

Mining as the “Locomotive” of the Colombian Economy: It’s Real Cost

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Abstract

For the past 15 years, the Colombian government has enacted laws promoting large-scale mining across the country with the banner of the sector becoming the engine for growth and development of the country. By declaring it an “activity for public utility and social interest”, expropriations, forced displacements, and licenses to operate in protected areas have been pervasive. Out of the 114 million hectares of the Colombian territory, the area dedicated to mining grew from 1.1 million hectares in 2001 to 5.34 million in 2010. Furthermore, a recent decree declared an area that encompasses 22.2 million hectares as “strategic mining sites” (Resolution 045 of 2012), which covers vast areas of the Amazon jungle and 18% of the national territory. The revenues have not translated in building up Colombia’s inadequate infrastructure or improving the productivity and competitiveness of sustainable sectors of the economy. Furthermore, the expansion of both industrial and artisanal mining has worsened social conflicts and increased poverty in mining regions. The rise in gold production has been paralleled by increased imports of elemental mercury, sodium cyanide, and proliferation of illegal mining operations. With these antecedents, this document provides arguments to consider the mining “boom” in Colombia as “adverse to” rather than as a “potentiator” of the prosperity and peace of the country. A few studies that are representative of the environmental consequences of industrial and artisanal gold mining, such as destruction of tropical forests, are used to illustrate some issues of concern.

Keywords: Colombia; Mining; Artisanal; Industrial; Mercury; Gold

Highlights

1. The mining boom of the past 15 years, particularly for gold, together with new laws passed by the Colombian government, are expected to convert 18% of the national territory into “strategic mining areas” within the next decades.
2. The expansion of both industrial and artisanal mining has worsened social conflicts, levels of violence, forced displacements, and indexes of poverty in mining sectors.
3. The rise in gold production has been paralleled by increased imports and use of elemental mercury and sodium cyanide, and proliferation of illegal mining operations throughout the country.
4. One of the 4 largest South American areas of tropical deforestation due to gold mining, and the most mercury-contaminated sites in the world, occur in Colombia’s Magdalena River Basin.
5. Solutions to the economic, human, and environmental problems are difficult to formulate as long as Colombia’s economy is built on short-term economic profits and political immediate success.

Introduction

One of the interesting shifts in world gold production over the past decades has been from mining in developed nations (US, Canada, Australia) into less developed nations such as Russia, South America and China. In effect, the shift has been from nations with environmental protection standards to those nations without. It is also virtually impossible to get mining permits in developed nations. Additionally, neither ore grade nor energy cost seems to be influential in these spatial production shifts.

The protection of all life forms, the most precious wealth of the planet can only be achieved by preserving renewable natural resources. Government leaders in poor nations say that mining is the “locomotive” of the economy and the country must “know how to exploit its natural resources in a responsible and sustainable way”, which is an oxymoron

because, as to how natural resources are regulated and managed, “exploit” and “sustainable” are antonyms. Only short-term economic benefits and political expediency are considered, while the long-term consequences of the destruction of life-supporting ecosystems are neglected. Moreover, because mineral resources are non-renewable, mining is not a “sustainable” activity; because something sustainable is “able to last or continue for a long-time”. Based on the antecedents and experiences from the past 15 years, there are strong arguments that mining in Colombia is a “threat” rather than a “potential” to the prosperity and peace of the country, that are necessary to achieve sustainable country-wide development. The aim of this review is to provide some perspective about the environmental and social impact of the current mining boom in Colombia. The main ideas of the paper that are outlined in the highlights section are expanded under the following headings:

1. Methodology
2. Governmental policy for mining and trends
3. Impact of industrial mining
4. Impact of artisanal and small-scale mining
5. Conclusions

Methodology

The core aspect of this manuscript is to present an overview of the status of mining in Colombia, both legal and illegal, and present fact-

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based arguments as to why the mining laws Colombia has implemented have done nothing to curtail the out-of-control detrimental effects to the landscape, culture and local way of life. The arguments develop from our synthesis of references from international organizations that have investigated the beneficial and adverse effects of mining on Colombian society. Even though this manuscript is written in the format of a “perspective”, providing reliable support (e.g., relevant references) for the contentions made were not always possible as a large body of information is available informally through websites, newspapers and other public media outlets. For this reason, we tried to focus the discussion on specific cases where facts are supported by reliable sources including well-known journals, international organizations, and academic institutions. Basic descriptive statistics were used with published government data for imports of elemental mercury and cyanide, and trends of gold production.

Governmental policy for mining and trends

The rampant growth of all mining sectors in Colombia since 2002, encouraged by generous governmental incentives to attract large corporations, is shown in Figure 1 for coal and gold as commodity examples. Of Colombia’s 114 million hectares (ha), mining used 5.3 million ha in 2010, a nearly five-fold increase since 2001 (1.1 million ha). About 40% of all the national territory is being solicited by multinational companies to develop mining projects [2]. Colombian law was modified in 2001 (law 685 of 2001) to expedite the exploration and exploitation of potential mining sites, in direct violation of several principles of the “Rio Declaration on Environment and Development” to which Colombia subscribed in 1992. Ironically, at the 2012 Rio de Janeiro summit (Rio+20), Colombia pledged to make another 176 million ha a “strategic mining reserve” [3]. In the words of Colombia’s President: “*The greatest development challenge for Colombia is to attain a sustainable mining, a sustainable environment, and a secure country in the following months*” [3]. This disposition was soon adopted via a decree (Resolution 0045 of June 20, 2012, art. 1). Strategic mining sites now encompass 22.2 million ha, which includes vast areas of the bio diverse Amazon jungle and a total of 18% of the national territory. The Colombian government commitments to “exploit its natural resources” contradict their acceptance of the Rio Janeiro major summit goals, to protect the planet from further degradation, and to manage natural resources so that all classes of resources can sustainably support the needs of the present and future generations. The previous law (Law 685 of 2001, art. 37) prevented municipal and regional authorities from prohibiting mining activities, declaring mining activities are under the jurisdiction of the central government.

Impact of industrial mining

The rapid growth in exports of mining products for the last 15 years has not been accompanied by development of the country’s infrastructure, stronger environmental regulations, and protection of indigenous cultures. Nor has growth of the mining sector translated into growth of domestic products (Figure 1). The mining boom doubled jobs between 2005 (150,000) and 2013 (350,000) [4], of which 35,000 are attributed to large-scale mining operations with skilled labor. Whether the increase in employment and revenues from mining has improved indexes of poverty is hard to evaluate from the sources available, as these are not always linked to specific sectors of the economy. For example, when the national level of poverty was considered by using the multidimensional poverty index (MPI) developed by the Oxford Poverty and Human Development Initiative (OPHI), Colombia had an overall reduction in poverty between 2005 (MPI=0.039) and 2010 (MPI=0.023), with average GNI per capita growth of 2.9% [5]. However,

the same study showed that for the year 2010, the level of poverty in rural areas was 6.8-fold higher than for urban areas (MPI=0.061 vs. 0.009). These results coincide with those of an independent project, elaborated by an alliance of national and international NGOs, to assess the effect on poverty of the different “engines of economic growth” implemented by current governments (Foro Nacional Ambiental, 2013). The study showed that the worst indexes of poverty (misery, unmet basic needs, infant mortality and violence) occurred in the most heavily mined regions of the country. It is thus clear that the benefits of royalties from the mining “locomotive” have not been invested to compensate the most affected people. Apart from the former nation-wide report, numerous websites and media outlets, including those of the Colombian Comptroller General [6], have been informing of specific cases where the mining boom is being accompanied by increased social problems, civil unrest, poverty, conflicts, and displacement of entire communities, to the extent of being worse than in places where coca crops are grown for making cocaine [7-10].

The mining laws passed in 2001 have undermined all the provisions that the 1991 constitution granted to indigenous people to manage their own territories and resources. With the consent of the Colombian government, mega-projects have been accompanied by large scale forced displacements, massacres, and human rights violations [11]. The acts of armed groups often favor the interests of the multinational corporations and/or Colombia’s government; such alleged role of corporate mining in paramilitary activities has been reported in detail (with court testimonies and depositions) by PAX [12] for the major coal mining companies operating in Colombia. However, few academic studies have examined in detail the side effects of the recent mining boom (legal and illegal) on the levels of violence. A recent social science paper that quantified the causal impact of the gold boom on indicators of violence such as homicides, forced displacements and massacres, found that the recent gold rush has become a new driving force in territorial conflicts and has exacerbated violence in gang-controlled (but not corporation-controlled) gold mining areas [13]. In light of this situation and the lack of an updated mining census, the Colombian Comptroller General (*Contraloría de la República*), which is a monitoring agency, has called for a moratorium or “standby” to granting any new mining concessions until the sector can be properly managed and administered to benefit Colombia [6].

Why is this happening in a country that is rich in both renewable and non-renewable resources? The answer is complex, but it is clear from the way that multinational companies operate that it is not in their interest to promote the development of the nation. Apart from the cases of large-scale coal mining, including the biggest coal mine of La Cerrosa in Guajira [12,14], the gold mining sector of Colombia would serve best to illustrate what is happening to the different stakeholders that are affected at an industrial or artisanal level.

The economic incentive for relaxed environmental and health requirements for gold mining is shown in Figure 2. We statistically estimated that the exponential increase in gold exports started in late 2005. These exports contribute over 2 billion USD to Colombia’s annual trade balance.

In Colombia, current governments are giving multiple concession rights to the largest multinational gold mining corporations, even if it means the displacement of entire populations that subsisted from traditional (artisanal) gold mining, such as the town of Marmato, in Caldas [16]. To this effect, the mining laws of the country were rewritten in 2001 to welcome these corporations and declare many artisanal

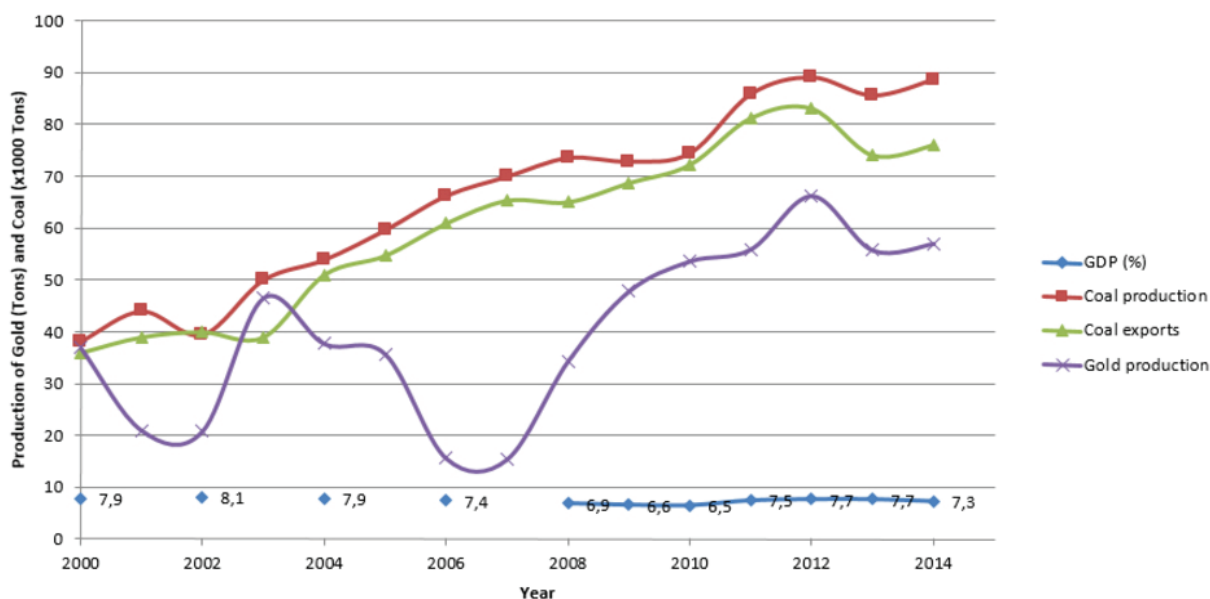
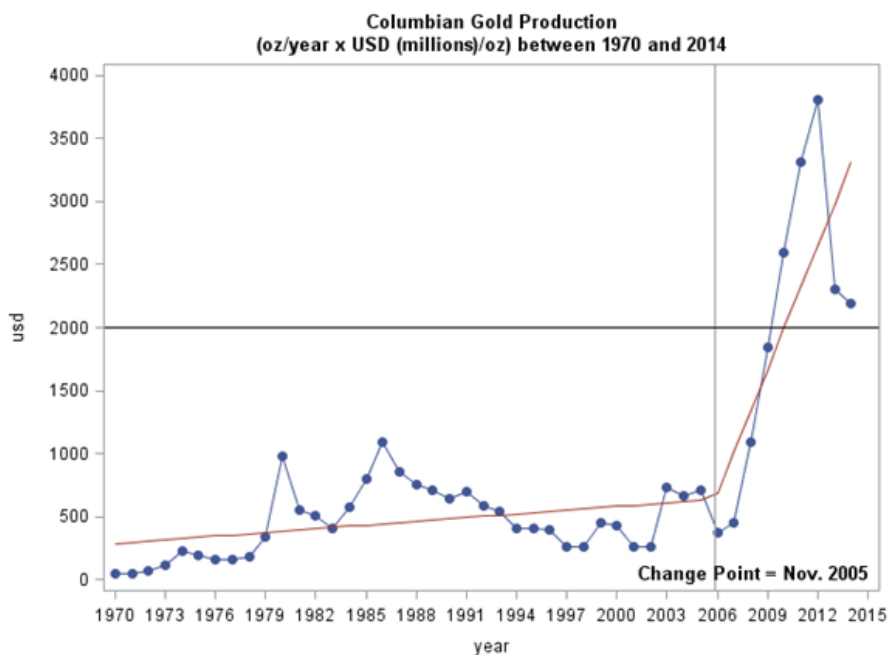


Figure 1: Colombian production of coal and gold commodities and total contribution of the mining sector to the Gross Domestic Product [1].



^a<http://www.macrotrends.net/1333/historical-gold-prices-100-year-chart> (and millions of ounces of primary gold mine production in Colombia)

^b<http://www.simco.gov.co/?TabId=121> (Historico Anual de Producción de Oro).

^c Schwartz (2015) Change point from estimated using SAS.

Figure 2: Inflation-adjusted price of gold^{a,b}. Gold exports (USD) started to increase exponentially^c in the last months of 2005 [15].

operations as illegal due to “their detrimental impact to society and the environment” (Law 685 of 2001 and Law 1381 of 2010). The new laws did not contemplate the deforestation of cloud forests by large-scale operations as detrimental to the environment, and their biodiversity was not qualified before being destroyed. The two essential requirements to begin corporate mining operations in Colombia are

an environmental license and an environmental management plan (Law 99 of 1993 art. 49, Decree 2820 of 2010 art. 8 and 9); yet, 90% of legal mining operations have neither according to an investigation supported by the Colombian Ombudsman’s Office in 2011 and 2012 [17]. An example that well illustrates the way “sustainable” large-scale mining is approved is “La Colosa” project in Cajamarca (Tolima), which

will be the third largest open-pit gold mine in the world, extracting 25 Moz of gold over its lifetime with an annual ore production rate of 70 Mt per year [18]. In 2013, the British Colombian Solidarity Campaign published its Alternative Report entitled “La Colosa: A Death Foretold” that specifically addresses the project’s negative impact on food and water security, the company’s (AngloGold Ashanti (AGA)) alleged involvement in political corruption, intimidation of opposition groups (including unsolved murders of community leaders opposing the project), and their participation in tax havens [19]. Based on documents and extensive fieldwork, the study provides a broad and detailed overview of the company’s corporate behavior in a nation with poor environmental and industry regulatory framework.

An open pit gold mine typically involves the demolition of all existing vegetation, leveling mountains, transporting ore to mills for grinding, creating mountains of tailings that erode mercury and other metals, and converting huge volumes of water that support the forest biomass, drinking water for humans, wildlife, and agriculture, to sulfuric acid and cyanide-contaminated runoff. “La Colosa” will cause the disappearance of cloud forests, depletion of water reservoirs, desertification of the land, and the creation of the largest tailing dam in the world with highly acidic water containing cyanide, and heavy metals. This project will also create 100 million tons of waste rock that will need to be dumped at a locality close to the open pit, and the exposure of sulfides of the rock to air and water will be a long-term source of acidic mine drainage [19]. According to the USA Environmental Protection Agency, hard-rock mining generates more toxic waste than any other industry. Although self-claimed “progressive” and “visionary” government officials consider this activity rational, and grant it all types of privileges and “national priority”, the undeniable truth is that an unprecedented destruction of all life-supporting ecosystems is occurring without consideration of the real long-term national and global consequences.

In addition to the adverse environmental legacy, protesting against such activity in Colombia is a personally dangerous activity. The main union leader—a simple farmer—opposing the development of the La Colosa project was assassinated in 2013 [19]. He is another victim of the roughly 3,000 union leaders killed between 1986-2010 [20]. More than half of all murders for union-organizing activity worldwide take place in Colombia, which has devastating effects on collective efforts to exercise workers’ rights. The company uses multiple strategies to distort information and evade an open debate, with former high-level state and municipal politicians who approved the project now working for the company (BM-Colombian Solidarity Campaign, 2013). Most worrisome is that mining concessions have also been given to this and other companies in areas of the country that include the fragile *páramo* tundra in the Andes (located between 3000 and 4,200 meters above sea level) and national parks, with river basins that play vital roles as water sources.

Artisanal and small-scale mining

Artisanal gold mining provides 200,000 jobs (0.43% of the Colombian population) according to Cordy et al. [21], but compared to industrial mining it is a subsistence economy. This is over half of the 315,000 jobs attributed to small-scale and artisanal mining for all commodities combined [4]. However, while small-scale mining creates more jobs than transnational corporations, it is conducted in an equally or even more destructive form. As an example, a few months after gold was discovered in April 2009 in the banks of the Dagua River, in the Cauca Region, over 7000 people and 300 bulldozers were stationed along its banks. Presently, 21 km of the river course look as if they have been bombed from the air (Figures 3a and 3b).



Figure 3a: Aerial view of the Dagua river course in area of artisanal gold mining. Notice the numerous pit holes created by bulldozing and expansion of the river margins.



Figure 3b: Aerial view showing artisanal miner settlements along the Dagua River course.

Satellite imaging shows that around 1680 Km² of tropical forest has been lost in South America as a result of gold mining between 2001 and 2013 [22,23]. One of the four main hotspot areas is centered in the Magdalena Valley River basin in Colombia. Much of the deforestation is attributed to small and medium scale mining operations, though some is being caused by large and theoretically, well-regulated operations. During the last decade, the Magdalena River drainage basin has experienced an increased erosion rate of 34%, from 550 t km⁻² y⁻¹ before 2000 to 710 t km⁻² y⁻¹ between 2000-2010 [24,25]. Those studies also showed that 78% of the catchment area experienced a 60% clearance of the natural forest between 1980 and 2010. The worst environmental tragedy caused by severe flooding recorded in Colombian history occurred in 2011 and affected 2.5 million people. Approximately 40% of those people lived in the Magdalena River basin. Undoubtedly, the loss of forest cover to act as a “sponge” has deteriorated the natural mechanisms of controlling and regulating water flow. The tragedy revealed the weaknesses of the Colombian emergency response system to prevent and tackle human emergency problems due to extreme weather events, and policies are yet to be established to prevent erosion and flooding problems. At present, the Magdalena River has an erosion

rate (690 t/km²/year) that is greater than any other river in South America, including the Amazon (167 t/km²/year) [25]. The impacts of such land runoff and siltation in coastal reef areas are not fully known but include coral reef degradation, loss of mangrove die-off, changes in marine-protected shorelines, and changes in species assemblages [26,27]. More easily assessed could be the economic impact of sedimentation in harbors that now require continue dredging to allow normal transit of cargo ships, such as at Buenaventura Bay, the largest Pacific coast harbor in Colombia which is downstream from the heavily mined Dagua River.

As a subsistence activity, artisanal miners also resort to simple methods of extraction, such as amalgamation with mercury (Hg). Some problems arising from this type of exploitation include not only the mercury contamination of the freshwater ecosystem, but also the physical alteration of the river course with sediment and subsequent downstream river overflows. Reflecting on this, in 2011 Colombia was ranked by the United Nations (UN) as the world’s largest *per capita* mercury polluter from artisanal gold mining. Globally, the municipalities of Segovia and Zaragoza (Antioquia) are the most mercury-contaminated sites in the world as a result of burning amalgam within the town limits [21]. Despite the risks involved in living in these places, where exposure to atmospheric mercury exceeds the exposure ceilings set by the UN, there is little interest by the authorities to investigate public health issues in these populations. Eventually, mercury reaches the aquatic environment and accumulates in the food chain, of which man is usually the final link. In July 2013, Colombia’s Congress passed a bill (Law 1658 of 2013, art. 3), that will ban the use of mercury in 10 and 5 years for the country’s industrial and mining sectors, respectively. However, the new law does not prohibit importing mercury (art 5) and only extends exiting provisions to monitor and control import and use. Existing laws have not impeded the high rates of illegal gold mining in Colombia (87% of the existing 4,134 gold mines are not registered; census of 2011 by Guiza and Aristizabal [6], so the implementation of Law 1658 will not succeed unless accompanied by economic incentives for entire communities that now depend on artisanal gold mining as means of livelihood.

A report to United Nations detailing the gold processing procedures that are typically followed by Colombian artisanal miners Veiga [28], reported that amalgamation with mercury is inefficient in recovering gold from ore (approximately 50-70%). The tailings are further extracted by cyanidation in vat leaching with subsequent gold precipitation with zinc shavings, and this is typically done in “entables” (processing centers). In a follow-up study by the same authors to better understand the behavior of mercury during cyanidation [29], it was shown that the leaching process also produced residues loaded with zinc, cyanide, mercury and other heavy metals, which are typically discharged into local creeks. Significant occupational exposure to mercury occurs since 28% of the mercury used is precipitated on the zinc shavings and is lost to the atmosphere when the shavings are burned. Methods of extraction that are safer to health and the environment, and are economically competitive, include ammonium thiosulfate [30], thiocarbamide hypochlorite and halogen-halide solutions [31].

Compounds of mercury behave differently, with methyl mercury being the most toxic that bio-accumulates in food chains. In this respect, Hg speciation and bioavailability were also studied in surface sediments affected by artisanal and small-scale gold mining (ASGM) in the Mojana region of Colombia [32]. The results demonstrated higher

levels in sampling stations that receive water streams carrying Hg from mining areas. Total Hg concentrations were slightly elevated with values between 196.2 and 1187.6 mg g⁻¹ dry wt. (dw) (mean 524.2 ± 256.8 mg g⁻¹dw). Concentrations of highly toxic methyl mercury, accounting for 1.7% and 3.6% of total Hg, were significantly correlated with the total Hg and organic matter (OM) [33].

As expected, our analysis of published data for imports of mercury and cyanide showed a parallel trend to those of gold production. As shown in Figures 4a and 4b, imports of mercury (+2,857.9 Kg/year) and sodium cyanide (+45,557.6 Kg/year), and export of gold (+3.25 tonnes/year) have had statistically significant increases between 1990 and 2012 (P<0.05) [34,35]. Furthermore, the cross-correlations between mercury, sodium cyanide, and gold are significant for detrended lags of ± 2-3 years. In comparison, between 1990 and 2000, there was no statistically significant trend in imports of sodium cyanide and mercury and exports of gold [36]. Between 2001 and 2012, all three commodities had significant positive trends (P<0.025); we estimated the positive trend for gold became steep

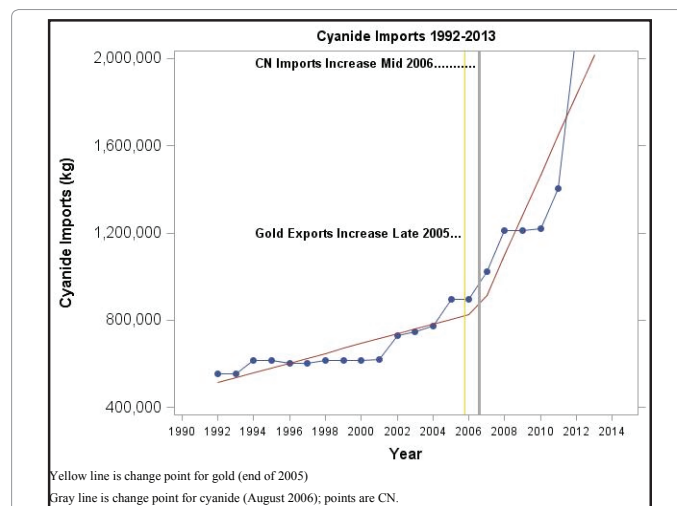


Figure 4a: Cyanide imports between 1991 and 2013. The confidence interval for point change was tight (3 years), notice imports for cyanide and mercury commodities follow a parallel trend to those of gold exports.

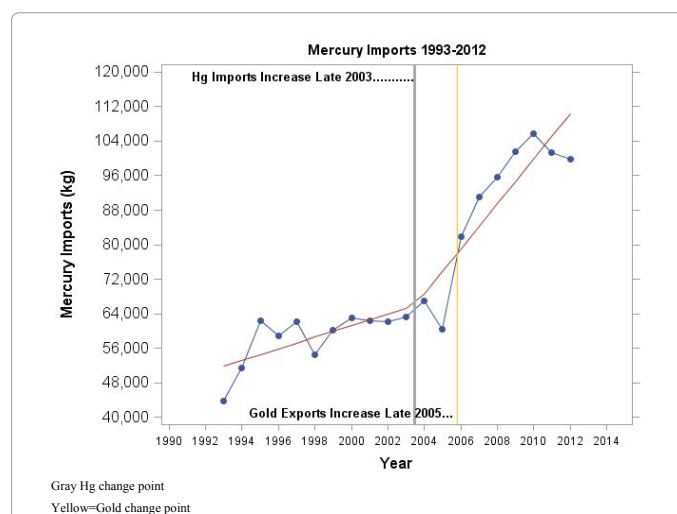


Figure 4b: Mercury imports between 1991 and 2013. The confidence interval for point change was tight (3 years), notice imports for cyanide and mercury commodities follow a parallel trend to those of gold exports.

in late 2005 and that shallower positive increases started in mid-2006 for cyanide and mid-2003 for mercury (Figures 4a and 4b).

Conclusion

The solutions to the economic, human, and environmental problems are difficult to formulate, let alone implement, in a socio-economic system based on short-term economic profits and political immediate success (i.e., four year cycles). If we start by saying that about 78% of all gold mined each year is made into jewelry [37], the real applications of gold to industrial uses and the development and progress of any society (i.e., electronics, dentistry or medicine) are very limited. In spite of its lack of value to real human needs, society has made it the most precious and valued item, that is worth (in the Colombian mining laws) the environmental devastation its extraction and processing creates throughout Colombian territories. Unfortunately, with the price of gold soaring, Colombia is now going through a gold rush that is not only attracting multinational corporations but also farmers and a large group of unemployed fortune seekers. However, as Gary Meffe [38] said in defining the concepts of sustainability, natural law, and the real World, "*we cannot deny the existence of natural laws that have governed life on the planet for tens of millions of years and will not change in response to the wishes and needs of human beings.*"

Nearly all gold consumers and multinational companies operating in Colombia are based in developed nations, so any initiative for a change will need to originate in those countries. Paradoxically, it is also the developed nations that export mercury and cyanide to Colombia. Are exporters asking, and do they care, "where that mercury and cyanide are being used and what their environmental and health impacts are?" In the end, the solution to this complex of problems will require awareness at all levels, not only of the general public but especially the political leaders and economists that who, by their regulations and actions, ignore the importance of maintaining sustainable biological and economic systems to meet the requirements of the present and future generations. Until, key players are convinced of the urgency of making drastic changes in Colombia's current "sustainable development" course, events like the Rio de Janeiro summit and signing non-binding commitments are pretenses that the world is taking real steps to address the most serious issues of Colombian society. Despite the deleterious consequences of mercury pollution, banning its use by artisanal miners and persecuting their activity, without providing incentives for economic alternatives, will worsen conflicts and the precarious economic state of many rural communities.

As a starting point for managing gold and other resources for the long-term, the Colombian government should include in the decision-making process the immediate-term effects of mining (say, next 10 years), future long term effect on the economy once the mining boom is over, the fate of the wastelands created by mining, loss of land available for renewable and sustainable agriculture due to transport of toxic metals beyond the mined areas, and the negative and positive benefits of current mining on the economic opportunities of the current generation involved in mining and of future generations.

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