The Effects of Mining Practices in Ecuador

BY: Nicholas Toth (Environmental Science)

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Instructor: Dr. Tait Chirenje

Abstract

For years Ecuador has extracted natural resources, like oil, within its borders as a means to generate economic growth and development. In recent years the private mining sector has seen an increase in mining operations throughout Ecuador's countryside. Like oil extraction, mining practices can have opposing effects to the surrounding area. Mining operations do provide economic benefits for Ecuador. Mining operations also have detrimental impacts to the environment and human health. Countries like Ecuador that use mining for economic growth are prone to effects of the resource curse. Experts question whether or not the positives of mining actually outweigh the negatives.

Keywords: Natural Resources, oil, mining, economic growth, economic development, environment, human health, resource curse

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The Effects of Mining Practices in Ecuador

Natural Resource Extraction in Ecuador

Natural resources can be both a blessing and a curse to a developing nation as their extraction can lead to a variety of different outcomes. On the one hand, natural resources have the potential to lead to economic growth and development. On the other hand, natural resources can have detrimental impacts to the surrounding environment and human health (Costa & Santos, 2013). In some cases, countries, such as Ecuador, experience a combination of these two potential outcomes when resources are extracted (Lewis, 2016).

Ecuador is a developing nation in South America located along the equator and has been described by the World Bank as "an upper middle-income country with a diverse geography." It has only been in recent years that Ecuador moved into this threshold (World Bank, 2018). One reason Ecuador was able to move into this new threshold came from the utilization of natural resources (World Bank, 2018). Oil became the primary resource that was utilized by Ecuador; overtime oil extraction became a significant part of Ecuador's economy (World Bank, 2018). According to Lewis (2016), oil has been Ecuador's leading export since the 1970s. In 2012 it was estimated that 503,600 barrels of oil were being extracted daily, which generated "12,711,229 thousand of dollars in exports" (Lewis, 2016).

At current rates of consumption, OPEC estimates there to be 8.3 billion barrels of crude oil remaining in Ecuador. If this number holds true, it is expected that the 8.3 billion barrels will last for another 35 years (World Bank, 2018). However, there is some controversy with this estimation as not everyone agrees with OPEC on how much oil is left in Ecuador. Tammy Lewis, a researcher who opposes OPEC’s estimation, addresses the fact that a majority of the remaining untapped oil deposits in Ecuador would not be easily accessible as it is located on federally protected lands (Lewis, 2016).

With the uncertainty that Ecuador faces with the future of oil extraction options to capitalize on other natural resources have begun to be explored. This has become more evident as in recent years, as Ecuador’s President has greenlit massive mining operations (Llangari, 2019). As a direct effect of this strategy, Ecuador has seen an increase in mining practices throughout the entire country (World Bank, 2018). Mining operations have the greatest chance for development and growth in the southern part of Ecuador, as untapped areas for mining reside primarily in the “Zamora Chinchipe, Morona Santiago, Azuay, and El Oro provinces” (Zumarraga & Fernado, 2019).

Current mining operations taking place in Ecuador have primarily focused on mining elements such as gold, copper, and silver (World Bank, 2018). While there is other mining taking place, these elements have the greatest potential for economic gain (Zumarraga & Fernado, 2019). At this time, the mining sector is still small, only accounting for “less than one percent of GDP” (World Bank, 2018). However, while the mining sector is generating less than one percent of GPD, it is important to note that the private sector has seen a steady increase in profit over the past couple of decades. While the extraction and exportation of crude oil continue to generate the most profit for Ecuador, mining operations have the potential to contribute to economic growth and development (World Bank, 2018).

Gold Mining in Ecuador

Gold, or Au, is the 79th element on the periodic table elements (Schutzmeier et al., 2016). Gold has always held value as gold has desirable physical characteristics and chemical properties. Due to its physical attraction and resistance to corrosion, gold has been used by both indigenous tribes and modern society as jewelry and currency (Europa Publications, 2002). Gold has favorable chemical properties. It is conductive, malleable, and ductile, which makes gold suitable for a wide range of industrial applications (Europa Publications, 2002).

Gold can be found in a variety of host rock (Phillips & Powell, 2010), but is commonly found in Quartz (Europa Publications, 2002). Gold deposition is thought to occur below the Earth's surface due to a mixture of chemical processes (Phillips & Powell, 2010), and Forms in "alluvial deposits and rich, thin underground veins" (Europa Publications, 2002). In the case of countries like Ecuador and Brazil, gold introduction to the environment is thought to be epigenetic, forming near the surface of the Earth, as geochemical evidence supports this theory (Phillips & Powell, 2010).

There are several places in Ecuador where large mining operations are currently taking place. While private foreign companies do not own all of the mining operations in Ecuador, the majority of the operations are owned and run by foreign interests. Two of the publicly owned operations are located in the neighboring towns of Portovelo and Zamora. These two towns are located in the southern part of Ecuador and are also in close proximity to the city of Cuenca, which is located 103km to the north of the two towns (Schutzmeier et al., 2016). The gold mining within these two towns currently only consists of small-scale mining operations, which are known as artisanal and small-scale gold mining, or (ASGM), (Schutzmeier et al., 2016). Schutzmeier et al. further discuss within their paper how the practices in these towns of Ecuador are similar to those that take place in other Amazonian countries such as Brazil and Peru. These practices are considered to be rudimentary, low-tech, and often manual methods (Massaro & de Theije, 2018).

There are two types of ASGM practices taking place at Portovelo and Zamora for gold extraction. The first is open-pit mining and the other is involves underground mining (Schutzmeier et al., 2016). Open-pit mining is “a method of mining in which the surface excavation is open for the duration of mining activity, employed to remove ores and minerals near the surface by first removing the waste or overburden and then breaking and loading the ore” (Cleveland & Morris, 2015). Underground mining is a method of mining that includes tunneling into the Earth to gain access to ore that is relatively far below ground. The extraction process involves the use of underground equipment to retrieve and bring the ore to the surface (Schutzmeier et al., 2016). After mining the ore, the miners must break the ore down into a fine powder. This process is usually done mechanically (Schutzmeier et al., 2016). Liquid mercury is an essential chemical used in the next part of the extraction process (Schutzmeier et al., 2016). The powder produced from refining the ore is mixed with liquid mercury. The gold particles will stick to the mercury and the other components in the powder will not; this process is known as amalgamation (Schutzmeier et al., 2016). The mercury-gold mixture is then smelted with a blow torch, which evaporates the mercury but leaves behind the gold nugget (Schutzmeier et al., 2016).

The private sector of gold mining has also started to increase over the past couple of years, expanding mining operations into new places across Ecuador, including in the Amazon Rainforest with the Fruta del Norte gold mine (Marques, 2019). This operation is owned by the Canadian company Lundin Gold and is located in close proximity to the city of Guayaquil

(Marques, 2019). The extraction of gold in this operation is similar to the mining practices previously discussed in gold mining operations.

Copper and Silver Mining in Ecuador

Copper, Cu, is the 29th element on the period table of elements. Copper has been used by itself and in alloys in the manufacturing of tools, receptacles, and in industry since ancient times (Europa Publications, 2002). Chemical properties that make copper appealing to be used in these ways are the fact that it is ductile, resistant to corrosion, and is considered to be an excellent conductor of heat and electricity (Europa Publications, 2002).

Silver, Ag, is a white metal, and it the 47th element on the periodic table of elements. Silver, like gold, has always held intrinsic value. Silver is used in a variety of products ranging from industrial products, the production of photographic materials, jewelry, silverware, and the manufacturing of electronic equipment and batteries (Europa Publications, 2002). Desirable chemical properties include being a conductor of both heat and electricity, as well as being malleable and ductile (Europa Publications, 2002).

Like gold, a majority of the copper and silver mining operations in Ecuador are managed by private foreign companies. Recently the Ecuadorian government greenlit the Mirador Mining project, which is located on the border of Ecuador and Peru. This project is being run by the company Ecuacorriente, which is a subgroup of the Chinese conglomerate CRCC-Tongguan (Llangari, 2019). President Lenin Moreno greenlit this project as a means of helping Ecuador shift the economy away from its dependence on oil (Llangari, 2019). The site’s primary focus is as a copper mining operation, but silver and gold mining operations are happening here too

(Marques, 2019). The Mirador project is planned to continue to be operational for the next 30 years (Llangari, 2019).

Further operations that have started mining include the Cascabel project, which also includes mining for copper, gold, and silver. This operation is owned by the Australian company Solgold. Another operation ongoing is the Llurimagua copper mine. This operation is led by two companies Ecuador's Enami and Chile's Codelco (Llangari, 2019). While these operations are not nearly as significant in size as the Mirador Project, they can still have an impact on the economy as well as the surrounding environment.

In many instances, copper ore, whether it is copper sulfide or copper oxide, is obtained by mining both underground and by open-pit or surface mining (Europa Publications, 2002). In the case of the Mirador operation, copper ore is being extracted like gold ore, through the practice of open-pit mining (Llangari, 2019). After being extracted, the copper ore is broken up by the explosion and then crushed before being mixed with a solution, made from reagents and water in the case of sulfide ores, and is then dried and smelted (Llangari, 2019). In the case of oxide ores, after the ore is crushed, it is mixed with material and dissolved in acid. This mixture is then mixed with a special organic-containing chemical reagent, which will selectively extract the copper, thus allowing the solution to separate into two distinct layers, which allows for easy extraction and disposal of the layers accordingly (Llangari, 2019).

Extraction methods used to separate silver from other alien elements are rather different from those taken for gold and copper. While gold and copper refinery practices consist of one or two distinct methods, silver practices rely on the abundance of silver composition that makes up the ore in question (Europa Publications, 2002). In the year 2000, about 75% of silver production was generated as a byproduct of other metal mining operations such as gold, copper, lead, and Zinc (Europa Publications, 2002).

Economic Impact of Mining in Ecuador

Like the practice of extracting oil, mining has proven to be profitable as the private sector generated $717 million dollars in 2017 (World Bank, 2018). The profit generated by the private sector in 2017 represented an increase of 55.9 percent compared to 2016 (World Bank, 2018). This increase seen from 206 to 2017 is not unexpected as "growth has increased from an average of 4.1 percent between 2001 and 2006 to 11.5 percent between 2007 and 2014" (World Bank, 2018). New construction projects also take place during new mining operations. These construction projects build infrastructure that is needed to support the mining operation and remain intact for communities to use after the mining operation is completed. Infrastructure built can range from transportation systems like roads and ports or to developing ways to bring clean water into new areas (World Bank, 2018).

In the private sector, there are a couple of different operations currently taking place. The first of these projects is the Fruta del Notre project. This project is expecting to mine roughly 310,000 ounces of gold each year from reserves that are estimated to be 5.02 million ounces of gold (Marques, 2019). The Ecuadorian government owns 51% of the equity in the profits made (Marques, 2019). The Mirador project is taking place on a reserve estimated to have "3.2 million tonnes of copper reserves, along with 3.4 million ounces of gold and 27.1 million ounces of silver" (Llangari, 2019).

Currently, experts claim that Ecuador has not reached its full potential of mining practices that can take place within its borders (World Bank, 2018). The World Bank (2018), has documented that while the current mining sector in Ecuador is small, there has been an increase in mining operations over the past decade. "During the years of 2016 and 2017, the Ecuadorian Ministry of Mining increased exploratory mining concessions across the country from roughly 3% to around 13% of the country's continental land area (Vandegrift et al., 2017)" (Roy et al., 2018). The majority of new growth and profit that is generated by mining operations tend to originate primarily from the private sector (World Bank, 2018). Small scale mining operations do not have the same impacts as more extensive operations, but instead often result in inadequate and insufficient gold recovery (Massor & de Theije, 2018). This is important as it means that it is unlikely that the majority of people in Ecuador will benefit financially from an increase in mining operations.

The Resource Curse and the Paradox of Plenty

Countries that have an abundance of natural resources logically should have an advantage over countries that do not and, therefore, should be more prosperous (Cleveland & Morris, 2015). However, this is not the case. In many instances, an inverse relationship between high levels of natural resources and growth rates see more frequent economic progress (Cleveland & Morris, 2015). The resource curse is a theory that aims to explain the reasoning for why this phenomenon occurs (Cleveland & Morris, 2015). The theory claims that an abundance of resources leads to corruption within the state and the exploitation of resources by other countries (Cleveland & Morris, 2015).

"The concept of the resource curse tends to stimulate debate" (Arellano-Yanguas, 2011), as some experts question examples of, and even the legitimacy, of the resource curse. Some experts claim the curse only looks specifically at economic growth and not at economic development (Costa & Santos, 2013). Regardless of the debates about the curse's legitimacy, there are clear examples of countries with an abundance of resources that experience a lack of economic growth (Costa & Santos, 2013). This belief is further corroborated by (Costa & Santos (2013), who state that a country having an abundance of natural resources does not necessarily guarantee economic growth or stability. Costa & Santos (2013) state that the "abundance of natural resources and economic growth are not positively correlated, which has become known in the literature as the "resource curse" or the "paradox of plenty" (Mikesell, 1997, Auty and Gelb, 1986, Conway and Gelb, 1988, Gelb et al., 1988, Auty, 1988, Auty, 1991a, Auty, 1991b, Auty, 2003, Auty, 2005, Sachs and Warner, 1995, Sachs and Warner, 1997, Sachs and Warner, 1999, Sachs and Warner, 2001, Sala-I-Martin, 1997, Doppelhofer et al., 2000)" (Costa & Santos, 2013).

A neighboring country to Ecuador that can be used as an example for the resource curse is Peru. Peru was an extremely powerful and wealthy nation during the time of the Incas but is now considered a developing country (Irazola, 2017). Peru, which had the most productive gold mines in the 1500s, became subject to foreign power, which exploited the nation for its wealth (Irazola, 2017). Even after being liberated, corruption from within prevented Peru from ever developing the way that it should have (Irazola, 2017). According to Cleveland & Morris (2015), these are both important aspects of the curse.

Peru's experience with the resource curse is relevant to Ecuador as similarities of natural resource distribution between the two countries suggest that Ecuador is susceptible to similar effects of the resource curse. Furthermore, the argument can be made that Ecuador has already experienced the effects of the resource curse through the practice of extracting oil. In the book, *Ecuador's Environmental Revolutions: Ecoimperialists, Ecodependents, and Ecoresisters* Lewis (2016), discusses how the extraction of oil has impacted Ecuador's growth and government. Lewis discusses how the corruption of Ecuador's government has impacted growth, while foreign companies were able to exploit Ecuador for its oil, leaving behind damaged and infected ecosystems (Lewis, 2016). This is troubling as the current growth in mining operations in Ecuador are owned by foreign countries (World Bank, 2018), which may lead to parallel outcomes to take place.

Environmental and Human Impact of Mining

In many instances, mining operations have proven to be destructive to the environment and have led to a decrease in biodiversity in the area. Loss of biodiversity happens from deforestation, disturbances created from road construction, and mass amounts of sediment making its way into river systems (Roy et al. 2018). Figure 1.1 and Figure 1.2 depict a typical open-pit mining operation, where workers are shown using high-pressure water hoses and construction equipment to alter the landscape as part of mining operations (Massaro & de Theije, 2018). Even without workers using hoses, soil erosion still takes place due to deforestation (Roy et al., 2018). Soil that was once held together by roots is now more susceptible to being affected by wind and rain. Deforestation is directly responsible for soil loss, increased sediment in streams and how they flow, and landslides (Roy et al., 2018).

Ecuador is one of the most biodiverse countries on the planet (Lewis, 2016) and should take issue with an increase of new mining operations as they now threaten environments in the Andes and the Amazon Rainforest (Roy et al., 2018). Damage to these environments will directly affect biodiversity as a whole, endemic species, and endangered species in these areas (Roy et al., 2018). Another reason why Ecuador should be concerned with mining practices is that mining is occurring on land that was once considered to be protected (Roy et al., 2018). This is extremely important. When land is no longer protected, it can fall victim to mining operations and suffer irreversible effects. While some companies try to restore the environment to prior conditions through restoration projects (Massaro & de Theije, 2018), there are still parts of the environment that remain affected by the disturbances caused by the mining operation. A restoration project is depicted in Figure 1.3, showing the owner of an open-pit mining operation standing behind newly planted plants that were part of the restoration efforts; sediment that was disturbed during the mining operation is also clearly visible (Massaro & de Theije, 2018). Since the sediment no longer compact or being held together by roots, it is now susceptible to erosion (Roy et al., 2018).

Environmental contamination is also a drawback to mining operations as toxic chemicals and elements are used and uncovered during the time that a mine is operational (Harris & McCartor, 2011). One of the most common heavy metals to be used or become uncovered during a mining operation is mercury (Harris & McCartor, 2011). Mercury can have a variety of effects on the human body, including damage to kidneys, the nervous system, the respiratory and cardiovascular systems, and can even cause neurobehavioral disorders (Harris & McCartor, 2011). People around the world have been affected by mercury that has entered the environment through mining operations. Figure 1.4 depicts the number of people, estimated at over 33,000, that have been affected in Ecuador (Harris & McCartor, 2011). Mercury is dangerous in the environment as it bioaccumulates within organisms affecting the food chain (Cleveland & Morris, 2015). Animals affected by this will suffer similar diseases to humans exposed to high levels of mercury (Harris & McCartor, 2011).

In gold mining operations, mercury is used multiple times during both extraction and refinery processes (Schutzmeier et al., 2016). While private operations claim that their refinery process takes place in different countries (Marques, 2019), smaller mining operations do not (Schutzmeier et al., 2016). The refinery process for gold mining is extremely hazardous as mercury can leech into the environment and be absorbed into the bodies of the workers. Towns like Portovel have dealt with environmental and health issues for decades (Schutzmeier et al., 2016).

Other environmental impacts caused by mining include acid mine drainage, which is the process where drainage from mines with a pH of 2.0 to 4.5 leeches into the environment (Cleveland & Morris, 2015). The acid dissolves minerals in rocks when this mixes in water, creating acid mine water, which elevates concentrations of sulfate and dissolved iron (Cleveland & Morris, 2015). The low pH water is harmful to the environment, specifically aquatic ecosystems, and aquifers (Cleveland & Morris, 2015). Another toxin that is common in mining is lead pollution, which can enter the body as a vapor or by being ingested in drinking water (Harris & McCartor, 2011). In small doses lead is hazardous as it can cause anemia, neurological damage, physical growth impairments, nerve disorders, pain and aching in muscles and bones, memory loss, kidney disorders, retardation, tiredness, headaches, can cause congenital disabilities, and lead colic (Harris & McCartor, 2011). In higher doses lead is even more hazardous as it can cause seizures, delirium, coma, and can even be fatal (Harris & McCartor, 2011). With the impacts on both the environment and to humans, it seems that an increase in mining operations, public or private, in Ecuador could prove to be problematic for the country (Roy et al. 2018).

Conclusion

Countries have no say in the quantity of natural resources that exist within their borders. Ecuador is a country whose declaration prides itself on its biodiversity and nature (Lewis, 2016). Ecuador must carefully weigh the pros and cons that come from mining operations. With the evidence at hand, mining does not seem to be the perfect solution to help Ecuador become less reliant on oil. While mining has the potential to help Ecuador for the time being, it can also pose new challenges that would have to be addressed in the future. Furthermore, an increase in mining will likely only parallel the effects of oil extraction in Ecuador. The negatives of mining outweigh the positives as while some economic growth may occur, it would be limited to the few (World Bank, 2018), while the many will instead deal with an increase in medical problems and the loss of nature.

Figures

 

Figure 1.1 and Figure 1.2 (picture depicting manual methods used in mining practices (Massaro & de Theije, 2018))

Figure 1.3 (picture depicting a restoration project where open pit mining took place (Massaro & de Theije, 2018))

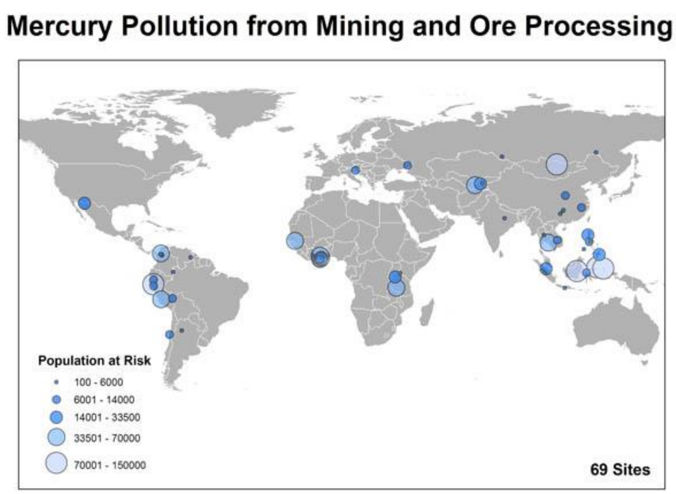

Figure 1.4 (Mercury pollution from mining and ore processing ((Harris & McCartor, 2011)

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