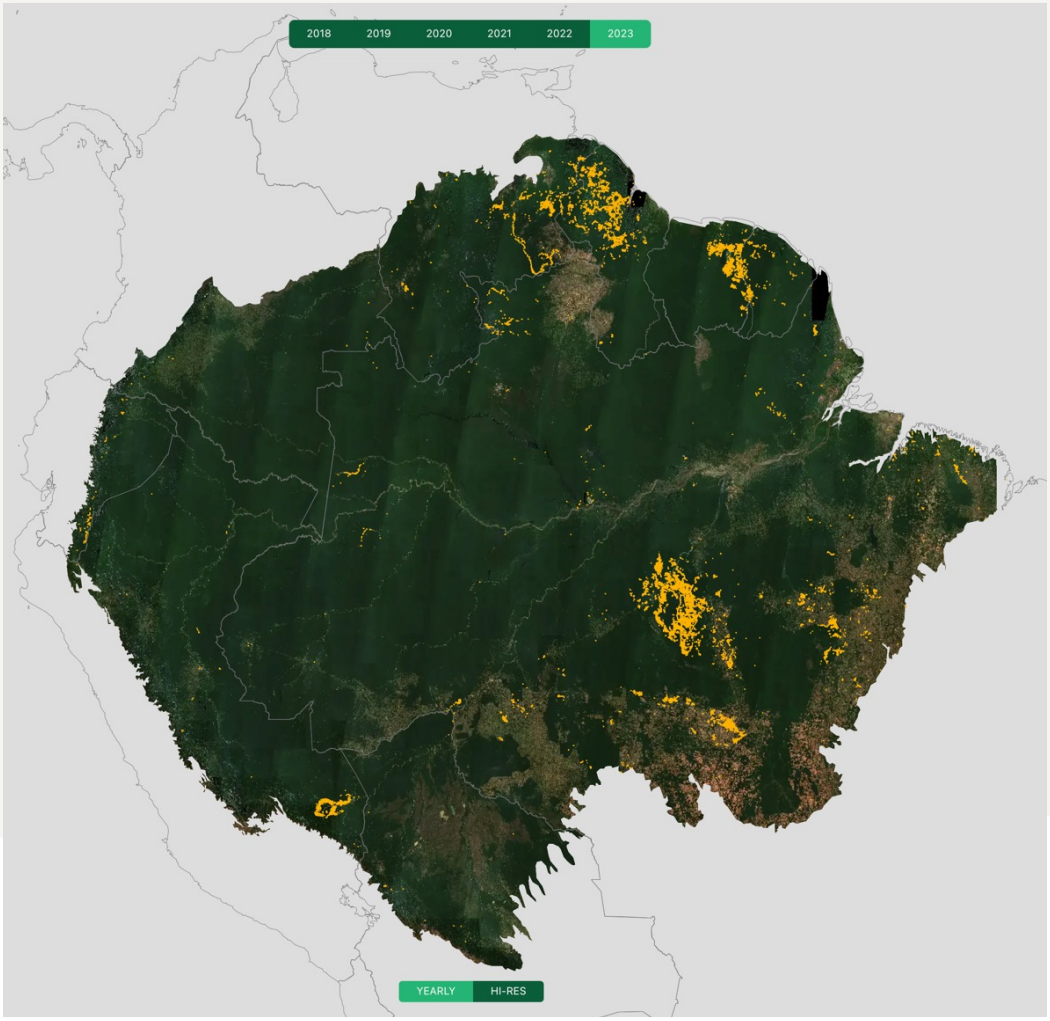


FIGURE 3 Mining areas detected in 2023.

SOURCE: Amazon Mining Watch, https://amazonminingwatch.org/en#4.44/-64.39/-3.43

Yanomami Indigenous Territory (Brazil)

The Brazilian state of Roraima, which shares a northern border with Venezuela, has been a hotspot for gold mining since the 1980s.[8] Most mining in the region is in the Yanomami indigenous territory, the biggest indigenous reserve in Brazil. It is home to approximately 27 000 Yanomami and members of other indigenous ethnicities in what is the largest population of indigenous people in the country.

The most recent gold rush began in 2016 when Brazil's economic crisis, combined with rising international gold prices, prompted miners from across the country to migrate to Roraima in search of wealth from the rivers that traverse Yanomami lands.[9] Between 2019 and 2023, more than 20 000 illegal miners invaded the area.[10] Brazilian federal law enforcement estimates that, between 2016 and 2024, over 8 000 hectares of forest were destroyed for illegal gold mining operations in Yanomami territory.[11] These operations created mining settlements that also include nightclubs, churches, supermarkets and pharmacies.[12]

The influx of *garimpeiros* (illegal miners) has triggered a humanitarian crisis in the Yanomami community, as the miners have brought disease, violence and environmental degradation.[13] Their arrival has

resulted in a number of health issues, including infectious diseases, intestinal parasitosis, malnutrition, mercury exposure and instances of sexual exploitation in exchange for food and natural resources. As a result, the community faces displacement and increased mortality rates.[14]

The invasion of miners, which in some cases has exploited divisions within the Yanomami community, has benefited from financial and weapons support by criminal groups.[15] Among the miners are former convicts or runaways affiliated with the Primeiro Comando da Capital (First Capital Command, PCC), a Brazil-based transnational criminal group that traces its roots to São Paulo prisons in the 1990s. Operating nationwide, the PCC is involved in various illicit markets and is known for its sophisticated operations and violent tactics.[16]

The PCC operates extensively in Roraima, which features several key cocaine trafficking routes.[17] Over the past decade, the group has established 18 subunits throughout the state. With its expansion into illegal gold mining, the PCC marked the Yanomami territory as its nineteenth area of operation in 2021.[18] The PCC and other criminal organizations have also financed the construction of airstrips in farms located in the vicinity of the Yanomami territory. More than 100 pilots are active in the region, carrying loads of approximately 500 kilograms of illegal gold and cocaine per flight. In addition to operating their own gold mines, the PCC supplies drugs and armed security guards to mines run by their allies in the Yanomami territory.[19] The PCC's long-standing alliance with the Venezuelan criminal organization Tren de Aragua raises particular concerns, as their relationship may deepen illegal mining and environmental harms affecting the Yanomami population.[20] Criminal groups such as the PCC can provide armed security at mine sites, which they refer to as maintaining 'discipline' and 'order', as well as engage directly in mining activities.[21]

The increase in illegal mining and the number of organized crime groups active in the Yanomami territory since 2016 has contributed to more violence and hindered local health clinics' ability to serve the indigenous community, which in turn has caused chronic food shortages. The situation worsened after the Jair Bolsonaro government refused to implement institutional responses to aid the Yanomami. Between 2019 and 2023, deaths from malnutrition increased by 330 per cent, and hundreds of Yanomami children died of treatable diseases.[22] In January 2023, one of the first measures that newly elected President Luiz Inácio Lula da Silva (Lula) took was to declare a state of emergency in the Yanomami territory. The government deployed healthcare specialists, environmental protection officials and federal law enforcement there to address the health crisis and combat the invasion of illegal gold miners.[23]

Federal intervention quickly escalated tensions with the PCC, which refused to leave Yanomami territory. In April 2024, federal officers invaded a PCC camp and killed Sandro Moraes de Carvalho, one of the group's leaders.[24] The PCC retaliated by issuing a decree in 2024, known as a *salve*, promising to kill the federal agents involved in the operation. Clashes with federal agents have since continued, as the emergency operations have failed to remove the PCC from its gold mines.[25]

Despite increased efforts by the Lula government to combat illegal gold mining, it persists in the Yanomami territory, primarily due to the continued presence of the PCC and deep-rooted corruption among state-embedded actors. In Roraima, there are reports that high-ranking officials are on the payroll of illegal mining gangs, and the state's pro-*garimpeiro* governor Antonio Denarium has proposed legislation that would make it illegal for public officials to destroy mining equipment.[26] State prosecutors are also investigating more than 100 local police officers for participating in the local illegal gold trade.[27] In October 2024, the head of the Roraima Military Police was arrested for reportedly selling weapons to gold miners.[28]

Brazil's Yanomami indigenous territory in Roraima – home to the country's largest indigenous population – has become a critical hotspot for illegal mining operations run by criminal networks. *© Alan Chaves/AFP via Getty Images*

Tapajós River Valley (Brazil)

The Tapajós River Valley in the Amazon state of Pará in Brazil is another major illegal mining hotspot. Most mining there is either conducted inside federal government-owned *Unidades de Conservação* (Environmental conservation units, UCs), where it is strictly prohibited, or in areas managed by municipal authorities. These local officials frequently issue mining licences in exchange for pay-offs from criminal activities.[29] The two UCs with the highest rates of deforestation in Brazil are in the Tapajós, where illegal miners have burned down swathes of the local biome to excavate gold.[30] Forest fires started by these miners contributed to a record outbreak of wildfires in the Brazilian Amazon in 2024, resulting in the loss of more than 11 million hectares of forest area.[31]

Similar to Roraima, trafficking networks for illegal gold and drugs converge in the Tapajós. This area is an important part of the Amazon drug corridor through which the Comando Vermelho (Red Command, CV) – one of the most powerful criminal groups in Brazil – moves cannabis and cocaine from Brazil's borders with Peru, Bolivia and Colombia to international ports in northern Pará state.[32] Two major highways, the Trans-Amazonian and the BR-163, facilitate drug movement toward Brazil's largest

cities and to international ports in Rio de Janeiro and Itaguaí, where the CV is well established. CV-associated drug traffickers and illegal gold miners use the same airstrips and pilots to move their products throughout the region.[33] The CV also sells drugs to miners engaged in illegal gold mining. In the Tapajós, the group trades cocaine for gold; specifically, 25 grams of cocaine for 1 gram of gold, which provides a discrete and valuable source of revenue.[34] According to the Brazilian Federal Police, the CV employs intermediaries to export the gold mined in the Tapajós to international refineries in the United Arab Emirates and Europe.[35]

Violence in the Tapajós is increasing due to the growing presence of criminal groups. Novo Progresso, one of Pará's main population centres, ranks seventh in homicide rates among the 772 municipalities in the Brazilian Amazon, averaging 99.9 victims per 100 000 inhabitants for the 2020–2022 period.[36]

In November 2024, the Lula administration launched a cross-agency operation to combat illegal gold mining in the Tapajós Valley, focused on the Munduruku indigenous territory.[37] The operation involved 20 federal government agencies from law enforcement, indigenous affairs, environmental protection and social services, and was overseen by the office of Lula's chief of staff. By the end of November 2024, the operation had destroyed 44 boats, 12 excavation machines and seven dredges, and issued more than BRL20 million (US$3.04 million) in environmental fines.[38]

Madre de Dios and Loreto (Peru)

Peru is the leading gold producer in Latin America,[39] with illegal mining the second-most pervasive criminal market in the country, according to the GI-TOC's 2023 Global Organized Crime Index.[40] Peru in 2023 exported 405 tonnes of gold, valued at approximately US$8.5 billion, while illegal mining generates between US$3.2 and US$4.0 billion per year.[41] Approximately 500 000 artisanal mines operate in Peru; an estimated 90 per cent of ASGM is illegal or informal.[42] This lack of regulation makes the gold mining sector vulnerable to control and taxation by criminal groups.[43]

Madre de Dios, known for both its productive capacity and environmental effects, is one of the most concerning mining hotspots in Peru. The expansion of gold mining in the region has been attributed to high gold prices and the COVID-19 pandemic, which left many people with few other livelihood options.[44] In 2017, Legislative Decree No. 1100 – a government initiative to organize and formalize gold mining in the area – established the Madre de Dios Mining Corridor.[45] Since then, a considerable amount of deforestation in the area has occurred legally.

In early 2019, the Peruvian government launched Operation Mercury, a multisectoral intervention aimed at combating illegal mining, with an initial focus on La Pampa. The operation, led by the army and police with judicial support, sought to eradicate illegal mining and its associated crimes and restore public authority in the area.[46] It involved 1 200 police officers, 300 soldiers and 70 prosecutors.[47] In 2021, the operation was succeeded by the Restoration Plan, which expanded interventions to other critical mining areas in Madre de Dios.

Aerial view of illegal gold mining dredges in Madre de Dios, one of Peru's most critical illegal mining hotspots.
© Ernesto Benavides/AFP via Getty Images

However, deforestation rates have remained high and illegal activities have persisted. From 2021 to 2024, the Monitoring of the Andean Amazon Project (MAAP) recorded 30 846 hectares of deforestation due to mining – equivalent to more than 40 000 soccer fields – with 26 per cent occurring outside the Madre de Dios Mining Corridor.[48] Within the corridor, criminal groups are reportedly operating and mining with prohibited river dredges and draglines, an activity that is supported by corrupt authorities and the informal nature of mining operations in the area.[49]

Northern Peru in particular is increasingly threatened by illegal mining, especially in Loreto and other areas where the activity has surged due to a lack of law enforcement and rising gold prices. The use of dredges, which have been found operating in the Marañón, Napo, Putumayo and Nanay rivers, has contributed to this growth.[50] Colombian criminal groups reportedly recruit and train locals to build simple dredges using converted lorry engines and wooden rafts.[51] The presence of transnational criminal organizations in addition to local mafia-style groups has led to an increase in violence, particularly against indigenous groups.[52] Other conflicts stem from illegal miners – who frequently migrate from other regions – coming into contact with farmers and indigenous communities.

Orinoco Mining Arc (Venezuela)

Gold has been a dominant sector in Venezuela[53] since 2016 when the government established the Orinoco Mining Arc (OMA) as a strategic development area.[54] Covering 111 800 square kilometres across northern Bolívar state, the OMA aimed to buttress the mining sector[55] following the sharp

decline in oil production caused by US sanctions.[56] Its purpose is to exploit large quantities of gold, bauxite, coltan and diamonds, among other minerals.[57] While there is no official or reliable data on the amount of gold extracted in Venezuela, the Organization for Economic Co-operation and Development estimates that illegal gold production amounts to 46.5 tonnes annually.[58] In 2023, this figure was believed to have increased by 30 tonnes, bringing total production to approximately 75 tonnes per year and generating an estimated US$5.1 billion in revenue.[59]

When the Venezuelan state started mining in the OMA, it encountered criminal organizations operating in the area. In response, the state negotiated agreements that involved nearby communities, state actors and some Colombian armed groups. However, these groups exploited the arrangements to embed themselves alongside the state, thereby gaining more control and influence over mining operations.[60] Criminal organizations, including Revolutionary Armed Forces of Colombia (FARC) dissidents and the National Liberation Army (ELN),[61] collaborate with Venezuelan criminal groups such as the R Organization, Las Claritas Sindicato and Tren de Guayana. These groups dominate mining in Bolívar state, allowing them to influence local economies, political systems and communities.[62] As a result, miners in the OMA often suffer from labour exploitation and violence at the hands of these criminal groups.[63]

Gold mining in the OMA is considered the biggest threat to the Venezuelan Amazon and its indigenous inhabitants.[64] Many native communities, such as the Yanomami, have had to abandon their ancestral lands or work in the mines to survive, often facing the threat of violence from armed groups and rising living costs. Meanwhile, mercury contamination in water sources has exacerbated malnutrition by disrupting hunting and fishing activities, while the influx of illegal miners has exposed local communities to respiratory and sexually transmitted infections, tuberculosis, diarrhoea and hepatitis.[65]

Ecuadorian Amazon

Illegal mining has emerged as one of Ecuador's primary illicit economies in recent years. Nearly half (46.7 per cent) of illegal gold mining occurs within indigenous territories.[66] According to data from MAAP, there has been a rapid expansion in illegal gold mining, particularly in the province of Sucumbíos, where mining exploitation areas grew by 750 per cent between 2015 and 2021.[67]

The increase in gold mining is closely linked to surging gold exports. For the first time since 2020, exports from small-scale gold producers reached US$1.34 billion in 2023, surpassing US$1.25 billion worth of shipments from Canada's Aurelian, the only large and formal gold mining company operating in Ecuador.[68]

This growth comes as organized crime tightens its grip over ASGM in Ecuador through violence and extortion. Illegal mining and the gold trade provide avenues for local criminal organizations including Los Lobos and Los Choneros, as well as foreign groups such as Colombia's Los Comandos de la Frontera and Brazil's PCC, to diversify their income and launder drug profits.[69] Ecuadorian criminal gangs are increasingly dominating gold mining districts such as Sucumbíos, removing or extorting miners and controlling almost all stages of the gold supply chain.[70] They are also reportedly kidnapping miners for ransom.[71] This illegal mining encourages other criminal activity, including mercury, weapons and drug smuggling.[72]

In Ecuador, as in Brazil, local corruption plays a significant role in the gold sector, in which local officials and powerful businesspeople are heavily involved. Their control over land and mineral rights and

ownership of processing plants facilitates Ecuador's illegal gold trade. Despite the critical role they play in these illicit supply chains, however, there is a lack of transparency and oversight regarding these individuals and the processing plants and gold exporters they operate.

The rise of organized crime groups in Ecuador corresponds to an increase in violence, with murder rates increasing fivefold between 2019 and 2023. This trend was particularly pronounced in areas previously considered peaceful but which have recently seen the expansion of criminal groups seeking to take control of mining districts in the Amazonian regions of Sucumbíos, Zamora Chinchipe, Pastaza, Morona Santiago and Orellana.[73]

Responses to the illegal mining threat in Ecuador are complicated, with proponents both for and against supporting gold mining in the country. New mining districts in Sucumbíos and other Amazon regions have primarily affected indigenous communities, who are increasingly afraid to speak out for fear of retaliation, while several local officials opposing illegal mining have been attacked or killed.[74] For example, the A'i Cofán community, which is reliant on hunting, fishing and farming, has been severely affected.[75] Conversely, there are other people, including members of the A'i Cofán indigenous community, who engage in mining, viewing it as a lucrative source of income and a means of economic advancement amid widespread informality and poverty in Ecuador's remote areas. This duality, common among many Amazonian indigenous communities, makes it challenging to combat illegal mining.

Trends

Encroachment and capture by organized crime groups

Involvement in illegal gold mining marks a crucial evolution in the strategies of Latin American transnational organized crime groups. Various factors are driving illegal gold mining to replace cocaine trafficking as a critical income source. For example, gold profits have been lucrative during periods when coca market prices fell in Colombia, Ecuador and Venezuela.[76] The gold sector is also an effective way to launder money from the drug trade. Gold's high international value allows criminal groups to generate significant profits, which can be reinvested into other illegal activities, used to purchase weapons or strengthen corrupt relationships with government officials.

Transnational organized crime groups have shifted from indirectly engaging in gold mining by selling drugs or sharing airstrips to being directly involved in the extraction and sale of illegal gold. This shift has been more pronounced since the COVID-19 pandemic, which brought about record-high gold prices. Groups such as Ecuador's Los Lobos and Los Choneros, Colombia's Los Comandos de la Frontera, FARC dissidents and the ELN, and Brazil's PCC and CV have invaded local communities, decimated forest areas and illegally extracted gold. There are also signs that FARC dissidents are increasingly participating in gold mining in Colombia's Amazonas department.[77]

The involvement of large, cash-heavy criminal groups in the Amazon's illicit gold mining market has resulted in more expansive and sophisticated extraction methods. As far back as 15 years ago, illegal gold mining in the region consisted mostly of people using rudimentary gold panning techniques along riverbanks, which required months of work to find gold.[78] Today, gold mining has become increasingly mechanized, operating across larger areas, with miners using state-of-the art dredges and portable satellite internet access to coordinate logistics and stay alert to nearby law enforcement operations and environmental inspections.[79] For example, in Colombia's Vaupés department, along the

Puré River valley, investigations have documented the transfer of dredges and barges for large-scale gold exploitation.[80] These operations are leaving severe environmental impacts while simultaneously consolidating the river as a strategic corridor for cocaine and marijuana trafficking into Brazil.

Environmental harms

Illegal gold mining's environmental effects are well documented and include mercury contamination, forest fires and ecosystem degradation.[81] While deforestation is a major concern, illegal mining also has devastating effects on waterways, causing water stress to become more acute. Consecutive droughts in 2023 and 2024 have severely reduced the Amazon's water supplies, undermining its role as a vital water source in the region.[82] Over the last 20 years, for example, Brazil has lost 16 per cent of its natural water bodies in the Amazon.[83] As geopolitical disputes over water access become an increasingly salient global issue, the hazardous effects of environmental crimes in the Amazon threaten to escalate regional tensions over access to this critical resource.[84]

International cooperation and intervention in the Amazon underscore the urgent need for improved environmental monitoring technologies and their integration into enforcement responses. There is currently a major enforcement gap, as ongoing efforts fail to consolidate financial tracking mechanisms, legal frameworks and cross-border intelligence sharing with environmental monitoring efforts. A more integrated approach is necessary – one that not only enhances the technological infrastructure for detecting illegal mining, but also strengthens institutional collaboration at the local, national and international levels.

Mercury supply chains

Most mining operations use mercury to extract gold from ore, which pollutes rivers and puts riverine and indigenous communities at risk of mercury contamination.[85] This can have serious health issues, including developmental delays in children, cognitive impairment and damage to the kidneys, lungs and immune system.[86] In response, many countries have adopted the Minamata Convention, a global treaty aimed at protecting human health and the environment from mercury and other harmful emissions, as well as pursued relevant regulation.[87] Peru, for example, banned mercury imports in 2015.[88]

However, mercury continues to circulate throughout the region,[89] and demand has only increased as the legal market has diminished.[90] While the flow of mercury in Latin America is not a new phenomenon, the recent surge in gold prices has helped create a network linked to gold exploitation and trade in several countries.[91] For example, Brazil does not have an outright ban on mercury, although it has implemented stringent regulations on its use. Even so, between 2018 and 2022, Brazil imported a record 68.7 tonnes of mercury, which law enforcement suggests is mostly being used for illegal gold mining rather than regulated activities.[92]

Mercury pollution levels can vary significantly based on processing methods and various other factors, making it difficult to estimate overall emissions. However, existing estimates indicate dangerously high levels of mercury emissions, with the Amazon Cooperation Treaty Organization estimating that more than 150 tonnes of mercury are released into the rainforest's rivers annually.[93] By 2023, Colombia was the third most polluted country in the world, after China and India, emitting approximately 75 tonnes of mercury each year.[94] Communities in the Colombian, Peruvian and Brazilian Amazon – particularly in the Yanomami indigenous territory – record contamination levels far above the maximum amount

advised by the World Health Organization.[95] Peru's Madre de Dios hotspot is estimated to have the highest concentration of mercury in Latin America, at 180 tonnes.[96]

Still, mercury supply chains remain opaque. China and Mexico are thought to be among the largest exporters of mercury, which reportedly enters the Amazon region through Bolivia, Peru and Guyana.[97] Mexican cartels are believed to be the main suppliers of mercury to criminal organizations in the region.[98]

Bolivia appears to be a critical distribution centre. Since 2015, the country has consistently ranked among the top two countries for mercury imports, second only to India.[99] From 2016 to 2021, Bolivia imported more than 1 100 tonnes.[100] Today, the main suppliers of mercury to Bolivia are Russia and China.[101] Mercury is openly sold in local markets alongside other illegal goods such as fuel and gold.[102] It is diverted by legal importers or small-scale traders in Bolivia's border areas[103] who then transport the mercury to various locations throughout the Amazon region.[104]

Guyana also imports mercury, despite ratifying the Minamata Convention in 2014.[105] The country has set an annual import limit of 34 500 kilograms, making it one of the last in the region to legally import mercury.[106] However, dozens of gold shops and mining supply stores divide and sell mercury under the table in small quantities, which minibuses and charter planes then distribute to small-time buyers in gold mines throughout Guyana, as well as traffic it to neighbouring countries where it is sold at 10 times the original price. There are concerns that state authorities may be collaborating with criminal groups in this trafficking because Guyanese authorities have never reported a seizure of an 'informal mercury importation'.[107]

The ongoing use of mercury in illegal gold mining operations in the Amazon reveals a critical lack of regulatory oversight with regard to international cooperation efforts. Poor monitoring of mercury trade routes, coupled with inadequate border controls, creates a secret supply chain that facilitates mercury's illegal distribution throughout the region.[108] As enforcement often focuses on specific mining sites, it fails to disrupt the upstream supply chains that sustain these illegal activities. Additionally, the absence of financial oversight mechanisms allows mercury transactions to occur without restrictions, reinforcing the tie between environmental crime and illicit financial networks, and underscoring the need to address the structural factors that enable them.

The growing influence and power of criminal networks involved in mining in the Amazon have severe consequences for local communities, leading to violent competition among criminal groups. Miners often resort to violence when communities oppose or refuse to participate in illegal mining operations, resulting in forced displacement or coercion. In Colombia, for example, members of indigenous communities are frequently coerced into labouring for several hours for minimal or no compensation and are prevented from leaving under penalty of death.[109] In Venezuela, criminal groups and state agents have displaced indigenous communities that oppose mining,[110] while in Peru, environmental leaders have been murdered for defending their rights or land from illegal mining and drug and land trafficking.[111] Reports of labour exploitation at mine sites, including child labour, are also prevalent.[112] Some of the most severe reports of human rights abuses are in Venezuela's OMA, where criminal actors impose low wages, extort miners in exchange for protection and engage in forced labour.[113]

Within the Amazon, violence rates have surged. In the Brazilian Amazon, the homicide rate increased by 41 per cent in 2023 compared to the national average.[114] This uptick was evident in the city of Tabatinga, which reported one of the highest homicide rates on the continent at 95.9 per 100 000

A miner amalgamates gold with mercury in Madre de Dios, Peru. This extraction method has contaminated rivers and caused severe health impacts in indigenous and riverine communities. *© Ernesto Benavides/AFP via Getty Images*

people.[115] In Colombia, the city of Leticia ranks among the country's five most violent departmental capitals, although its homicide rate was substantially lower than Tabatinga, at 31.4 in 2023.[116] In Iquitos, Peru, more than 75 per cent of residents feel unsafe, and Madre de Dios once recorded the highest homicide rate in the country.[117] Ecuador is experiencing a similar trend; the homicide rate in the city of Francisco de Orellana spiked by 210 per cent between 2023 and 2024, while the town of Shushufindi saw its rate soar from 41 to 123 deaths per 100 000 residents in the same period – nearly a 200 per cent increase in one year.[118]

There is also a strong connection between sexual exploitation and illegal mining.[119] Sex trafficking linked to the mining sector has been reported in Peru[120] and other countries in the Amazon region. Mining enclaves often foster environments conducive to sex trafficking.[121] These camps, typically isolated and male-dominated, generate heightened demand for commercial sex, which in turn drives the recruitment and coercion of women and girls, disproportionately from Indigenous and rural communities.[122] Such dynamics entrench cycles of violence and exploitation, while simultaneously reinforcing structural gender inequalities that are intrinsically linked to extractive economies in the region.

Responses

New technologies

In 2019, Brazil's Federal Police partnered with four Brazilian universities to develop a forensic test to trace the origins of gold in the country.[123] The programme, called Ouro Alvo (Target Gold), launched in 2021 and includes a database of gold samples from across Brazil. This database can identify the source of gold, allowing law enforcement to confirm whether it was illegally extracted from environmental protection areas or indigenous territories.[124] Ouro Alvo represents an important technological innovation aimed at improving oversight over Brazil's gold supply chain. In January 2025, the Lula government signed an agreement with France that will expand the programme to also trace gold origins in French Guyanese territory.[125]

International cooperation

The recently signed Brazil–France agreement is an important step forward in enhancing cross-border responses to illegal gold mining in the Amazon. Beyond expanding the programme to include French Guyana, the agreement grants the French government access to Brazil's MAIS (Meio Ambiente Integrado e Seguro) software programme, which provides data on deforestation metrics – including deforestation from illegal gold mining – using satellite imagery.[126] It also permits criminal evidence gathered in French Guiana to be used in environmental crime investigations in Brazil, and vice versa. The bilateral agreement follows a marked increase in illegal gold mining in French Guiana, where more than 10 000 Brazilians – many of whom are affiliated with organized crime groups – have crossed the border to exploit French Guyana's National Park, one of the Amazon Basin's largest natural reserves.[127]

Civic–military responses

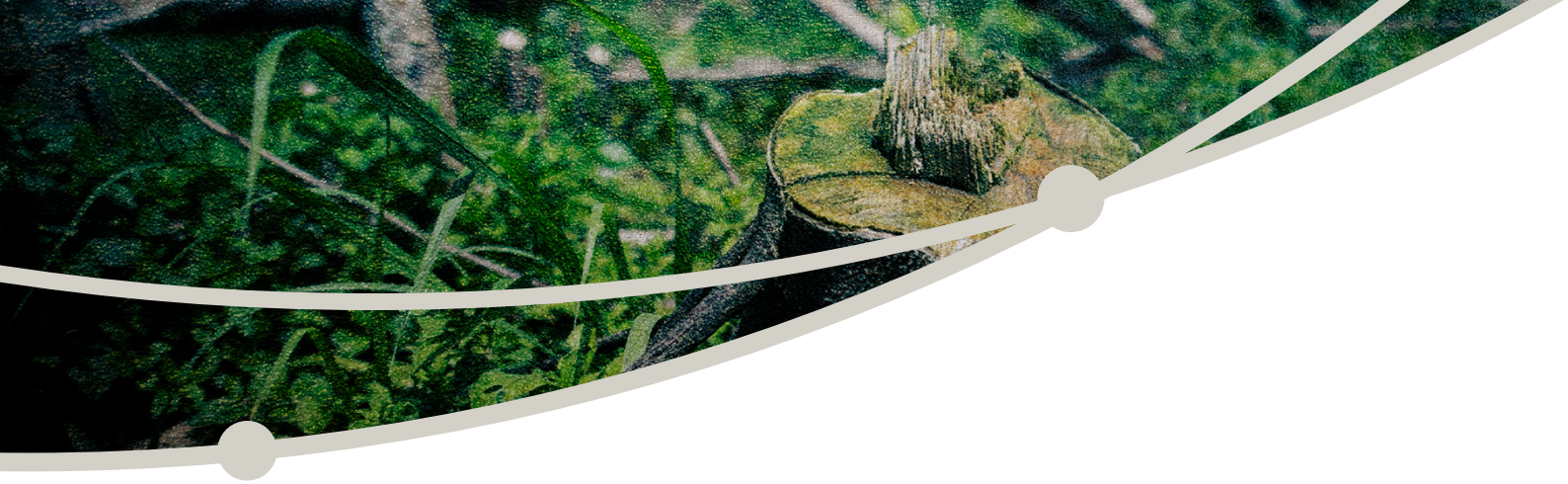
In addition to interstate agreements and the development of new technologies to combat illegal gold exploitation, governments have taken measures to regain control over territories in mining districts. These efforts aim to counter criminal organizations' significant influence, reduce violence and mitigate the severe environmental damage caused by gold extraction practices.

One notable example is Operation Mercury in Peru. This intervention resulted in an initial 92 per cent reduction in deforestation along the Malinowski River, which borders the Tambopata National Reserve and the Interoceanic Highway.[128] However, while the eviction of miners and destruction of equipment halted illegal mining in the area, the operation mainly displaced these activities rather than reduced them, and it failed to mitigate the related environmental harms.[129]

Meanwhile, in Colombia, the government established the National Unit Against Illegal Mining and Antiterrorism (UNIMIL) within the National Police through Resolution 0492 in 2014.[130] UNIMIL is responsible for coordinating and carrying out operations against illegal mining, with the goal of eradicating all forms of the activity, addressing associated public order issues and protecting natural resources and environments from its negative effects.[131] The unit seeks to not only act through police intervention, but also strengthen institutional capabilities in affected areas. Additionally, UNIMIL aims to tackle the connection between illegal mining and other illicit activities such as drug trafficking, armed conflict and organized crime, as many of these groups are financed through minerals exploitation.[132]

Since UNIMIL's implementation, successive governments in Colombia have highlighted its success at combating mining operations run by armed and criminal groups, including by seizing gold and equipment, destroying illegal mines and arresting offenders. However, the initiative has faced criticism for disproportionately detaining artisanal miners while allowing other actors connected to state authorities to evade prosecution.[133] Additionally, the state's limited control over vast areas, coupled with the adaptability of these groups, has led to a 'contagion' effect, with affected areas seeing a shift in operations to adjacent regions after successful military operations. Recently, under President Gustavo Petro, government efforts to address the contagion effect have adopted a dual approach that emphasizes both the destruction of mining equipment and the formalization of mining activities.[134]

The examples in Peru and Colombia demonstrate the importance of recognizing ASGM's value as a livelihood option for rural communities – a recognition that is crucial to combating illegal mining and preventing organized crime groups from taking control of the sector.



DEFORESTATION

While illegal gold mining has been growing, causing greater socio-environmental damage in the Amazon, the driving force behind the rainforest's environmental crime ecosystem continues to be the interconnected issues of land grabbing, deforestation and timber trafficking. The Amazon Basin spans 8 million square kilometres, an area larger than the European Union.[135] For generations, various actors have sought to profit from this vast region, often with the support of government policies that view land occupation, even if illegal, as important for national development.

For example, the Brazilian military dictatorship in the 1970s incentivized labourers from other areas of the country to settle land in the Amazon.[136] The government justified the programme as a means to protect the Amazon from foreign encroachment.

Land grabbing, which involves the destruction of local ecosystems with the complicity of local authorities, the sale of timber and the implementation of environmentally harmful economic activities remains rampant in the Amazon. Deforestation acts as an initial step, allowing land to be converted for large-scale industrial agriculture, cattle ranching and illegal crop cultivation.[137] In parts of the Brazilian, Bolivian, Colombian and Peruvian Amazon, monocultures of soy, maize and sorghum are especially prevalent. In the latter three countries, Mennonite colonies have seized large tracts of land by corrupting state authorities and exploiting weak regulatory systems that permit the legalization of properties within protected areas and national parks.[138]

The conversion of forests into pastureland for cattle ranching is particularly evident in Brazil and Colombia.[139] In Colombia, this practice is closely linked to coca cultivation, which is now increasingly occurring in Peru, Ecuador and Bolivia as well. Deforested land is used not only for growing coca and setting up laboratories, but also for creating networks of land and waterways that facilitate the international cocaine trade. As a result, the economic exploitation of Amazonian territories has become heavily dependent on environmental crime and the large-scale destruction of natural ecosystems.

Hotspots

Guaviare: The Arc of Deforestation in the Colombian Amazon

The department of Guaviare covers 5 million hectares, around 90 per cent of which are protected by natural park designations, forest reserves or indigenous reserves.[140] Many of these areas are thus effectively untouchable, instead prioritizing environmental conservation.[141]

In Guaviare, deforestation has occurred more recently compared to other regions in Colombia due to two reasons. First, the counterinsurgency war of the state against the FARC limited the influx of settlers and land grabbers. Second, the presence of the FARC and their environmental regulations 'controlled' and restricted indiscriminate logging.[142]

However, after the FARC was demobilized in 2017, challenges in implementing the resulting peace agreements – including security issues for signatories and delays and breaches in the Havana Accords – as well as the state's failure to manage environmental degradation triggered a surge in deforestation in Guaviare. By 2024, Guaviare was the third-highest deforested region in Colombia, according to data from the Ministry of Environment.[143]

Unlike in other areas and times periods of the country, when farming families cleared small patches of forest to grow subsistence crops or coca, Guaviare has seen the arrival of so-called land accumulators over the last eight years. These individuals are altering the land's original use by converting it into pasture for cattle. As a result, vast areas of the rainforest have been transformed into grasslands for livestock grazing.[144]

Deforestation occurs through tree felling, which facilitates the illegal timber trade, as well as through fires set by people during hot, dry periods. After the trees are removed, the land is then converted into pasture and sold to third parties who use it for grazing or growing monoculture crops.[145] Livestock's role in deforestation is evident given that Guaviare had no previous history of livestock farming. Between 2016 and 2023, the number of cattle in the region increased by nearly 200 per cent, from 281 611 to 549 246, according to the Colombian Agricultural Institute's National Livestock Census.[146]

Most people entering Guaviare do so by illegal roads, which have expanded, allowing for forests to be converted into pastures for land grabbing and unsustainable livestock practices. Land grabbing typically involves the illegal occupation of state-owned land, as well as private and protected areas, and the practice is becoming increasingly organized and widespread.[147] Two roads are notable: the Marginal de la Selva and the Calamar–Miraflores. Marginal de la Selva was part of an international transport initiative to support integration and modernization under President Juan Manuel Santos (2010–2018).[148] However, the road was never completed due to the environmental risks involved.[149] It was instead left unpaved, eventually becoming the main transport corridor between Guaviare's capital, San José del Guaviare, and the region's north-west, and opening new fronts for colonization.[150] The Calamar–Miraflores road, which was built without environmental permits, drew attention in 2019 when the mayors of the Calamar and Miraflores municipalities – both of whom had advocated for the road – were prosecuted and accused of deforestation, as it was constructed in a conservation area.[151]

Much of the current deforestation dynamics are controlled by FARC dissidents, specifically the Estado Mayor de Bloques y Frente group. In 2023, the group was associated with the loss of 4 970 hectares, representing 2 per cent of total deforestation in Colombia.[152] From 2017 to 2021, the group also extorted resources from livestock farming to rebuild themselves as an armed organization.[153]

FIGURE 4 Deforestation hotspots in Latin America.

However, under the Total Peace policy (2022–2025) and during peace talks with the Petro administration, they have used their regulatory power to either curb or encourage deforestation, likely as a means of showing goodwill or exerting pressure in the negotiations.[154] In 2022, for example, the group imposed strict limits on logging and land conversion and threatened residents who disobeyed these orders with fines and community service, which resulted in a more than 40 per cent decrease in deforestation rates in the regions under their control.[155]

The effects of deforestation in Guaviare in recent years are substantial. In 2020, the region had 4.86 million hectares of natural forest, covering 88 per cent of its land area. By 2023, it had lost 14 400 hectares of forest, equivalent to 9.84 million tonnes of carbon dioxide (CO_2) emissions.[156] All stages of deforestation's development are driving this trend, starting with the logging and burning of small-scale plots, which often involve vulnerable populations. This escalates to coca cultivation and eventually large-scale cattle ranching or monoculture development. The process is fuelled by investments in land mechanization and public interventions to improve roads and energy supplies as well as efforts to formalize rural areas despite legal restrictions. This shift from illegal activities to established cattle ranching and agro-industrial projects underscores the complexity and severity of deforestation's environmental consequences in the region.[157]

Deforestation in Colombia's Guaviare department is driven by land grabbing, illicit coca cultivation and cattle ranching. *© Ivan Valencia/Bloomberg via Getty Images*

The interconnectedness of deforestation, land grabbing, illicit crop cultivation and cattle ranching makes it challenging to mitigate deforestation in the Colombian Amazon Arc, where Guaviare is located. Mining, illegal logging and the unplanned construction or expansion of roads also make it difficult. Armed conflict and the presence of various illegal actors further exacerbate the situation, as these groups vie for control over deforestation regulation, coca cultivation, trafficking routes and the ability to extort activities such as cattle ranching and mining.

The Bolivian Amazon: Santa Cruz, Beni and Pando

More than 50 per cent of Bolivian territory falls within the Amazon, stretching south across the departments of Pando, Beni and Santa Cruz and covering much of the country's north-east. It also touches the northern part of La Paz and the eastern edge of Cochabamba.[158]

Over the past two decades, deforestation in Bolivia has reached alarming levels. In 2022, the country lost 245 177 hectares of primary forest, accounting for 12.4 per cent of total Amazon deforestation that year. The Colombian and Peruvian Amazon – a combined territory of around 127 million hectares – accounted for just 12.2 per cent, according to MAAP.[159] By 2023, it was estimated that 800 hectares were being cleared daily in Beni, Santa Cruz and Pando.[160]

Tree cover loss in Bolivia is primarily driven by the illegal timber trade and increased slash-and-burn land practices for coca cultivation, mining and monoculture farming.[161] In 2022, 52 per cent of logging

activities in Bolivia were deemed illegal, a 32 per cent increase from 2021.[162] While there is no official data for 2023, experts believe the trend persists due to ongoing agricultural expansion and poor management of forest fires, which are often deliberately set to clear land. By November 2023, forest fires had affected more than 3 million hectares.[163]

Once the timber is commercialized, the land is often converted for agricultural expansion, which is associated with illegal logging, land grabbing and land transactions.[164] Illegal logging and land grabbing are also closely tied to the illegal cultivation of coca and the production of cocaine and cannabis for drug trafficking.[165] In Bolivia, national parks have become hotspots for cocaine production, with laboratories established in remote areas to exploit natural tree cover and the logistical challenges that law enforcement faces in accessing these locations.[166]

Finally, it is important to recognize the role that the Mennonites play in this process. Since their arrival in 1954, the Mennonite population has grown rapidly, particularly since the 1990s, when 10 000 of them acquired 70 000 hectares of land from ranchers and small landowners.[167] Most of this growth has been concentrated in Santa Cruz, with smaller increases in Beni and Tarija. By 2019, Bolivia had 99 Mennonite colonies occupying 891 715 hectares, or approximately 21 per cent of the country's agricultural land.[168] The Mennonites have expanded primarily through land acquisitions managed by their delegates, often through private transactions with minimal government oversight.[169] However, this expansion has frequently faced criticism for its lack of transparency, with concerns about land grabbing and encroachment on indigenous and *campesino* territories.[170]

Mennonite colonies in Bolivia primarily engage in large-scale agricultural production, particularly for export crops such as soy. Santa Cruz, Beni and Tarija together account for more than two thirds of Bolivia's cultivated land. The Mennonites' economic impact is considerable; in 2015, they produced an estimated 16 per cent of the country's soy, one of Bolivia's main exports.[171] However, their agricultural practices have serious environmental consequences. According to the Global Forest Watch Observatory, between 2001 and 2021, soy production in Bolivia resulted in the deforestation of more than 900 000 hectares of land – equivalent to the size of Puerto Rico or the Bahamas – with Mennonites responsible for around a quarter of this loss, or 210 980 hectares.[172]

The Arc of Deforestation in the Brazilian Amazon

A total of 75 per cent of deforestation in the Brazilian Amazon occurs in a region known as the Arc of Deforestation, which stretches across 500 000 square kilometres beginning in the state of Maranhão and proceeding westward through south-western Pará, Mato Grosso, Rondonia and Acre.[173] This area became the focus of the Brazilian dictatorship's development projects in the Amazon during the 1970s, which promoted land occupation and led to the construction of several interstate highways that cut through the forest. These highways facilitated land grabbing and deforestation practices by providing environmental criminals with access to previously remote regions of the forest.[174] A series of clandestine roads have been built alongside these highways, allowing cattle ranches and plantations to be established deep within indigenous territories and environmental protection areas.

The epicentre of the Arc of Deforestation is located in south-western Pará state, specifically the cities of Altamira and São Felix do Xingu, where farmers with strong political support and elite connections engage in land grabbing.[175] As a result, these two cities have the highest rates of deforestation in the Brazilian Amazon.[176] From 2020 to 2023, satellite data revealed that more than 4 000 square

kilometres of forest was cleared in Altamira and São Felix do Xingu, the bulk of which was in indigenous territories that fall under the two cities' jurisdiction.[177]

Of Brazil's municipalities, São Felix do Xingu has the highest number of cattle – more than 2.5 million – most of which graze illegally occupied public land.[178] The city's cattle-to-humans ratio is 38 to 1.[179] The prospect of seizing large tracts of land, particularly in south-western Pará, has attracted considerable migration from other regions of Brazil. This influx of people has brought with it other issues, including increased drug and sex trafficking and prostitution. All of these activities have contributed to heightened violence in both Altamira and São Felix do Xingu, largely manifesting in land disputes and the growing presence of drug trafficking groups such as the PCC and the CV. Altamira, with a homicide rate of 107 per 100 000 people in 2017, and São Felix do Xingu, with a rate of 65.5 per 100 000 people in 2023, exemplify this trend.[180]

Illegal logging in Altamira, São Felix do Xingu and other territories in the Arc of Deforestation is fuelled by the high demand for timber, particularly yellow ipe, which can fetch a retail price of US$6 300 per cubic meter in the United States.[181] That is 80–90 times higher than its extraction price, creating substantial profit margins for timber traffickers that can rival even the drug trade and further incentivizing deforestation.

Between 2008 and 2020, satellite data from Brazil's space agency revealed that 3.3 million cubic metres of timber were illegally harvested in the Arc of Deforestation.[182] The bulk of this timber was transported to a sawmill, where it was falsely certified as legally sourced timber. The Brazilian Ministry of Justice, in cooperation with the GI-TOC and other civil society organizations, is currently developing a new regulatory framework that will classify this practice as timber laundering, akin to money laundering. The timber was then delivered by truck to the international ports of Belém and Santana, where it was exported to the United States and Europe.

Timber traffickers have formed corrupt ties with local and national government officials. In May 2021, Brazil's Federal Police indicted the environment minister from the Bolsonaro administration, as well as 10 officials from IBAMA, for accepting bribes from timber exporters.[183] In exchange, the officials issued decrees that authorized the export of illegal timber shipments and blocked criminal investigations into timber traffickers.

BR-319 highway

While the Arc of Deforestation is a well-known hotspot for deforestation, land grabbing and timber trafficking, the central part of the Amazon Basin in Amazonas state – a previously untouched portion of the Brazilian Amazon – is also becoming a prominent location for these environmental crimes. This territory, which runs across a north–south route between the capitals Manaus and Porto Velho, is currently being targeted by environmental criminals and local political elites who are seeking to build the BR-319 interstate highway to connect the two cities.[184]

The BR-319 was one of several Amazon projects that the Brazilian military dictatorship launched in the 1970s. Unlike other major highways completed during that time, however, a 400-square-kilometre segment of the BR-319 was never completed due to high construction costs. As a result, this area of Amazonas state is one of few in the rainforest that have avoided large-scale deforestation and the invasion of environmental criminals. Yet there was a renewed push from the Bolsonaro administration (2019–2022) to finish the BR-319, driven by the prospects of creating a new frontier for land grabbing, timber trafficking, cattle ranching and monoculture plantations. The territories south of the

Construction of Brazil's BR-319 highway has accelerated deforestation in surrounding areas. *© Michael Dantas/ AFP via Getty Images*

BR-319, which include the border regions of the states of Amazonas, Rondonia and Acre, have become prominent locations for cattle ranching after years of environmental degradation. Completing the BR-319 is of strategic interest to local land grabbers and farmers, as it would allow them to more easily move their products into international markets.

In the final months of the Bolsonaro administration in 2022, environmental authorities issued a preliminary licence approving construction of the middle section of the BR-319 highway. Following this approval, land grabbers began to invade territories nearby to the highway in the hope that the pavement of the road would significantly increase the value of the land. In fact, sales of illegally obtained plots along the BR-319 were openly advertised in shopping malls and billboards throughout Manaus, the Amazon region's largest city.

Since 2023, these land grabbers have burned large swathes of forest surrounding the BR-319, causing severe air pollution in Manaus.[185] In September 2024, the Lula government issued final approval to pave the BR-319 highway. By that time, however, land grabbers had already burned down or felled 4 000 square kilometres of forest, an area six times the size of the highway itself. The middle portion of the BR-319, which previously played a vital role in conservation efforts, has quickly become a new and profitable hotspot for land grabbers and loggers.

Trends

FARC dissidents' involvement in logging and environmental protection in Colombia

FARC dissidents' ability to both promote deforestation and assume the role of environmental regulators and protectors is rooted in the legacy and experience gained by many mid-ranking members of the demobilized guerrilla group. Although the FARC caused significant harm to the environment for

decades, they differed from current violent groups in rural Colombia in their approach to deforestation. In areas where FARC rebels operated, they often restricted deforestation to avoid detection by the state and give themselves greater freedom of movement throughout the forest.[186]

Since the demobilization of the FARC in 2016 and the subsequent emergence of dissident factions, deforestation rates have increased for two reasons. First, many peasants in these areas took advantage of the lack of regulation to clear forests. Second, dissident groups, seeking resources, encouraged deforestation as part of their strategy to intensify economic activities, including ranching, logging, mining and coca cultivation. This has led to the accelerated loss of woodland and jungle in areas previously controlled by guerrillas.[187]

During the Total Peace process, some FARC dissident groups, which are active in the Amazon, tried to gain recognition by adopting a policy to reduce logging in their territories.[188] However, divisions within the group, combined with the withdrawal of several dissident factions from peace negotiations with the government, renewed concerns about armed groups' relationship with the forest. This is particularly alarming for groups controlling areas in the Amazon, as they could return to illegal logging and other destructive criminal activities.[189]

The faction of ex-FARC members not participating in negotiations has lifted logging restrictions, allowing some tree felling in exchange for a tax, as well as expanded its network of thousands of kilometres of roads through the rainforest.[190] This led to a 35 per cent increase in deforestation rates in 2024, with 107 000 hectares felled compared to 79 256 hectares in 2023.[191]

Carbon credits: Criminal infiltration and illegal logging

More than US$9 billion in carbon credits have been sold worldwide over the past 20 years, and these financial transactions have been widely touted as a conservation solution for the Amazon.[192] However, a 2024 investigation by the *Washington Post* found that 29 of the 35 existing carbon credit projects in the Brazilian Amazon involve land that has been illegally seized through land grabbing and illegal logging.[193] As a result, funds from these sales are benefitting environmental criminals. The lack of government oversight of carbon credit sales in Brazil has facilitated the involvement of environmental criminals in this sector, particularly since the government only ratified a law regulating the carbon market in November 2024. Even with this new framework, however, fraud in land titling remains rampant, empowering environmental criminals to acquire legal claims to stolen plots.

In 2024, an investigation by the Brazilian Federal Police uncovered fraudulent practices involving five large carbon credit projects for reducing emissions from deforestation and forest degradation in developing countries.[194] According to the police, the five projects relied on bribing public officials and illicitly certifying public land as private property to sell over BRL180 million (US$33 million) worth of carbon credits.[195]

Despite the presence of criminal interests in the carbon credit market, state governments in the Brazilian Amazon are implementing various incentives to promote carbon credit sales as a solution to the climate crisis. Meanwhile, the FARC dissident group Estado Mayor Central (EMC) is coercing indigenous communities in Colombia's Guaviare department to enter into carbon credit agreements in exchange for 10–15 per cent of the credit sales.[196]

Cocaine trade increasingly linked to deforestation in the Amazon

While the Amazon Basin has for decades been a major transnational drug trafficking corridor, it has also become an increasingly important location for drug production, particularly cocaine. Over the past 10 years, drug traffickers have established coca plantations in remote forest reserves in the Peruvian Amazon's Ucayali and Mariscal Ramón Castilla provinces.[197] The Peruvian government estimates that between 2020 and 2022, more than 14 000 hectares were deforested in Ucayali alone to make way for coca plantations.[198]

These plantations have labs that can refine coca crops into cocaine, with the Brazilian criminal group CV the primary financial backer.[199] This production and processing of cocaine is of immense strategic value to the group, which already dominates the cocaine trafficking route along the Amazon River. By overseeing cocaine cultivation in the region, the CV can control the entire chain of drug production and trafficking. The group is actively recruiting local indigenous youth to work at its coca plantations, where they can earn up to US$520 a month – far higher than typical local wages – while local girls are being coerced into sex work. However, these youths often spend their earnings on food, alcohol and drugs, contributing to rising rates of drug consumption and increased cocaine and cannabis sales in the tri-border region of Brazil, Colombia and Peru.[200]

Many of the coca plantations that the CV finances in Mariscal Ramón Castilla are deforesting vast swathes of the forest in the Javari River Valley. These plantations are increasingly expanding south towards the river, which marks the border between Peru and Brazil.[201] The CV is developing these plantations to improve its trafficking operations, raising concerns that they may continue deforesting to create coca farms on the Brazilian side of the border. The group has taken over fishing and trafficking of the pirarucu, the world's largest freshwater fish, along the Peru–Brazil border. The pirarucu is highly sought after in international wildlife trafficking for its protein and other valuable parts such as the skin.[202] The CV uses the pirarucu caught in the Javari River Valley to feed nearby coca plantation workers, while also shipping both cocaine and pirarucu along the Amazon River.[203]

Illicit crops, livestock farming, illegal mining and drug trafficking are driving deforestation across the Colombian Amazon and endangering environmental defenders.
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In Colombia, deforestation is also closely tied to the cocaine trade, particularly in the Guaviare region. Here, the establishment of informal roads that connect to rivers has facilitated drug trafficking to international markets. In recent years, Guaviare has become a strategic hub for cocaine trafficking, especially towards Brazil, due to the influence of Colombian armed groups, such as FARC dissidents, and Brazilian organizations including the CV and PCC.[204] Similarly, significant deforestation has occurred in protected areas along the Putumayo River in Colombia's Putumayo department, where coca cultivation increased by 70 per cent from 2021 to 2022 – from 28 205 hectares to 48 034 hectares. The river, the main transport route for the drug to both Brazilian and European markets, also supports a chemical supply network involving Colombia, Peru and Ecuador.[205] This network bypasses weak state control and enables coca growers to process the drug in laboratories on site.[206]

It's a similar situation in Bolivia, where coca cultivation, despite being regulated, has increased in protected areas and natural parks. These locations are ideal for growing coca and setting up cocaine laboratories because they are secluded and have ample access to water. Approximately 90 per cent of these laboratories are located in the Chapare region of Cochabamba, where the demand for chemical precursors is high and the market is largely unregulated.[207] In 2023, Bolivian authorities seized a record amount of cocaine, continuing a trend from 2022 when they confiscated 690 tonnes of chemical precursors across 41 containers.[208] Experts estimated the seized substances could have been used to produce between 50 and 60 tonnes of cocaine hydrochloride.[209] According to the United Nations Office on Drugs and Crime, this seizure accounted for 80 per cent of all such confiscations globally that year, underscoring Bolivia's growing role as a producer and exporter of cocaine.[210]

Deforestation, combined with crop cultivation in protected and border areas and the development of the cocaine production process, has created a criminal ecosystem in Bolivia. This ecosystem is increasingly dominated by local mafias collaborating with Brazilian criminal groups such as the PCC and the CV, as well as Albanian mafia networks.[211] These areas in the Amazon have reorganized drug trafficking routes, making the country's geography an asset for traffickers.[212]

New deforestation techniques

Criminals are continually finding new ways to engage in land grabbing, deforestation and timber trafficking. In the Amazon, land grabbers are increasingly turning to chemical deforestation to avoid satellite detection. Instead of cutting down large numbers of trees, which can be quickly traced through Brazil's advanced Real-Time Deforestation Detection System (DETER), they are using chemicals such as herbicides to gradually kill trees, making it appear like a natural process.[213] Once the trees are dried out, they then set mass fires to quickly burn them down. IBAMA has identified more than 30 000 hectares of Amazon territory that suffered from chemical deforestation between 2010 and 2020, and has issued over BRL72 million (US$13.3 million) in fines to the landowners responsible.[214] However, the extent of this practice is likely far greater, as IBAMA halted nearly all of its monitoring activities during the four years of the Bolsonaro government (2019–2023), allowing offenders to exploit the lack of law enforcement and ramp up their use of chemicals for deforestation.

Additionally, the proliferation of clandestine roads in protected environmental areas and indigenous territories has allowed environmental criminals to access remote forest areas rich in valuable timber.[215] In these areas, criminals have also developed deforestation techniques designed to evade satellite monitoring, such as leaving the tallest trees standing while cutting down smaller ones nearby, thereby obscuring the deforestation from satellite images.[216]

Responses

Bolstering environmental protection agencies

Brazil, which holds more than 60 per cent of the Amazon's territory and 70 per cent of its population, plays a critical role in regional deforestation efforts. This role, however, was considerably diminished during the Bolsonaro administration, which slashed budgets for environmental and indigenous agencies, froze hiring processes, halted environmental crime raids and paused overall monitoring of the Amazon. Since Lula took office in January 2023, agencies such as IBAMA, the National Indigenous People Foundation, the Chico Mendes Institute for Biodiversity Conservation (ICMBio) and the environmental directorate of the Federal Police have received ample political support, larger budgets and new personnel. The Lula administration also created a Ministry of Indigenous Affairs. Despite these improvements, serious capacity issues remain, including a strong agricultural caucus in Congress that allocates more funding to activities that incentivize land grabbing than to environmental protection, as well as ongoing demands for wage increases among IBAMA and ICMBio staff, which resulted in a two-month strike at both agencies in 2024.[217]

Still, the current administration has launched a series of large-scale operations involving IBAMA and federal law enforcement to tackle deforestation in the Amazon. The latest initiative is Operation Maravalha, which is the largest effort against illegal logging in Brazil in over five years. Launched in February 2024, this operation seeks to curb illegal logging in protected areas and indigenous territories in the states of Rondonia, Amazonas and Pará.[218] So far, the raids conducted as part of this operation have seized 5 000 truckloads of timber.

IBAMA officers detain a suspected miner during a raid on an illegal mining camp in Brazil's Yanomami territory, February 2023.
© Alan Chaves/AFP via Getty Images

In response to the need to protect and conserve the Amazon Basin, Colombia has also implemented several initiatives. Two notable efforts include Operación Artemisa (Operation Artemis), launched by former President Iván Duque, and the current Petro administration's Plan de Contención (Containment Plan).

Operación Artemisa was Colombia's first 'integrated' strategy to combat deforestation. It involved officials from the Attorney General's Office, the Mobile Carabineros Squadron, the police, the National Army, and the Ministries of Defence, Environment and Sustainable Development. Their goal was to pursue and legally prosecute people engaged in illegal logging activities in protected forest areas. The operation primarily targeted departments in the Amazon foothills, including Meta, Caquetá and Guaviare.[219]

Its results, however, have been widely criticized, as it neither reduced deforestation nor slowed it down. Deforestation actually increased from 158 894 hectares (around 392 636 acres) in 2019 to 174 102 hectares (around 430 215 acres) in 2021.[220] Additionally, there were reports of significant clashes between settlers and farmers, abuse of power and impunity for large landowners.[221] In contrast, President Petro's Plan de Contención focuses more on community dialogue, which has contributed to a reduction in deforestation. Nonetheless, environmental issues and deforestation control have been closely linked to development of the Total Peace policy, with armed groups using the environment as a bargaining chip.[222]

Satellite detection of deforestation hotspots

While employing satellites to identify deforestation hotspots is not a new practice in Latin America – having been used for three decades to monitor deforestation dynamics and issue early warnings – Brazil leads the way in this area. The country developed the Satellite Monitoring Programme for Deforestation in the Legal Amazon (PRODES), which was later followed by DETER.[223]

PRODES was created in 1988 as a tool to remotely detect deforestation in the Brazilian Amazon. Through its use, it has been revealed that one fifth of the forest has been lost over the last four decades.[224] To enhance this effort, Brazilian officials established DETER in 2004 to issue daily alerts on vegetation loss.[225] In addition to these government initiatives, civil society efforts such as MAPBiomas[226] and the Institute for Man and the Environment of the Amazon (IMAZON) have emerged to support conservation.[227]

Each of these initiatives, whether from the government or civil society, aims to monitor deforestation, although they employ different methods and have distinct objectives. PRODES seeks to ascertain the deforestation rate in the Brazilian Amazon, which covers 4.2 million square kilometres, or 49 per cent of Brazil's territory.[228] DETER simply seeks to inform Brazilian authorities responsible for combating deforestation, including ministerial bodies and state secretariats.[229] The MAPBiomas network's purpose is to verify and improve the alerts issued by PRODES and DETER.[230] Meanwhile, IMAZON's job is to track the monthly loss of native vegetation and forest degradation in the legal Amazon to better understand the area's dynamics and trends.[231]

There are also international efforts in Brazil that monitor deforestation. Most prominent is Global Forest Watch, led by researchers at the University of Maryland and funded by the World Resources Institute, which tracks land use and forest cover. Additionally, the Lula administration launched Brazil's MAIS programme in 2023 to promote sustainability and development in regions such as the Pantanal.

One of its primary actions involves using satellite monitoring technology to fight wildfires, particularly in delicate ecosystems like the Pantanal.[232] The initiative provides access to satellite images and other geospatial data for accurate tracking of wildfire hotspots, real-time fire detection and quickly supplying information to authorities to facilitate coordinated and effective wildfire response efforts.[233]

Following Brazil's experience with deforestation, other countries have developed initiatives as well. For example, in 2012, Colombia, the UK, the United States and Switzerland created the first system – known as Terra-i– to monitor deforestation across Latin America in near real-time using satellite data from NASA's MODIS satellite sensor.[234] It helps governments, conservation organizations and climate policymakers assess recent deforestation trends and identify emerging hotspots. The system was developed through a collaboration between the International Centre for Tropical Agriculture in Colombia, the Nature Conservancy in the United States and South America, the School of Engineering and Management of Vaud in Switzerland, and King's College London.[235]

There is also the Foundation for Conservation and Sustainable Development, which closely monitors deforestation dynamics in the Colombian Amazon using surveillance flights. The data collected is used for resolving land-use conflicts and guiding regional planning in the Amazon. In 2021, the foundation helped establish its counterpart in Peru, with concrete actions carried out in Madre de Dios and Loreto, and has also supported several environmental organizations in Venezuela.[236]

However, no monitoring system is perfect. With regard to satellite and aerial monitoring, for example, clouds can significantly obstruct visibility. Additionally, the images used may overlook certain forms of vegetation loss that the human eye could detect.[237]

Total Peace

After the peace process with the FARC ended in 2016, there were numerous reports that warned of an increase in deforestation in the group's former areas of influence. This was especially concerning in the Amazon regions, where the FARC had played the role of environmental authority.

To tackle deforestation, President Duque employed a militarized strategy to halt deforestation, but it was far from successful. From 2018 to 2021, 875 944 hectares of forest were lost despite the efforts of Operación Artemisa,[238] which sought to protect forest reserves and National Natural Parks. Instead of reinforcing state authority, the approach further undermined it in areas where the state already lacked credibility.[239]

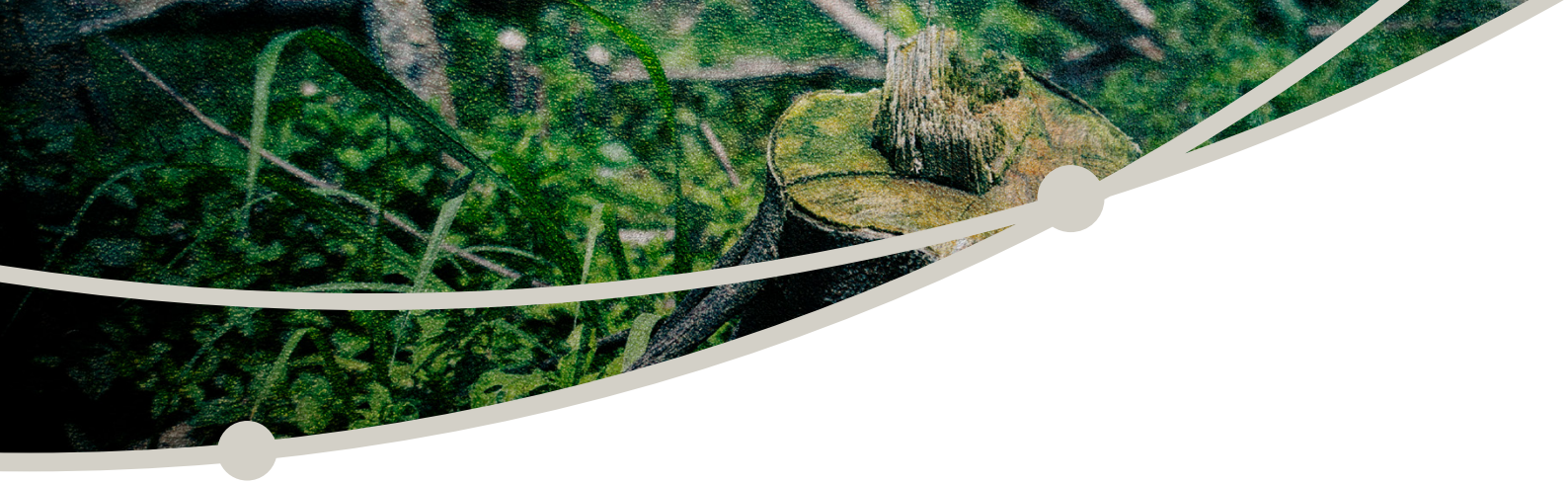
Following Petro's election in 2022, Colombia changed its approach to deforestation by devising a new policy known as the Deforestation Containment Plan. This environmental protection model revolves around five pillars:

- conservation agreements that build effective partnerships with communities to protect their territories;
- an environmental agenda for peace that aims to integrate environmental policies into the broader Total Peace policy, which consists of simultaneous negotiations with armed and criminal organizations across the country;
- institutional strengthening that trains and empowers local authorities in environmental control and monitoring;
- development of a criminal investigation strategy; and
- deployment of the state security forces.[240]

The Deforestation Containment Plan has successfully reduced deforestation in Colombia by 40 per cent. In 2023, the country recorded its lowest deforestation rate in 23 years, with only 79 256 hectares of forest cleared, down 36 per cent from 123 517 hectares in 2022. Reductions were notable in the four departments that make up the Amazon's Arc of Deforestation, with declines of 57 per cent in Meta, 52 per cent in Putumayo, 34 per cent in Caquetá and 27 per cent in Guaviare.[241]

However, quarterly monitoring reports in 2024 indicated a reversal of this trend, with deforestation once again increasing in key Amazonian departments. By 2024, deforestation rose to 25 263 hectares in Caquetá, 16 908 hectares in Guaviare, 5 443 hectares in Putumayo and 21 107 hectares in Meta, four territories that are critical to forest conservation in Colombia.[242] The overall reduction in deforestation can be attributed to two reasons. One is the Conservar Paga programme,[243] which incentivizes communities that inhabit 57 per cent of the country's forests – spread across indigenous and Afro-Colombian territories and Rural Reserve Zones – to engage in forest protection. The government has so far invested US$160 million in this initiative.[244]

Second, the Total Peace plan has motivated some armed groups to promote deforestation as a way to gain political recognition and demonstrate their influence. Initially, these groups prohibited or severely limited all logging and burning activities.[245] However, as the peace process has progressed and FARC dissidents have fragmented, deforestation has again increased. Armed groups in Colombia have exploited the situation to negotiate with the government and assert dominance over their rivals. Notably, Iván Mordisco's group, which is part of the EMC, has distanced itself from conservation policies in the Amazon after it was excluded from the Total Peace process.[246]



CONCLUSION

Environmental crime in the Amazon represents a complex and adaptive criminal ecosystem that challenges both intervention efforts and analytical frameworks. Environmental criminals are constantly innovating, leading to widespread ecosystem destruction and rising violence throughout the region. While this report highlights several substantial responses to environmental crimes being implemented – from improved forensics to large-scale law enforcement operations seeking to dismantle illicit activities – current institutional directives are struggling to keep pace with the expansive reach of the Amazon's environmental crime ecosystem.

Current strategies often fail to capture the interconnected nature of these illegal activities, while intervention programmes are fragmented, reactive and insufficiently informed by comprehensive analytical models. Below are five major gaps in both intervention and analysis that undermine the fight against environmental crime in the Amazon.

- **The lack of a comprehensive criminal ecosystem approach to analyzing and addressing environmental crime.**

A major shortcoming in tackling environmental crime in the Amazon is the failure to conceptualize illegal activities as part of an integrated criminal ecosystem. Current interventions treat environmental crimes as discrete, market-specific issues rather than acknowledging how they are deeply interconnected and reinforce one another. This fragmented approach misrepresents how criminal networks operate, as they do not function within a single sector, but instead diversify their revenue streams, exploit loopholes in legal markets and shift between different environmental crimes to maximize profits and minimize risks. The absence of a comprehensive systems-level approach has resulted in poor resource allocation and ineffective enforcement strategies, thereby enabling criminal organizations to exploit both regulatory and enforcement gaps.

- **The overlap between legal and illegal markets: how weak regulations encourage environmental crime.**

Another issue concerns law enforcement's failure to recognize the fluidity between legal and illegal markets. Instead, their efforts are often focused on eradicating physical infrastructure used in illicit mining and illicit logging activities, leading them to overlook how criminal actors exploit regulatory loopholes to integrate unlawfully sourced resources into formal supply chains. The Amazon is not just a site of illegal extraction, but also a critical hub for laundering commodities such as gold, timber and cattle. In the Amazon, illegally mined gold is refined legally, timber from protected areas is laundered using fraudulent land titles and cattle raised on deforested land is sold as legitimate agricultural products. Weak due diligence, poor financial oversight and inconsistent trade regulations enable these goods to enter global markets with minimal scrutiny. This overlap between legal and illegal activities is a structural feature of organized environmental crime, allowing criminal networks to legitimize their profits and operate with impunity.

- **Weak enforcement against illegal mining despite its central role in environmental crime.**

Illegal gold mining is one of the most profitable and environmentally destructive criminal economies in the Amazon, yet enforcement efforts remain inadequate, fragmented and overwhelmingly reactive. Current initiatives instead rely on short-term police raids and site demolitions, which fail to address the deeper financial, economic and governance frameworks that sustain this activity. As a result, miners frequently relocate to new, often more remote areas, leading to increased deforestation and ecological damage. Illegal mining is not just an environmental crime; it serves as a key pillar of organized crime economies, financing armed groups, transnational cartels and illicit financial networks. Gold has become the preferred medium for laundering profits from drug trafficking and other illegal activities, yet law enforcement continues to treat mining as an isolated issue, failing to target the broader supply chains and financial structures that allow illegal gold to enter the global economy.

- **Weak anti-corruption measures that enable organized crime in the Amazon.**

Corruption is a structural enabler of environmental crime in the Amazon but enforcement strategies often fail to adequately address it. Organized criminal networks infiltrate various levels of state institutions, including local law enforcement, environmental agencies and national regulatory bodies, ensuring that illegal activities like illegal mining, land grabbing and deforestation continue without consequence. Corruption takes many forms, such as fraudulent land titling, bribing officials responsible for environmental protections and collusion between private companies and state actors. These practices undermine enforcement efforts and neutralize legal deterrents, enabling criminal organizations to bypass regulations, evade prosecution and embed their operations within formal governance structures. Unless there is a systematic approach that prioritizes transparency, strengthens legal accountability and targets the political and economic interests that sustain environmental crime, corruption will continue to shield organized criminal networks, allowing environmental degradation to persist unchecked.

- **Failure to address the socio-economic drivers of environmental crime.**

Current interventions in the Amazon fail to acknowledge and address the economic dependencies that drive environmental crime. Most enforcement efforts wrongly assume that eliminating illegal activities will dismantle illicit economies, ignoring the socio-economic realities that allow these operations to thrive. Criminal networks do not merely exploit economic vulnerability – they provide financial stability, protection and employment opportunities in ways that formal economies and state institutions have failed to deliver. In regions such as Brazil's Yanomami indigenous territory and Tapajós River Valley, illegal gold mining has become the backbone of local economies, with criminal groups offering food, housing and security in exchange for labour. This integration of crime within everyday survival makes it unrealistic to expect communities to disengage from these illicit economies without viable alternatives.

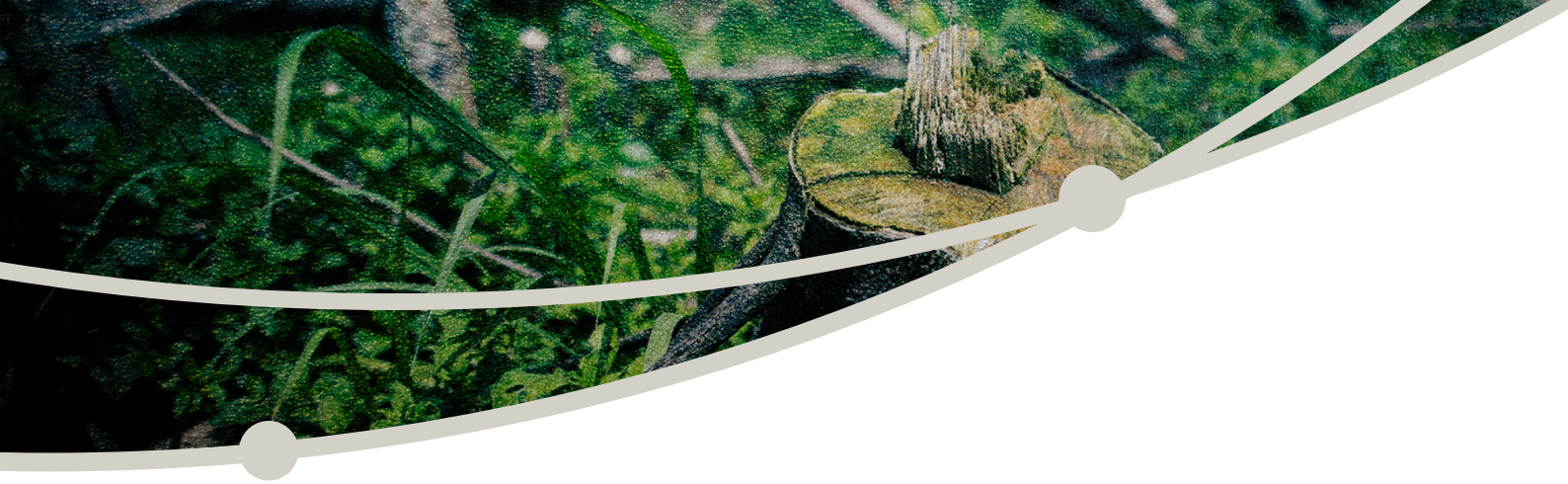
Recommendations

The following recommendations seek to address the gaps outlined above:

- **Enhance country-specific and context-driven approaches.** Cooperation initiatives in the Amazon should prioritize strategies based on thorough national assessments that take into account each country's existing enforcement mechanisms, legal system and institutional capabilities, ensuring that interventions address concrete needs rather than generic challenges. Direct engagement with national and subnational law enforcement agencies is crucial for aligning cooperation efforts with conditions on the ground and preventing redundancy. Furthermore, interventions should build on the knowledge and success of previous national and regional initiatives, including many of the ongoing responses outlined in this report, to maximize impact rather than continuously produce broad policy recommendations

that fail to translate into effective enforcement actions. In that vein, it is essential to invest in community-led environmental protection initiatives that empower local and indigenous groups to serve as front line defenders against land invasions, illegal mining and deforestation.

- **Adapt cooperation strategies to respond to the evolving nature of environmental crime.** As environmental criminal networks evolve their tactics, international cooperation efforts should prioritize real-time information sharing across law enforcement and judicial agencies. Strengthening mechanisms for continuous monitoring and intelligence sharing will allow for quick adjustments to intervention strategies, ensuring they remain effective against emerging threats. Cross-border cooperation should also consider the establishment of specialized task forces that investigate the intersection of environmental crimes and broader illicit economies, including arms and drug trafficking, human smuggling and financial crimes across Amazon Basin countries. These interconnected criminal networks require a coordinated investigative approach that goes beyond traditional environmental enforcement. These task forces should include environmental authorities, financial intelligence units, anti-organized crime agencies and forensic analysts to enhance intelligence sharing and improve enforcement action.
- **Adopt a holistic approach to the environmental criminal ecosystem**. Understanding environmental crime in the Amazon requires moving beyond isolated offences and recognizing the broader ecosystem that enables these operations. Criminal networks engaged in deforestation, illegal mining and wildlife trafficking frequently intersect with other illegal activities including drug trafficking, human exploitation and arms smuggling. Policy responses should incorporate environmental crime into a broader transnational organized crime framework, leveraging intelligence sharing and cross-sectoral collaboration to identify overlapping networks.
- **Analyze illicit financial flows to disrupt criminal supply chains**. Amazon Basin countries and international partners should focus on understanding the financial mechanisms that sustain environmental crimes, focusing on how illicit profits are laundered through formal economic systems. Illegal gold mining, land grabbing and timber trafficking, for example, generate substantial revenue that is then funneled through regional and international financial systems – often disguised as legitimate transactions. By strengthening cooperation among financial intelligence units, private sector actors and law enforcement agencies, the countries of the region can improve their capacity to track, freeze and seize assets linked to environmental crimes.
- **Focus on illegal gold mining and its precursors.** Current strategies to combat environmental crime predominantly focus on deforestation, often neglecting the rising significance of illegal mining and its ties to other illicit economies. Gold in particular has become a critical conduit for laundering proceeds from drug trafficking, arms smuggling and human exploitation, yet a comprehensive understanding of gold supply chains in the Amazon is lacking. Mapping these supply chains is critical to strengthening cooperation among environmental enforcement agencies, financial intelligence units and transnational crime experts. In addition to understanding gold supply chains, regional governments should prioritize interventions that target illegal mining precursors, particularly mercury, which is essential for illegal gold production. Despite clear evidence linking mercury smuggling to money laundering, drug trafficking and arms sales, law enforcement agencies lack the knowledge and tools to track and disrupt these illicit networks. Without a targeted approach, international efforts will continue to focus on surface-level enforcement rather than employ other strategies to dismantle illegal gold mining networks.
- **Increase oversight of carbon credit markets to mitigate fraud risks in conservation efforts.** Regional governments and international partners need to closely monitor the growing vulnerabilities within carbon credit markets, where weak regulations have allowed fraudulent schemes to divert conservation funding for criminal enterprises. Without improved oversight, these financial mechanisms risk exacerbating issues that they aim to solve. Strengthening due diligence processes, enforcing transparency standards and enhancing regulatory safeguards are critical to ensuring the integrity of these markets.



NOTES

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