WWF

REPORT

2018

HEALTHY RIVERS HEALTHY PEOPLE

ADDRESSING THE MERCURY CRISIS IN THE AMAZON

A REPORT FOR WWF BY

Dalberg

An urgent call to action to free the Amazon from the impacts of mercury used in artisanal and small-scale gold mining.

The Amazon region is a unique environmental icon. Spanning more than a third of the South American continent, it contains the greatest share of biodiversity in the world. Further, it is home to more than 34 million human inhabitants, including some 3 million indigenous peoples. It is an invaluable source of water, food, shelter, medicines, and culture to these people of diverse origins, stretching back thousands of years.

However, today the Amazon is under threat. Artisanal and small-scale gold mining is a prominent source of livelihoods and income in the region. These informal, unregulated operations make heavy use of mercury in the gold purification process, which is then released into the water and air. This mercury is carried far from the mines, irreversibly contaminating plants and animals throughout the region. Ultimately, it has severe negative impacts on the health, productivity, and quality of life of people living across the Amazon.

Based on the findings of Healthy Rivers Healthy People, WWF urges governments, gold wholesalers and retailers, consumers, and miners themselves to take immediate action against the rampant use of mercury in the Amazon. Governments must enact and enforce meaningful anti-mercury policies, and gold products retailers must commit to sourcing all gold through verified responsible supply chains. Failure to do so will result in the continued poisoning and destruction of one of our planet's most important environmental resources.

WWF CALLS ON AMAZON GOVERNMENTS AND OTHER GOVERNMENTS WHO PLAY A ROLE IN THE GOLD AND MERCURY MARKETS TO:

SIGN, RATIFY, AND ENFORCE the Minamata Convention on Mercury, including the development of National Action Plans and relevant supporting policy by 2020 and the strengthening of national mechanisms and resources to support miners in adopting mercury-free practices, and holding one another accountable for compliance with relevant national and international laws and agreements governing mercury use,

SHARE BEST PRACTICES regarding the prevention of illicit mercury use with the support of the Minamata Convention Secretariat,

IDENTIFY OPPORTUNITIES to support miners in adopting alternative, environmentally sustainable livelihoods, and provide the necessary technical and financial support and incentives to enable such transitions.

WWF CALLS ON PRIVATE SECTOR GOLD BUYERS AND RETAILERS TO:

PRIORITISE THE DEVELOPMENT OF MERCURY-FREE SUPPLY CHAINS and bring only responsibly and sustainably sourced gold to market,

DEVELOP PARTNERSHIPS WITH AMAZON MINING COOPERATIVES who engage in mercury free practices to support their growth and development, creating incentives for long-term mercury-free operations.

WWF URGES MINING COMMUNITIES TO:

FORM FORMALIZED MINING COOPERATIVES among local communities to leverage pooled resources for new mercury-free mining technologies and access higher-end markets for responsibly-sourced gold,

WORK ACTIVELY with local authorities to adopt new policies and regulations, and utilise available financial and technical assistance for adopting mercury-free mining practices.

WWF URGES ALL CONSUMERS OF GOLD AND GOLD PRODUCTS, INCLUDING BANKS TO:

PURCHASE GOLD ONLY FROM RESPONSIBLE RETAILERS with verified supply chains, considering the environmental and social impacts of unverified gold purchases.

The report was written by Dalberg Advisors, and the team comprised of El Ghali Fikri, Henry Koster and Wijnand de Wit.

DALBERG ADVISORS

Dalberg Advisors is a strategy consulting firm that works to build a more inclusive and sustainable world where all people, everywhere, can reach their fullest potential. We partner with and serve communities, governments, and companies providing an innovative mix of services – advisory, investment, research, analytics, and design – to create impact at scale.

WWF

WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global network active in more than 100 countries.
WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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Chapter 1

VALUE OF THE AMAZON

THE AMAZON REGION IS A UNIQUE ECOLOGICAL TREASURE

Covering an area of approximately 6.7 million square kilometres, which is more than twice the size of India, the Amazon is the largest rainforest on Earth. It spans eight South American countries and one European territory (*see Figure 1 below*). Flowing throughout the rainforest is the Amazon River, the world's largest river by volume. It stretches more than 6,500 kilometres across the region, and can reach widths of up to 50 kilometres during the rainy season. The river is formed of over 1,000 tributaries of varying length and width that extend over about seven million square kilometres, and totals some one million square kilometres of freshwater ecosystems. Together, this freshwater system comprises the Amazon Basin, the planet's largest freshwater drainage system.[1] **The basin contains up to 20% of all the world's freshwater, and discharges approximately 219,000 cubic metres of water into the Atlantic Ocean every second.**[2] The basin's freshwater contributes to the vast biodiversity and delicate equilibrium of the broader basin biome. Water levels protect wildlife habitats, and populations of river fish provide a food source for other species.[3]

Figure 1.-

Map of Amazon Biome and Basin freshwater system[4]

The Amazon hosts the most biologically diverse biome on Earth. The region is home to approximately 10 per cent of Earth's biodiversity. Many of these species, such as the Amazon river dolphin and dorado catfish, cannot be found anywhere else on the planet. In fact, studies found that 87% of amphibians, 82% of reptiles, 25% of mammals and 20% of birds species found in the Amazon are endemic to the region.7 Knowledge of the Amazon's biodiversity continues to expand as new species are discovered. Over just the last 20 years, scientists have documented over 2,200 new species of plants and vertebrates.[8, 9, A]

ENVIRONMENTAL VALUE

The Amazon Biome is home to 10% of Earth's biodiversity.

40,000
PLANT SPECIES

2,500
FRESHWATER FISH SPECIES
such as the piranha

1,300
BIRD SPECIES
including the harpy eagle and the toucan

427
MAMMAL SPECIES
including the jaguar, the giant otter and the Amazon river dolphin

400
AMPHIBIAN SPECIES

370
REPTILE SPECIES

The Amazon biome also provides critical ecosystem services for the region.

The natural activity of the Amazon's vibrant plant life provides three types of services that benefit the region's people and wildlife. ***Supporting services*** are essential enablers of all the other environmental activities, and include functions such as nutrient recycling, soil production and prevention of erosion, habitat provision, maintenance of diverse gene pools, and support for ecosystem resilience.[10, 11] ***Provisioning services*** generate materials that can be consumed sustainably to support animal populations as well as human well-being and livelihoods.[12] Residents of the Amazon region depend heavily upon the environment for these natural resources, which they use for food, medicine, shelter, clothing, energy, and more. Finally, and most importantly, ***regulating services*** maintain the natural balance of the environment through processes such as water recycling and purification, and air filtration.[13] These functions not only promote the regional environment's long-term sustainability, but also have far-reaching impacts on the entire planet. **Between 50-75% of the annual rainfall in the Amazon biome is recycled back into the atmosphere through the process of evapotranspiration, totalling as much as seven trillion metric tonnes of water each year.**[14] Altogether, the Amazon's water cycle contains as much as 20% of all the world's freshwater**.** For this reason, it is a vital resource with implications for life around the planet. And already, shifting climate patterns have driven reductions in annual rainfall across 69% of the Amazon.[15]

The Amazon's regulatory services provide a powerful buffer against global climate change.

On a regional level, **the Amazon's position within South America and the natural barrier formed by the Andes to its southwest mean that the forest plays a central role in maintaining rainfall patterns across the continent**. The freshwater that it recycles back into the atmosphere is trapped by the mountains, and moves downward into some of the continent's most fertile and productive land.[16] In addition, the immense scale of evapotranspiration in the region plays a central role in maintaining the forest's humid and relatively cool climate.

Meanwhile, **studies estimate that the Amazon's trees capture approximately 430 million metric tons of carbon from the atmosphere each year, storing as much as 10 per cent of the world's total carbon reserves.**[17, 18] By capturing carbon from the air and replacing it with clean oxygen, the ecosystem serves to reduce the volume of greenhouse gases in Earth's atmosphere.[19] This has a significant effect in combatting the impacts of climate change and slowing global warming. However, as the climate continues to change, it may have significant impacts upon the Amazon biome. Rising temperatures and droughts can result in the shrinking of forested areas and more frequent catastrophic flooding.[20] In addition, freshwater ecosystems are particularly vulnerable to climate change, as changing water temperatures and rainfall patterns impact the natural process of the ecosystem's inhabitants. These results would bring significant harms to all animal and human life in the region.

[A] *WWF's New Species of Vertebrates and Plants in the Amazon 2014-2015 details 381 new species that were discovered over 24 months, including 216 plants, 93 fish, 32 amphibians, 20 mammals (2 of which are fossils), 19 reptiles and 1 bird. https://www.wwf.org.uk/sites/default/files/2017-09/UntoldDiscoveriesAmazonUK.pdf.*

ICONIC SPECIES OF THE AMAZON REGION

Amazon River Dolphin

Scientific name: *Inia geoffrensis; Inia boliviensis; Inia humboldtiana*

Habitat:

Widely spread throughout the Amazon River basin, it is most commonly found in lowland, fast flowing, white-water rivers, as well as clearwater and blackwater rivers

Key facts:

Growing up to 2-3 metres in length and weighing more than 160 kilograms, the Amazon river dolphin is one of just three dolphin species in the world found only in freshwater. It is known for its pale pink colour, which is most common among adult males.

Dorado Catfish

Scientific name: *Brachyplatystoma rousseauxii*

Habitat:

Found across the Amazon Basin, spanning from the Peruvian foothills to the Amazon Delta

Key facts:

This large fish – reaching up to two metres in length – is a staple of the local small-scale fishing industry. It is unique for its migratory patterns, breeding in the Andean foothills in the west of the Amazon and traveling across the continent to mature in the Amazon Delta. The adult fish then make the return journey, to breed once again in its original spawning grounds in the Amazon headwaters. This is the longest freshwater migratory pattern in the world, stretching across more than 8,000 kilometres.

Jaguar

Scientific name: *Panthera onca*

Habitat:

Once living across a range stretching from the southwestern United States all the way down to Argentina, the jaguar is now most commonly found only within the Amazon Basin.

Key facts:

Jaguars, the largest species of cat in the Americas, often live near water and are strong swimmers. The species often hunts in the rivers, and this apex predator plays an important role in maintaining healthy population levels of many Amazon species.

SOCIAL VALUE

The Amazon River is an essential source of food and water for a growing population already numbering about 34 million people.[21]

The total population of the Amazon region, reaching across national boundaries, is equivalent to that of Saudi Arabia. The basin's water resources are critical for the health and well-being of residents. In many Amazon countries, freshwater fish is the main source of protein for riverine communities. **Local annual fish consumption averages 94 kilograms per person, which is almost six times the global average.**The region's urban communities are also reliant on freshwater fish for their diets, with an annual consumption more than double the world average. [22] The most commonly consumed species throughout the region are large migratory catfish, which are highly dependent upon the Amazon River's water quality and connectivity for survival. In addition, residents rely on the Amazon Basin as an important domestic water source. For instance, in Peru, total water withdrawal from the basin is around 2,360 million cubic meters per year, which is around one-sixth of the country's total water demand.[23]

The Amazon has provided a home for indigenous populations for thousands of years, and has shaped their lives and customs.

Approximately 3 million indigenous people constituting 390 groups live in the Amazon.[24] These populations have developed lifestyles using the region's natural resources for housing, nutrition, and medicine. Their cultural and spiritual beliefs are also rooted in the Amazon's natural elements. Ancient knowledge of indigenous plants and animals are used to treat the sick, and are the basis of many local religious practices.[25] Beyond the intrinsic cultural value of these practices, they also contribute to a healthy way of life for the indigenous population. Studies of indigenous groups have shown that parents' knowledge of local plants is correlated with positive health and nutrition outcomes for their children.[26, 27]

Over time, the Amazon's human populations have grown to include a vibrant mix of historical backgrounds and cultures. **While historically mostly rural, approximately 65 per cent of Amazon residents now live in urban settings, including in several large cities such as Manaus, Belém, and Iquitos.**[28] These cities include diverse ethnic groups that reflect the history of the region. In addition to indigenous peoples and those of European descent, the populations include groups of mixed heritage such as the *caboclos,* which are of mixed indigenous-Brazilian and European heritage, as well as those of African descent. Each population brings unique customs, ways of life, and cultural knowledge to their communities, including differing practices and interactions with the environment.

ECONOMIC VALUE

The Amazon supports a range of revenue-generating activities, including agriculture, fishing, medicine, mining, sustainable forestry, tourism, and power generation.[29] The unique qualities of the basin environment benefit these industries and support the livelihoods of millions of people. For example, the basin's ability to recycle more than half of local rainfall back into the atmosphere delivers a reliable source of water for the region's farmers. As a result, only 10 per cent of farmland across South America requires irrigation, including as little as approximately 1.5 per cent in Colombia and Brazil.[30, 31]

The region's natural resources are a key contributor to local economic output, and retain further potential for sustainable development.

Likewise, the river supports the artisanal fishing industry, which provides livelihoods for approximately 40 per cent of households in riverine fishing communities.[32] **In the Brazilian Amazon alone, the fishing sector employs over 160,000 people, including some 120,000 subsistence fishers, and generates a total annual value of about US$400 million.**[33] Amazon countries are also the source of valuable natural inputs to the pharmaceutical industry. Studies estimate that the Amazon is a major contributor to the US$33 billion-per-year global market for botanical and plant-based drugs, and that there is significant opportunity for further research and growth.[34]

FRESHWATER RESOURCES

The Amazon's rich environmental, social, and economic values are all critically dependent upon the region's unique freshwater system.

The unparalleled scale of this water system provides critical support to the region's vibrant ecosystems, and enables the services and benefits they provided.

Further, millions of residents draw their food and livelihoods from these waters. In this way, the region's plants, animals, and people are all inextricably linked by their shared reliance upon this freshwater system.

Any threat to the Amazon Basin system would put the health of the entire region at grave risk.

Chapter 2

THE THREAT: MERCURY POLLUTION IN THE AMAZON

HISTORY AND CONSEQUENCES OF EXTRACTIVE ACTIVITIES IN THE AMAZON

Extractive and other environmentally unsustainable industries have long histories in the Amazon

Its resource-rich environment has fuelled extractive activities since shortly after the arrival of European explorers. For example, the initial search for gold began in Brazil as early as the 16th Century, and the region saw its first major gold rush in the late 17th Century.[35]
Then, in the late 19th Century, a boom in the global rubber market drove the rapid establishment of a large-scale regional rubber industry, particularly in Brazil, Colombia, and Peru.[36] **Extractive activities in the region further accelerated through the latter part of the 20th Century, with the development of thriving oil, timber, and mining industries.**[37, 38, 39] Meanwhile, the growth of resource-intensive activities such as large-scale agriculture and cattle ranching further strained the region.[40] Many of these activities have also driven extensive infrastructure construction, built to facilitate access for industrial operations.

Many of these industries have had significant negative impacts on the environment. Activities such as mining and oil extraction can heavily pollute local freshwater resources, while agriculture and mining often lead to the clearing of vast forested areas. These trends have been exacerbated by rapid infrastructure development, which has increased access to remote resources and newly-cleared farmlands. **In just the period from 2001 to 2012, the Amazon region lost a total of 17.7 million hectares of forest**, primarily in Brazil, Peru, and Bolivia.[41] The losses over the past 40 years together amount to more than 18 per cent of the rainforest's total historical area *(see Figure 2)*.[42]

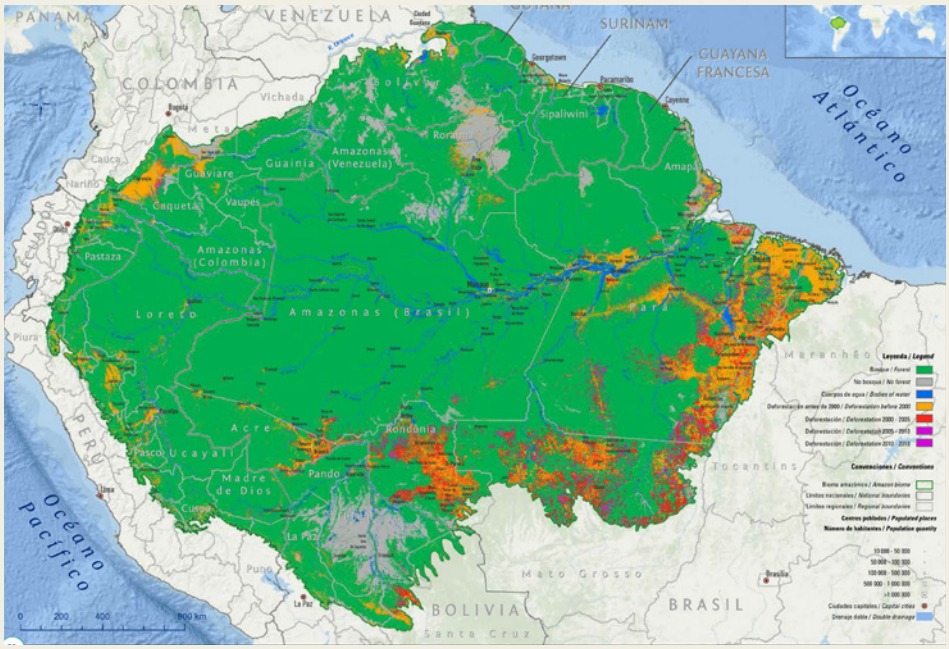

Figure 2.-

Map of deforestation in the Amazon biome.

The region's heavy economic reliance upon environmentally harmful industries is unsustainable for longterm development, and contributes to local inequality.

The focus on natural resource exports creates an unstable foundation for the Amazon region's economies. Export economies remain vulnerable to global market fluctuations, while these activities have significant and lasting consequences on the domestic environment and inhabitants. Further, export-focused economies tend to benefit the rich and marginalize the poor, reinforcing a cycle of inequality. Extractive activities are often undertaken in indigenous peoples' lands, putting their rights at risk. Those activities in the region that offer the hope of lucrative employment – especially in comparison to other local alternatives – are often illegal and, therefore, risky undertakings. Too often low-income rural residents with little formal education have few other economic opportunities. This leads many vulnerable individuals to enter the extractive industries where they remain trapped in a dangerous cycle of poverty, or to be affected by the negative impact which the proximity of these industries can cause to their territories and livelihoods.

PRESENT-DAY CONTEXT OF MINING IN THE AMAZON - INTRO TO ASGM

Today, mining remains a core part of the region's extractive operations.

*M*ining is a major economic sector for many Amazon countries, especially Brazil, Colombia, Guyana, Peru, and Suriname.[45, 46, 47, 48] Gold is of particular focus in the region, and income from gold production supports millions of local residents. **Amazon countries produce approximately 400 metric tons of gold annually, meeting almost 10 per cent of the world's gold demand.** In value, gold exports by Amazon countries amount to about US$12 billion annually, with Peru alone collecting around US$5.7 billion or over 15 per cent of its total export revenue from gold.[49, 50] The region's mining sector is dominated by large-scale corporations, which operate industrial mines on government-granted concession areas. These mining activities can result in widespread deforestation and environmental pollution, to the significant detriment of the regional environment. Further, as pollution is less visible than deforestation, it historically has received less public attention, despite the significant harm it inflicts.

Many of the region's vulnerable communities engage heavily in small-scale gold mining, despite its dangers, as it provides a comparatively lucrative livelihood.

The Minamata Convention on Mercury, a UN treaty aimed at reducing global mercury pollution, defines artisanal and small-scale gold mining (ASGM) as "gold mining conducted by individuals or small enterprises with limited capital investment and production."[51] **ASGM is generally an informal activity, in which laborers are not documented or regulated by local authorities.** As a result, they often work illegally on private or protected lands. These small-scale operations make limited use of mechanical tools and modern best practices, which leads to low productivity, poor output quality, weak safety standards, and minimal compliance with environmental protection standards.[52] Nevertheless, **small-scale operations are responsible for 15 per cent of Amazon countrie's gold production, and the sector may employ as many as 1.5 million people**.[53, 54]

The miners are predominantly members of rural, low-income communities seeking reliable livelihoods for themselves and their families. Community members are drawn to this work, despite its risks, by the expectation of higher incomes than other local industries can offer. Further, in such vulnerable communities with limited access to education or financial resources, historical ties to the mining sector promote continued involvement over time.

INTRO TO MERCURY POLLUTION FROM ASGM

Mercury plays a central role in the process of purifying the gold collected in small-scale operations. In the ASGM gold production process, mercury is used to amalgamate – or bundle up together – particles of gold that are mixed in with the soil in riverbeds. When done efficiently, the process requires approximately one kilogram of mercury per kilogram of gold recovered. However, ASGM miners frequently utilize inefficient processes that require much larger quantities of mercury. Sometimes up to 50 units of mercury are used to produce one unit of gold.[55] Further, while tools and technologies exist to reduce the amount of mercury required, or to capture the mercury during the amalgamation process and prevent its release into the environment, ASGM miners often are not aware of or cannot afford such equipment. As a result, **ASGM is the largest single source of human-driven mercury pollution in the world**, accounting for 37 per cent of all emissions into the atmosphere and into local water sources.[56] In the Amazon region this percentage is even higher, with ASGM responsible for an estimated 71 per cent of all mercury emissions, totalling more than 200 metric tons of emissions each year.[57]

Artisanal and small-scale gold mining is the leading source of mercury pollution in the Amazon.

The Amazon's freshwater systems rapidly spread mercury contamination throughout the environment, posing a grave threat to the health of local residents and of people living or travelling in proximityof the Amazon. **Mercury is a volatile chemical element that does not disintegrate over time. As such, mercury emissions into the environment are irreversible and difficult to contain.** Mercury released into the air and into local water bodies by mining operations can be carried far from the initial sources through the Amazon's extensive freshwater systems, affecting large swaths of the region. For example, in the Guianas, a study suggests that ASGM-related emissions are directly responsible for the pollution of approximately 6,000 kilometres of water bodies.[58] Similarly, Paramaribo, Suriname, has experienced dangerous levels of mercury despite being located many kilometres from any mine.[59] **Animals also contribute to the spread of mercury by absorbing it into their bodies from polluted waters and then traveling away from the sources.** When these contaminated animals are eaten or decompose, they pass the toxins on to their predators through the food chain or release them into the environment. Man-made dams along Amazon waterways can also exacerbate the problem. Plants in newly-flooded areas release additional toxic mercury into the water as they decompose.[60] Given the shared reliance of people, plants, and animals on the Amazon's water resources, contaminated water can have direct consequences on life in the region. When ingested, either directly or through the food chain, mercury can cause significant developmental and neurological harm, with permanent and untreatable consequences. However, despite this significant danger, mercury pollution in the Amazon has received little public attention at either the local or global levels. This is because its impact, while significant, is often "invisible" due to the gradual nature of its toxic effect, and because the most vulnerable victims are often voiceless indigenous peoples and local communities.

Mercury emissions into the environment are irreversible and difficult to contain.

THE MIGRATORY DORADO CATFISH

*B*rachyplatystoma rousseauxii, commonly known as the dorado catfish or gilded catfish, is one of the Amazon region's many unique species. This fish, growing up to two meters (more than six feet) in length, can be recognized by its silver-gold colour and its scale-free skin. Beyond its sheer size, this so-called "Goliath catfish" is renowned for making the longest freshwater fish migration in the world – traveling across the entirety of the Amazon region twice during its lifecycle.[B]

The dorado spawn in the Andean foothills of Peru, in the headwaters of the Amazon River on the western edge of South America. Shortly after birth, the new-born fish begin swimming downstream, following the Amazon River for approximately 5,800 km (3,600 miles) to the Amazon estuary on South America's Atlantic coast. They remain there and mature for two to three years, at which point the fully-grown catfish begin the reverse journey. The fish travel upstream back across the continent to their original spawning grounds, taking as long as one or two years to complete the trek. Upon arriving, they breed and begin the cycle anew.[C, D] This migration, totalling more than 11,600 km (7,200 miles) in their lifetimes, is unparalleled in freshwater species and surpasses other iconic migratory species such as the chinook salmon and European eel.

11,600km

The Dorado catfish is renowed for making the longest freshwater fish migration in the world, travelling across the entirety of the Amazon region, for more than 11,600 km.

In addition to its exceptional migratory pattern, this species is also a staple of the culture and diet of many Amazon communities. Due to its size, the fish is considered a noble species by local people, and an important catch for subsistence fishers. The high value of each fish, coupled with the its relative abundance in the Amazon waters, make it a core part of the small-scale fishing economy and major source of income for local households. As a result, the dorado also features heavily in local cooking,

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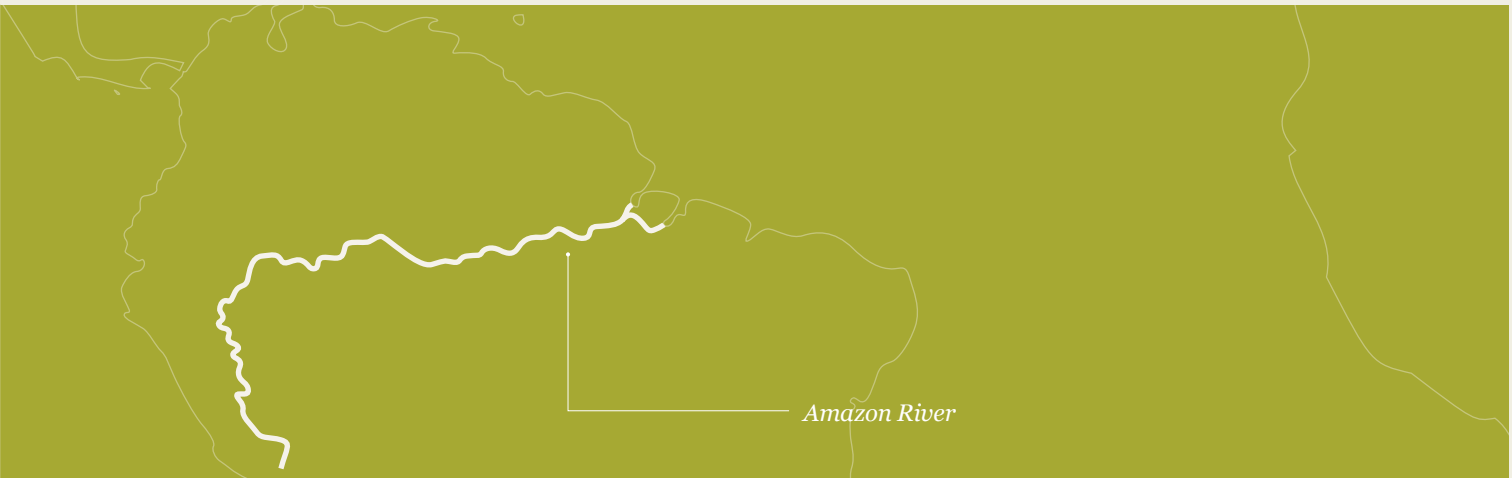
B - Wildlife Conservation Society. (2017, February 6). Scientists Confirm Dorado Catfish As All-Time Distance Champion of Freshwater Migrations. https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/9759/Scientists-Confirm-Dorado-Catfish-As-All-Time-Distance-Champion-of-Freshwater-Migrations.aspx.

C - Ibid.

D - Lee, L. Dorado catfish is a freshwater endurance champ. (2017, February 8). New Atlas. https://newatlas.com/dorado-catfish-marathon-swimmer/47792.

E - Burgos, R. M., Maurice, L., de Decker, M., Estudio de contenido de Mercurio en peces amazónicos como base de recomendación de consumo por poblaciones locales



and serves as a major source of protein for riverine communities. For example, the "bagre" broth made from dorado is an Amazonian specialty, originating from a blend of indigenous and mestizo settler cultures. The hearty broth is believed to have reviving and healing properties, and is often consumed after celebrations and holidays.

Unfortunately, the dorado now faces grave threats to its future. The construction of dams and other infrastructure along the Amazon River may prevent the fish from completing its marathon migration, as parts of the river become impassable. Likewise, mercury pollution from local ASGM activities threaten the health and wellbeing of the species.A study in the Ecuadorian Amazon showed that 97% of catfish present high mercury levels, on average, 5 times higher than the recommend mercury concentration on fish for human consumption [E]

The dorado, an apex predator, can consume dangerous quantities of mercury from contaminated prey, accumulated through the food chain. This can result in serious harm to its hormonal processes, immunity to pathogens, and central nervous system functioning. These consequences threaten the future of a unique species, and the environmental and economic value that it provides to the region. Further, these migratory animals can contribute to the spread of mercury throughout the Amazon, carrying it within their bodies as they traverse the region, and transporting it to local fishing communities far from mining activities.

ENVIRONMENTAL RISK OF MERCURY POLLUTION

Mercury contamination of the Amazon Basin poisons wildlife and threatens endemic species.

Mercury is easily absorbed by aquatic microorganisms, such as plankton, and accumulates in more dangerous chemical forms, such as methylmercury, in carnivorous fish species higher up in the food chain.[61,62] This can become particularly dangerous for fish-consuming animals, such as river dolphins and jaguars, which are exposed to high concentrations of mercury from their food sources. A study in the Brazilian Amazon showed that 81 per cent of carnivorous fish had detectable mercury levels. Most of those had concentrations higher than the World Health Organization's guideline for maximal exposure (0.5 µg/g). Some samples had concentrations as much as five times this limit. Another recent study of the concentration of mercury in four river dolphin species in the Amazon and Orinoco river basins detected mercury in all samples. More than 26% of sampled dolphins exceeded the mercury limits for humans set by the World Health Organization.[64] Meanwhile, plants can also accumulate lower levels of mercury through the soil, posing a risk to herbivorous animals in the region.[65] **Contaminated animals can experience damage to their reproductive systems, as well as neurological disorders affecting their motor skills and coordination**, which has been documented in birds, for example.[66] Consequently, these animals may be less able to hunt effectively or to mate, which threatens the long-term health of their species. This threat is compounded by the fact that ASGM activities in the Amazon often take place in areas of particular environmental importance, such as rainforests, water bodies, and even protected nature reserves. As a result, the consequences of ASGM activities – including environmental contamination from the emission of mercury and other polluting chemicals – pose a particularly acute threat to the region's most unique and valuable resources.[67, 68]

HUMAN RISKS OF MERCURY POLLUTION

Environments contaminated with mercury also pose significant risks to human health.

The consumption of heavily-contaminated fish, as well as direct exposure to mercury through the air and from drinking water, can cause serious harm to humans. **The World Health Organization classifies mercury as "one of the top ten chemicals or groups of chemicals of major public health concern**," as exposure can lead to a range of human health disorders.[69] These include effects on the nervous, digestive, immune, cardiovascular, renal, and respiratory systems. In particular, fetuses exposed to mercury can face long-lasting consequences to the development of their nervous systems.[70, 71, 72, 73] Figure 3 summarizes the human health impacts of mercury exposure.

Type of mercury	Health disorders due to exposure
Elemental mercury (inhaled)	• Insomnia • Tremors • Buccal inflammation (inflammation of the mouth and lips) • Kidney disease • Pulmonary inflammation and edema • Gastrointestinal disorders
Organic mercury (consumed)	• Visual disturbance • Neuromuscular and psychomotor disorders • Hearing loss • Muscle tremor • Paralysis • Cognitive and motor delays and impairment

Figure 3.-

Health disorders caused by human exposure to mercury.[74]

Residents of mining communities may directly inhale mercury vapours released through the open-air burning of gold during the purification process. The miners' and other community members' proximity to the mining activities places them at the greatest risk of dangerous exposure to mercury. For example, the average level of air-borne mercury near gold mining operations in Venezuela was found to be 183 times higher than the World Health Organization's recommended limit for human exposure.[75] **Annually across the region, between 130,000 and 220,000 healthy life years are lost due to disability induced by moderate chronic metallic mercury intoxication**, according to a 2016 study in the Annals of Global Health.[76] In other words, affected miners may experience a ten per cent or greater loss of quality of life and productivity while suffering from the consequences of significant mercury exposure. It should also be noted that these are conservative estimates that consider the impact of just one type of mercury on limited populations. The miners, and others living in communities near mines, are often unaware of the dangers associated with exposure to mercury, and therefore fail to take steps to protect themselves and their families.

ASGM activities place miners and their immediate communities at the highest risk for mercury poisoning.

Indigenous peoples and Amazon communities far from mining operations may unknowingly consume contaminated food and water, with serious consequences.[77] Fetuses are among the most vulnerable groups to mercury exposure. Pregnant women who are or have been exposed to mercury can transmit the toxins to their fetuses, which can impair the development of their nervous systems.[78] **Overall, mercury is estimated to alter the health conditions of over 1.5 million individuals across the basin**. A study conducted in the Madre de Dios region of Peru, a centre of ASGM activity, found dangerous

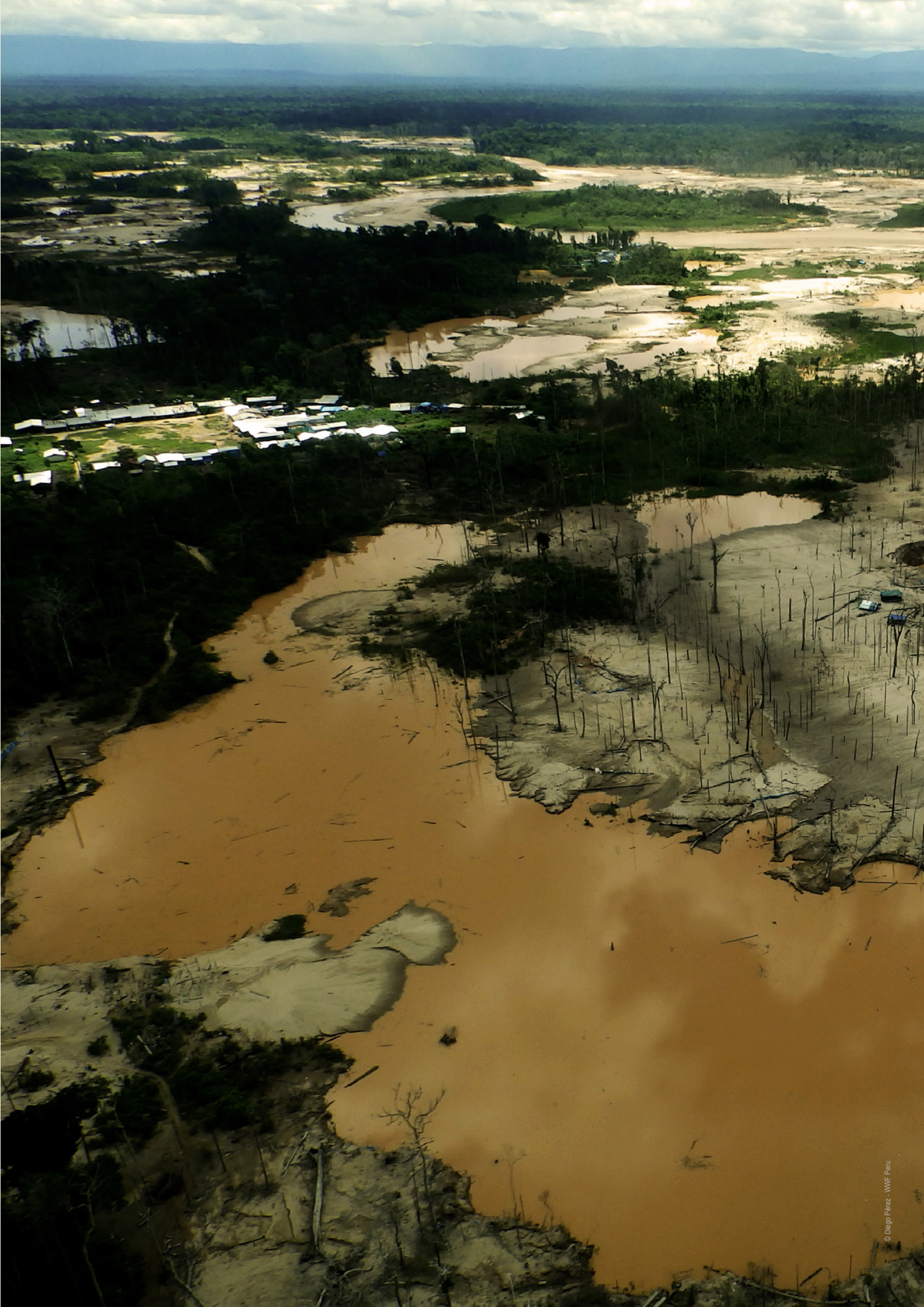
The broad diffusion of mercury throughout the region also threatens vulnerable populations outside of mining communities.

levels of mercury in the hair of 40 per cent of all people tested, including those far from any mine.[79] Another study, by the World Health Organization, **estimated that as many as 62.4 per cent of infants in fishing communities of the Brazilian gold mining region would experience a loss of at least two IQ points due to mental retardation caused by mercury exposure.**[80]

The consequences of human exposure to mercury can have significant negative impacts on people's health and their ability to work. **Mercury poisoning can cause reduced neurological and motor function, vision and hearing loss, and can even contribute to premature death.** Environmental mercury contamination can also harm the health of crops, fish, and other sources of non-mining livelihoods. Taken together, these consequences can severely harm the well-being of families and communities through reduced income and resources. Likewise, on a larger scale, national economic output may suffer, harming the country's long-term economic health. Further, the need for healthcare among those affected by mercury poisoning, especially among those unable to afford such services, creates a logistical and financial strain upon national health systems. The impacts of mercury exposure threaten economic productivity, outputs, and peoples' livelihoods both within and beyond the mining industry.

LOOK TO THE FUTURE

Without urgent action, mercury-intensive artisanal and small-scale mining activities will continue to pollute the Amazon's freshwater system, and threaten the future prosperity of the region. High gold prices and the lack of viable economic alternatives will continue to draw local communities to ASGM activities. The ongoing use of mercury will lead to the accumulation of increasingly toxic concentrations in the environment, particularly in water bodies and marine animals. These threats to the Amazon's water resources pose severe risks to the sustainability of the entire region, and the important environmental, social, and economic values that it provides.



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Chapter 3

PAST EFFORTS & LESSONS LEARNED

INCENTIVES FOR ACTION

In addition to the clear environmental case for protecting the region's unique biodiversity and ecosystem services, each industry stakeholder group has distinct economic and social motivations to address mercury pollution in the Amazon.

Stakeholders across the gold value chain have powerful incentives to act against the use of mercury in artisanal and small-scale mining activities.

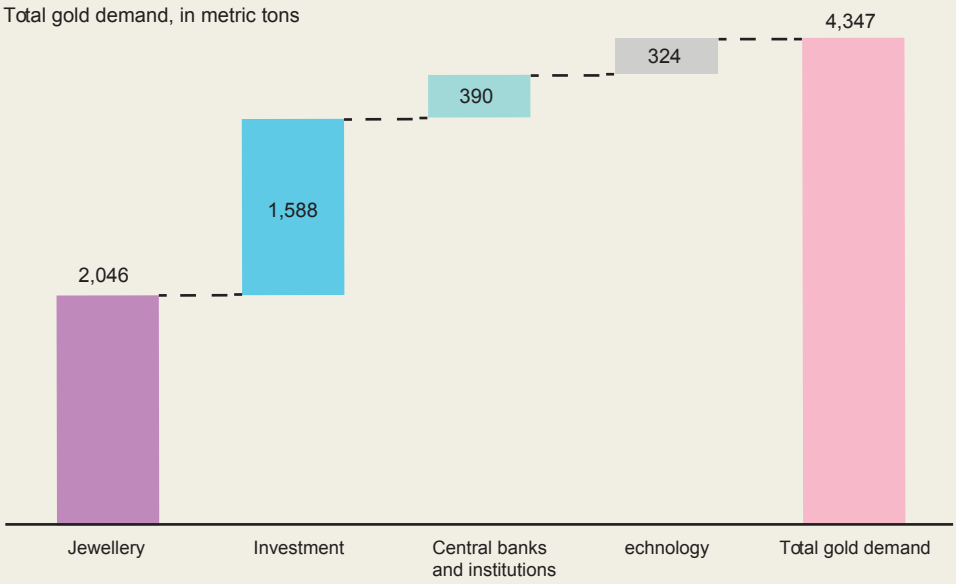
Miners and their communities arguably have the highest incentive for change, due to the severe health consequences of extended exposure to mercury, can see sharply reduced lifetime earnings. The disabilities caused by mercury poisoning can reduce their working productivity, resulting in lessened outputs and lower wages. Based on the estimated prevalence of mercury poisoning in the region, its impact on mortality and productivity during life, and the approximate daily earnings of miners and non-miners in the region, **Dalberg estimates that Amazon countries lose more than US$4 billion in human productivity each year due to reduced productivity and loss of life as a result of mercury poisoning.**[81] This means fewer funds for food and shelter, which harms the well-being of entire families. In addition, affected individuals may require expensive medical care, further reducing the resources available for essential goods. Though these remote populations historically have not had information made available to them on the links between mercury use and these harms, organizations have begun educating rural communities and encouraging them to act.

Nearly half of all gold demand is driven by the jewellery sector, making companies vulnerable to consumer pressure for responsible sourcing initiatives.

Meanwhile, private sector gold buyers, and especially jewellery manufacturers, are incentivized by the early development of a global market for responsibly-sourced gold, including an emerging consumer interest in mercury-free supply chains. As nearly half of all gold is utilized by the jewellery industry, this represents a powerful market incentive for mercury-free production *(see Figure 4)*. In response, high-end jewellery retailers such as Cartier and Chopard have launched limited product lines using only responsible-sourced materials. Meanwhile, national and international regulations are also being developed to oversee the procurement practices of international gold buyers. For example, the European Union (EU) adopted a regulation on "conflict minerals," which will enter into force in 2021. It will ensure that EU importers of gold – among other minerals – meet international standards for responsible sourcing, and do not contribute to the "exploitation and abuse of local communities, including mine workers."[82] While this regulation does not address mercury use specifically, it is a powerful first step in protecting the health and well-being of marginalized laborers. These regulations will raise the cost of conducting business for irresponsibly-mined gold, and should encourage gold buyers to support responsible, mercury-free initiatives.

Figure 4.-

Distribution of gold demand by buyer type, 2016



*Note: *Includes investments in bars, coins, and exchange-traded funds.*
Source: Wolrd Gold Council

Governments, external to the value chain itself, have numerous additional incentives to address the use of mercury in artisanal and small-scale mining.

Many countries are under increasing international political pressure to act, driven by rising concerns regarding population health, economic productivity, and sustainability. Mercury poisoning is a serious public health concern in some parts of the region, and requires urgent government attention. The dire need for care among populations who often cannot afford it puts significant strain on national health systems. Further, the lost productivity in the workplace by those suffering from mercury poisoning is a threat to the health of Amazon economies. Taking action to preserve the health of millions of local laborers serves to strengthen the labour market and fuel continued growth.

PREVIOUS INITIATIVES - GOVERNMENTS

The international community has demonstrated a commitment to combating mercury use through its ratification and support of the Minamata Convention. This global treaty aims to "protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds."[83] It calls on parties to: ban new mercury mines and phase out existing ones; phase out the use of mercury in a range of products and processes; control mercury emissions into the environment; and regulate the informal ASGM sector.[84] When ASGM activities are "more than insignificant," the convention calls on parties to develop and implement national action plans for sustainably developing local ASGM practices.[85] The implementation of the Minamata Convention is supported by international technical and financial assistance mechanisms such as the Global Environment Fund.

Almost all Amazon basin countries have signed the Minamata Convention, Suriname being the last to ratify in March 2018, and Colombia being in the process of signing. However, so far only Peru and Guyana have taken steps toward the development of national action plans, which are due to be completed by 2020. Therefore, there is still a need for many countries to enact and enforce national anti-mercury policies, and to leverage legislative tools in the fight against mercury in ASGM activities. See Figure 2 for an overview of the status of Amazon countries in implementing the requirements of the Minamata Convention.

Some basin countries have taken additional legal steps to protect against mercury use. **Some countries have undertaken independent efforts to regulate the use of mercury in ASGM operations in order to push for compliance with local environmental standards.** For example, both Colombia and Peru have passed laws to incentivize ASGM formalization, in order to provide illegal miners with pathways to legal work, and to reduce mercury use.

Figure 5.-

Status of Amazon countries in adoption and implementation of the Minamata Convention.

THE ACTIONS OF THE GUYANESE GOVERNMENT

TO SUCCESSFULLY IMPLEMENT THE TERMS OF THE MINAMATA CONVENTION

The mining sector has been the main source of economic growth in Guyana for the last two decades. In 2015, gold accounted for 42.8 per cent of exports, totalling US$501 million. Artisanal and small-scale mining dominate the industry, which is fully dependent on rudimentary mining practices using mercury for gold separation. In fact, despite its small size, **Guyana was 8th in the world for mercury imports in 2015, and between 2008 and 2013, annual mercury use tripled to 35.82 tons**.[F]

The growth of this sector and the high use of mercury have had profound environmental and social impacts. An estimated 45,000 hectares of forest were cleared for gold mining activities between 1990 and 2009. Furthermore, the Guiana Shield is an important global site of freshwater production, and water catchment zones have been significantly impacted. A total of 5,840 kilometres of rivers and creeks have been destroyed, with an additional 28,771 kilometres of downstream waterways potentially being contaminated with turbidity and mercury.[G] These disruptions in the water supply and increased turbidity are major concerns for the health and livelihoods of indigenous peoples.

The Government of Guyana signed the Minamata Convention in October 2013 and ratified it in September 2014, being one of the first countries in the region to sign the legally-binding agreement.

Since then, the government has taken several steps to implement the convention. It convened a national working group to guide the development of a National Action Plan, with the aim of eventually banning all mercury use by 2020. More broadly, the ratification of the convention signalled strong government commitment on the issue of mercury-use in ASGM, acknowledging the significant threat of this practice on the environment and local peoples. The ratification has led to increased governmental dialogue with local and international organizations, miners, and communities, promoting a coordinated approach towards mercury-free mining.

F *- The Observatory of Economic Complexity. (2015). https://atlas.media.mit.edu/en.*

G *- Pasha, S., Wenner, M. D., & Clarke, D. (2017). Toward the greening of the gold mining sector of Guyana: Transition issues and challenges. Inter-American Development Bank, Country Department Caribbean Group.*

To stimulate the development of mercury-free mining practices, the government set up the Mercury Free Mining Development Fund. The fund intends to support the adoption of mercury-free mining equipment by gathering evidence that these technologies improve gold recovery rates and provide miners with access to financial support for transitioning to mercury-free practices. However, the fund has faced some difficult challenges, as formal standards on mercury-free technologies are still being developed, and mercury-free mining remains costly and unpopular. Additional efforts will be required to make mercury-free mining economically viable and socially realistic.

Civil society organizations have also been active in supporting Guyana's implementation of the Minamata Convention, from both a policy and bottom-up approach. For example, the "Minamata Initial Assessment for Guyana," led by UNDP and GEP, aims to foster an enabling decision-making environment for the implementation of the Convention. UNDP is also developing the National Mercury Profile and Mercury Initial Assessment Report, highlighting the need for increased environmental monitoring in the region, as tracking the flow of mercury is particularly challenging. Furthermore, WWF has supported the Guyana Geology and Mines Commission on awareness raising, education, training, and field demonstration for stakeholders within the gold mining sector. The Commission seeks to address the insufficient awareness within mining communities about the negative impact of certain mining practices, and to encourage bottom-up behaviour change.

Being so deeply embedded in the local economy, transforming the mining industry to comply with the terms of the Minamata Convention will be a complex process. It will require coordinated action at the local and national levels, and the right tools and incentives for the mining population.

Guyana's progress illustrates a promising start on this journey, and lays out a framework for other countries in the region.

GOVERNMENT ANTI-MERCURY ACTION IN PERU

BEYOND THE TERMS OF THE MINAMATA CONVENTION

Over the last decade the spread of artisanal and small-scale mining (ASGM) and illegal mining in Peru has accelerated significantly, particularly in the gold-rich region of Madre de Dios, home to the lowland Amazonian forest. The region experienced its first gold rush in the 1980s, and **since 2008 Madre de Dios has exported 70 per cent of Peru's artisanal gold production to international markets**. Mining in the region is primarily carried out by heavy machinery and suction pumps, which have modified the natural landscape through deforestation, soil excavation, and the use of liquid mercury. Further, common mining practices in the region are highly polluting and make inefficient use of mercury. As a result, they release as much as **185 metric tons of mercury into the environment each year**.
A 2011 Peruvian National Water Authority study of Madre de Dios' rivers identified mercury concentrations 170 times higher than limits tolerated for domestic water, and approximately 3,500 times higher than limits tolerated for the conservation of aquatic ecosystems.

As a result, The Peruvian government began taking steps to address the problem. In 2002 it passed legislation promoting the formalization of undocumented miners. This aimed to bring the miners under national regulatory systems, and thereby allow the government to enforce existing environmental policy. This work continued in 2008 through the Ministry of Health, with the development of the country's "Health strategy for surveillance and control of contamination risks with heavy metals and other chemical substances," which included mercury contamination. Then, in 2012 Peru passed a legislative decree promoting the use of gravity-based purification methods instead of mercury in mineral activities, and further support for formalization of ASGM miners. The government also later announced the creation of a multisector commission to develop a strategy to sanitize the ASGM sector.[H] Finally, in 2014 the Peruvian Superintendence of Customs and Tax Administration (SUNAT) established a national registry of mercury use, seeking to track the movements and use of mercury in the country.

This legislative agenda shows an ongoing commitment by the Peruvian government to act against mercury pollution and protect the well-being of its citizens and the environment.

It remains too early to assess the full impact of these initiatives on the rate of mercury use in local ASGM, but the government remains optimistic that they will contribute to curbing the threat of continued pollution.

However, there remains room to do more. Although Peru has shown strong leadership in passing anti-mercury laws and supporting the formalization of ASGM activity, the government lacks the resources and capacity to fully implement and enforce these initiatives. Further, **future government action should seek to address not only the symptoms, but also the underlying drivers of continued ASGM involvement.** Specifically, it should support mining communities in exploring other, more sustainable employment opportunities, and provide the financial and technical resources necessary to enable such a transformation.

***H** - Pasha, S., Wenner, M. D., & Clarke, D. (2017). Toward the greening of the gold mining sector of Guyana: Transition issues and challenges. Inter-American Development Bank, Country Department Caribbean Group*

PREVIOUS INITIATIVES OTHER STAKEHOLDERS

Some mining communities have taken local actions against mercury use. These actions include community-led efforts to organize into cooperatives or joint-stock companies, as well as partnerships between ASGM miners and larger-scale companies. Such initiatives allow small-scale miners to adopt mercury-free techniques, to purchase modern equipment, and to sell their products to high-end retailers seeking responsibly-mined gold. For example, a group of about 480 artisanal gold miners in Peru established MACDESA, a private company producing 360 kilograms of gold annually. MACDESA obtained the Fairmined certification for its gold, in large part due to its use of mercury-free techniques.[86, 87, 88] In Colombia, artisanal gold miners in La Llanada formed the COODMILLA cooperative. As a testament to the cooperative's commitment to more responsible production, its Fairmined-certified gold was used to manufacture the 2016 Nobel Peace Prize medal.[89]

Private sector actors have also chosen to source gold responsibly, and to support miners in their effortsto adopt mercury-freemining practices.

More than 350 jewellery manufacturers and retailers are certified members of the Responsible Jewellery Council and comply with its code of practices. The code calls for members to "regularly assess risks of uncontrolled mercury use" by ASGM providers, and for member mining companies to "take steps to control, reduce, and where feasible eliminate, the use of mercury in mining and processing."[90] In addition to compliance with industry standards, some international brands have also put in place initiatives dedicated to the promotion of environmentally-sustainable ASGM.[91] For example, Cartier procures the entire production of a responsible gold mine in Honduras. Similarly, Chopard has partnered with the Colombian COODMILLA cooperative to provide technical support and has committed to purchasing a significant share of its production.[92]

REMAINING BARRIERS

Despite the efforts to date, stakeholders face significant continuing barriers in the fight against mercury in ASGM.

*E*ach stakeholder in the gold value chain faces unique challenges to removing mercury from ASGM operations. **National governments have been slow to take on-the-ground action to address the situation, due in large part to the significant financial and technical resources required to implement supportive programs.** Further, criminal activity surrounding many informal mining operations results in security risks that also inhibit government action. Meanwhile, the lack of government oversight on the informal mining sector impedes legal regulation and management. As a result, miners themselves have few incentives for behaviour change, preferring to continue traditional, inexpensive practices

despite their environmental and health costs. Further, those wishing to transition to cleaner practices often lack adequate technical expertise or financial resources to do so. Finally, despite the early growth of consumer preference for responsibly-sourced jewellery, private sector buyers do not yet experience adequate market pressure to trigger a large-scale change of procurement standards. This means that retailers continue to procure low-cost gold, often without knowing its origins.

The slow progress of Amazon governments in ratifying the Minamata Convention and developing national action plans demonstrates a lack of significant investment to date in moving beyond political promises. Meanwhile, when governments have taken action, national anti-mercury programs have frequently failed due to inadequate human, technical, and financial resources allocated to these programs. They have at times been limited in scope and scale, failing to create meaningful change in the mining industry. In addition, some government-led initiatives in the region have suffered from conflicting visions of the appropriate methods for addressing the harms of small-scale mining. A focused, concerted effort on either addressing the drivers of ASGM activity, formalizing ongoing operations, or transitioning miners into alternative livelihoods would better enable system change. Finally, government-sponsored programs have tended to focus on the technical aspects of implementing mercury-free mining practices – including updated processes and equipment – without addressing the systemic socio-economic conditions prevalent in ASGM communities that drive miners into harmful operations.[93, 94, 95] As a result, **miners often find the programs to be complex, bureaucratic, and unclear.**

Few Amazon countries so far have taken sufficient action on the ground, and many of the anti-mercury initiatives launched to date have suffered from poor policy design and implementation.

ASGM miners often lack the knowledge and financial capacity to manage formal labour organizations, to upgrade their operational practices, or to acquire new machinery.[96, 97] In Suriname, for example, a study revealed that miners' choices of mining techniques were driven by habits, perceived quantity of gold, and practicality.[98] These factors can prevent adoption of environmentally-friendly practices. Miners may also lack information on the economic benefits of clean mining techniques, which can be achieved by selling responsibly-mined products at a higher price. Overcoming these barriers requires external technical and financial support mechanisms provided by public, private, and non-profit actors.

Meanwhile, miners face difficulty overcoming the barriers to mercury-free mining without external support.

Current efforts to comply with environmental standards for gold sourcing are predominantly driven by large, international brands targeting niche market segments *(e.g. Chopard, Cartier, Tiffany).* However, these initiatives are often limited to small-scale corporate social responsibility efforts. Meanwhile, a WWF survey of the French jewellery sector showed that about 80 per cent of stakeholders, including refiners, producers, and retailers, had no knowledge of the origin of the gold used in their activities.[99] Broader progress in responsible gold procurement has been slow due to a lack of consumer demand, as consumers have been reluctant to pay a premium for responsibly-sourced products. This is compounded by the fact that most gold demand comes from emerging markets, where sustainable procurement standards are often even less valued.

Private sector programs to support mercury-free gold mining have been limited in number and scale and have failed to enact systemic change.

THE PROCESS OF LOCAL MINING ECOSYSTEM RESTORATION

Over the last decade, the spread of artisanal and small-scale mining (ASGM) and illegal mining has increased exponentially in Peru, in particular in the gold-rich region of Madre de Dios, home to the lowland Amazonian forest. **Since 2008, Madre de Dios has exported 70 per cent of Peru's artisanal gold production to international markets.** Mining in the region is primarily carried out by heavy machinery and suction pumps, which have modified the original natural landscape through deforestation, soil excavation, and the use of liquid mercury.

A global diversity hotspot, Madre de Dios has experienced mining-related forest losses of 4,437 hectares per year on average.[I] Associated to the loss of forest, studies have shown declining populations of songbirds and mammals in the region. The removal of the soil has led to a loss of the ground's physical-chemical properties, limiting the future prospect of natural regeneration. Finally, there are serious health concerns over the fact that **30 to 40 metric tons of mercury are dumped into the regional environment annually, and that 78 per cent of the population of the capital of Madre de Dios has been exposed to mercury contamination.**[J]

In response to deforestation and the associated social and economic impacts, the Peruvian state started a process of formalisation of mining activities, seeking to regulate the sector, and to remove illegal miners and destroy their equipment. In order to practice legally, miners were required to fulfil a series of commitments to mitigate the environmental impacts of their activities. In 2012, the government also enacted a series of legal degrees to regulate the illegal importation and trading of gold-mining supplies such as mercury and fuel. The aim was to ensure the economic continuity of legal mining activities, while engaging mining groups in environmental protection and restoration.

As part of this initiative, the government carried out a regional analysis to identify priority areas for forest restoration, using of drones to select the areas with the best conditions for reforestation. Experimental land plots were treated with biocarbon enriched with either organic products or NPK fertilizer, hydrogels and micro-nutrients. The government also supported the production of innovative, high quality seeds in local tech-farms to be planted on the identified plots. Finally, the government led an evaluation of the diversity of fauna in degraded areas as a baseline record, to assess whether re-forestation led to a return in biodiversity.

The drone-based identification of priority areas for restoration was an effective process in determining the scale of the problem and catalysing restoration and could be scaled to develop a full Amazonian regional map.

However, challenges in the formalisation process have become a barrier to scaling the reforestation efforts. The process is generating distrust and resistance from miners toward the government, and reforestation activities have received low participation. In fact, after a temporary inflection in the annual growth of mining-related forest loss in 2012, 2013 and 2014 saw a near doubling in the deforestation rate, and a growing number of illegal operations. Increased efforts to regulate the ASGM sector will be necessary support the long-term impact of restoration efforts.

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Chapter 4

THE PATH FORWARD

*M*ercury poses a critical threat to the health and longevity of the Amazon region. And yet, the action taken to date has been insufficient to address the problem, and challenges to successful interventions remain. **Stakeholders across the industry, with strong leadership from Amazon country governments as signatories to the Minamata Convention, need to act now to protect the well-being of this unique ecological treasure and the residents who rely on it.**

Preventing the contamination of the Amazon's freshwater resources from mercury-intensive ASGM requires a system-wide approach. New laws alone will be insufficient to drive a permanent shift away from mercury use in ASGM activities; governments must also enforce new regulations. Further, they must provide effective, long-term support to mining communities as they implement mercury-free practices and, where possible, support and incentivize a transition into alternative, more environmentally sustainable livelihoods. Meanwhile, **private sector stakeholders and miners themselves must also play an active role in removing mercury from the mining process.**

Gold industry stakeholders must take urgent steps against mercury pollution to safeguard the long-term value of the Amazon.

Consumers should express their preference for mercury-free gold. A firm change in consumer preference away from gold produced using mercury would create an incentive in the market for the supply of responsibly-mined gold. This would in turn reduce the profitability of using mercury-based techniques in ASGM, relieving some of the pressure these practices exert over the Amazon biome and basin.

Civil society and non-governmental organizations should raise awareness of the impacts of mercury pollution in the Amazon and support all other stakeholder's efforts to eliminate mercury use in the region. These organizations can help drive significant change by informing decision makers and the general public about the seriousness of the threat and shedding light within and outside the region on the current impacts mercury use in ASGM is having in Amazon environments and peoples. Civil society and NGOs need to be an ally for those in government and in the field that are working towards the design and implementation of policies towards the eradication of the use of mercury in the Amazon.

Sustainable change will require coordinated action by all industry stakeholders.

GOVERNMENT ACTION

Mercury-exporting countries should ratify the Minamata convention and begin a process of industrial transformation away from mercury export for ASGM.

Amazon governments should take a leading role against mercury pollution by enacting and enforcing anti-mercury legislation, including implementing and adhering to the Minamata Convention. Government policymaking and enforcement are key tools in the fight against mercury pollution. To begin, all governments should ratify the Minamata Convention, and develop ambitious, achievable national action plans that guide the way to eliminating mercury from local industrial activities. Then, **governments should enact and enforce the programs and regulations set out in these action plans, working with stakeholders across the industry to promote lasting change.** Critically, this will require collaboration with mining communities themselves. Given the informal and often illegal nature of ASGM in the region, as well as communities' dependence upon the mining sector for their livelihoods, governments will need to involve community members in the policymaking process and incentivize them to comply with new regulations. Transparency and accountability throughout the process will allow stakeholders to monitor governments' progress, and to develop an understanding of best practices to inform future engagement in this area. Through effective policymaking, incentives, and enforcement, Amazon governments can protect the well-being of communities and preserve the long-term value of the environment.

The mining and direct or indirect export of mercury towards the Amazon countries fuels the trade of the mineral within the region and its use in **illicit or unsafe** ASGM activities. Exporting countries therefore have a role to play in adjusting their policies so that they do not contribute to the use of mercury in the region by abiding to stricter practices and implementing the Minamata convention provisions.

Government policies should include specific regulations that protect natural resources from continued contamination by mining activities. Beyond working to remove mercury from ASGM activities, governments should go further to protect their countries' natural resources from permanent damage. In particular, they should take steps to:

Establish "no-go" zones and protected areas:

Governments should identify areas of critical environmental and social value and prioritize their protection from destructive activities. New laws should ban mining and other harmful industries from these "no-go" areas, with strict penalties for any violation. An integrated ecological perspective should be used for the designation of no-go zones, considering that mercury use can affect pristine areas even if these are not situated close to where mining activities happen.

Strengthen national mechanisms to support miners in adopting clean practices:

A lack of financial and technical assistance is a key barrier to miners' adoption of mercury-free practices. Governments should provide substantial, long-term support to ensure that miners can implement the tools and techniques they need to mine without mercury.

Remain accountable for implementing and enforcing national and international policy:

As stewards of the land and people they serve, Amazon governments must be held accountable for their role in protecting the region's resources and values. This requires transparency in their actions and monitoring of their impacts. It also requires a readiness to adapt to shifting circumstances and needs to ensure successful and lasting change.

A comprehensive, long-term approach to combatting ASGM-driven mercury pollution should also seek to reduce the overall scale of artisanal mining in the region. First, governments could incentivize miners to transition into alternative, sustainable local livelihoods. This would require significant financial incentives to encourage the shift away from mining activities, coupled with meaningful technical and social assistance programs. Over time, these efforts could support rural community members who to choose work in environmentally-friendly sectors. Further, governments should consider the root causes of the community vulnerability that drive people into mining. Broad-based educational programs, social outreach and assistance, and technical support can aid in providing local residents with access to enhanced employment opportunities.

OTHER STAKEHOLDER ACTION

There exist significant financial incentives for miners to adopt mercury-free practices, such as access to higher-end markets and greater revenues, which should encourage their collaboration with government programs. Therefore, **if adequately informed and supported through the process, miners should be expected to be fully engaged in adopting mercury-free mining practices.** However, doing so will require significant technical assistance to understand these market incentives, and financial support to implement the necessary changes. Likewise, **private sector gold buyers, such as jewellery retailers and financial buyers, should play an active role in eliminating mercury from ASGM activities.** They should establish visibility across their supply chains and ensure that the gold they procure is mined using sustainable practices. Industry certification programs, such as Fairmined, can support this process by monitoring the gold production process of participating mines and guaranteeing a high standard of practice. The growth of consumer demand for responsible gold should drive this shift, as retailers adapt to capture this new market. Finally, **civil society organizations**, already active across the industry, can spur these changes in several ways. They **can work with local governments on policy development and capacity building, serve to educate and support mining communities, and sensitize the public to increase demand for responsibly-sourced products.** These efforts can enable and accelerate the actions of other stakeholders, driving system-wide change for sustainable impact. Meanwhile, mining communities themselves should be active participants in adapting to new government policies and regulations, and private sector gold buyers should prioritize the development of mercury-free supply chains.

Looking to the future, governments should also address the underlying drivers of harmful ASGM practices and support the transition to alternative livelihoods.

WRAP-UP

Through strategic planning and coordinated efforts to reduce the use of mercury in gold production, gold industry stakeholders can preserve the Amazon's unique value for generations to come. The combined and collaborative efforts of government policymakers, private sector stakeholders, and mining communities offer a promising path to safeguarding the Amazon's resources and its inhabitants. Together, they can ensure that the region's freshwater resources remain a source of life and prosperity for all.

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