

Special Report

ROYALTY REFORM

led to more illegal mining



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Through multidisciplinary studies involving professionals from different sectors, the Universidad del Rosario offers the country and all those interested in the subject a variety of perspectives for knowing more about the mining taking place in Colombia. This work contributes to decision making.

Mining is a double-edged activity, being one of the most important for the national economy yet also proving one of the biggest worries in terms of preserving our natural renewable resources, and even the planet itself.

Its positives include a key contribution to the country's Gross Domestic Product (GDP), which for the third quarter of 2017 represented 1.90%—2.62 billion pesos—according to figures published by the Ministry of Mines and Energy. By June 2017, in line with reports by the National Administrative Department of Statistics (DANE), it had surpassed 3bn dollars in exports, and the Colombian National Mining Agency (ANM) claims the activity generates 350,000 jobs directly and, for each of these, four more indirectly, making a total of 1,750,000 employment posts.

Despite these bright figures in economics and productivity, there is no hiding the fact that mining is an aggressive activity for the environment. “If I go and tear out what is under the ground, I also have to tear up what is on top of it,” explains Andrés Gómez Rey, director of Specialization in Environmental Law at the Universidad del Rosario's Faculty of Jurisprudence, whose research is aimed at finding the middle ground between the diverse perspectives of this practice, without demonising it and certainly looking for the way to reduce its negative impact.

Add to this the fact that Colombia has the highest rate of informality in the world when it comes to mine exploitation. Sixty-five percent of the units on its territory are illegal, assures Leonardo Güiza, professor at the Faculty of Jurisprudence at this same University. “The phenomenon overwhelms us really, above all due to the increasing prices of certain minerals on the market, particularly gold,” the specialist points out.

If the country had precise information on this 65% of illegal units and behavior of municipal governments in relation to this activity, the story would be very different. “In the US, two thirds of companies do not know where their minerals come from. They might come from the Congo, from India, or from Colombia. We should all be concerned about this because it is an international issue,” says Santiago Saavedra Pineda, professor and member of the Faculty of Economics Research Group at the Universidad del Rosario, which is behind the development of a tool for obtaining correct data in this area.

To obtain them, Saavedra and Mauricio Romero, co-authors of research by the University of California, San Diego, used Machine Learning, models that automatically learn from pattern recognition within data. This automatic learning was served by predictions in diverse satellite imagery, which provided a vision of zones with open-cast mining presence, which they then cross-referenced against a map of mines with legal Government licences. This is how they obtained the illegal mining locations.

As the study clarifies, these three specialists from the Universidad del Rosario have pressed on with research on the mining phenomenon from three different angles but with several crossover points: they are doing so according to a multidisciplinary plan involving lawyers, biologists, geographers, geologists, political scientists, internationalists, and mathematicians, their aim being to gain a wide view of mining’s diverse aspects. And all three specialists worked their research into far-reaching elements: a book, an observatory, and a map.

Gómez Rey highlights the fact that this is happening at the University because academia reflects the reality of a country that produces hot debating points. “This debate takes place in academia on a friendly basis, but outside of here it can quickly become a violent debate. Being able to contribute from here to solving the tension from different perspectives seems to me to be of very great value,” he stresses.



In order to make a contribution in line with what this academic highlights, Advances in Science presents the findings of these three researchers.

UROSARIO, WITH MINING IN ITS SIGHTS

The recent passing of the Law of Royalties has led to the increase of illegal mining in some of Colombia’s towns. This is one of the conclusions of research by the Faculty of Economics at the Universidad del Rosario, which has made a map showing the locations of illegal open-cast mines. Intuition points to mining municipalities receiving a lower percentage than that paid by the companies. Furthermore, the study revealed a serious deterioration in the health of newborn babies born ‘downstream’ from illegal mining exploitation.

Behind the research now producing results by professors Santiago Saavedra Pineda of the Faculty of Economics, and Mauricio Romero of the University of California-San Diego, was their desire to know whether the reduction from 50 to 10 percent in royalty income for Colombian towns, written into the Decree-Law 4923 of 2011, had influenced the increase in illegal mining.

The researchers formed the hypothesis as to whether the mining parties, following royalty reform, preferred illegal exploitation because the amount for bribing local authorities is

less than the cost of meeting the demands for obtaining a legal licence. “Theoretically, we expect illegal mining to increase because the local authority gets less in royalties after the reform,” points out Saavedra, holder of a PhD in Economics from Stanford University.

“*Local incentives and national tax evasion: The response of illegal mining to a tax reform in Colombia*” is the title of the research study, whose first major challenge came from the lack of information on the location of the country’s illegal mines. The researchers decided to tackle this by using technology and tools allowing them to cross reference variables and create a map. “To solve the problem of measuring illegal activity, we build a set of innovative data by using predictions from automatic learning using satellite images,” explains the professor.

This is where ‘Machine Learning’ comes in to build the predictions. Taking as a basis the way one sees a landscape of an open-cast mine (lacking vegetation and brown in color, for example), they fed in the data to obtain predictions. “Our estimations suggest that 89 percent of Colombian mining areas are exploited without a licence, a high percentage but a figure close to that put out by the United Nations Office for Drugs and Crime (UNODC), which claims that 78% of gold extraction in Colombia is illegal,” explains the researcher.

With this clear information, the academics had to confirm or discard the theory on the increase of illegal mining

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→ One of the problems identified in the area of mining in Colombia is that different agents in the sector are not sufficiently joined up, says Leonardo Güiza, professor of the Faculty of Jurisprudence.





Allowing unrestricted freedom for extractive activities is an incomplete vision of mining; while the protection at any cost of renewable natural resources also has undesirable effects that reduce people's fundamental rights.

after Decree 4923. For greater certainty in the outcomes, they chose to follow the same process used for mining in Peru, comparable to that of Colombia since it employs similar legislation.

For each country, maps from before and after the passing of the law were analyzed, and the expected results were confirmed: the area proportion mined illegally in Colombia increased 4.47 percentage points, especially in towns with less central government influence. “Illegal mining levels in Colombia changed in comparison with those in Peru,” assured the economist Saavedra. The researchers calculate that, under the reformed royalty system, between 19 and 57 million dollars of revenue stopped coming in. This was due to the increase in illegal extraction. So, for each redistributed peso, between 3 and 9 centavos is lost through evasion. The health cost must be added to this amount, because the researchers found that the health impact associated with illegal mining grew tenfold.

A NEW HYPOTHESIS

Colombian law requires companies with mining licences to have an environmental licence for exploitation phases, one that controls the negative effects on the environment that may

THE UNIVERSIDAD DEL ROSARIO HAS REVEALED ASPECTS OF ITS RESEARCH INTO THE PHENOMENON OF MINING, WORK WITH DIFFERING FOCUSES BUT SEVERAL CROSSOVER POINTS, MAKING IT A MULTIDISCIPLINARY APPROACH.

be caused by the activity. Not complying with these practices not only impacts a region's biodiversity, but also causes damage to the health of residents living near the mine, and this fact led to the economists' next concern.

“We had the elements of the mine, the river's flow, the municipal capital, the fact that illegal mining causes grave damage to the environment, and the health of nearby populations due to the quantity of mercury thrown into rivers from gold extraction. So then we launched our next hypothesis: illegal mining impacts in major proportions on the health of the newborn of towns ‘downstream’ from mines,” recalls Saavedra.

It is well known that mercury, which is essential to gold exploitation, affects the heart, the kidneys, and the central nervous system, especially in women and children. For this reason, the figure we found is alarming: the effect on the health of newborn babies ‘downstream’ from an illegal gold mine is 2.53, ten times greater than that produced by a legal mine, 0.27.”

“And here we are talking about open-cast mines. There is no way of quantifying what happens with subterranean mining,” concludes Saavedra, whose study provides a clear picture of illegal mining in Colombia, one involving corruption, a lack of observation by the state, damage to the environment, dete-

rioration in people's health, and whose continuance is limited to the work available, legal or illegal.

SEARCHING FOR THE MIDDLE GROUND

Andrés Gómez Rey, a lawyer specializing in Environmental Law and holder of a Master's Degree in Administrative Law, is the co-author of *Mining Activity in Moorlands, Wetlands, and Forest Reserves*, a book that sets out to explain to the layman about prohibitions on this activity that work as a protection measure for the aforementioned ecosystems.

Since the market offers no book on ‘flora and fauna for dummies’, the text—which provides as much reflection as research—is written so that persons with no knowledge of the subject can grasp what is happening in the area of environmental protection. “Its aim is to explain in some way why the current disorder has a historical background, the product of state behavior,” he points out.

Although Gómez Rey sees himself as being on the “green wing” of mining law, he is committed to finding the middle ground so the state can maximize its benefits from this activity but with the minimum possible detriment to environmental and social conditions where it is carried out. In his view, allowing unrestricted freedom for extractive activities simply to boost GDP is an incomplete vision of mining; and protection in defence of renewable natural resources “sounds pretty” but it also has undesirable effects on people's fundamental rights.

“Being very ‘grey’ has some effects, and so too does being ‘green’. But it's really about looking for middle grounds. The book aims to tell what has happened and show that each pos-

sible interpretation has consequences. And we must get Colombia to protect its environment, but also its GDP,” he underlines.

DOING THINGS WELL IS NOT ENOUGH

To illustrate his viewpoint, Gómez Rey turns to an example he himself recognises as “very radical”, but he argues that not all the implications of doing things well are necessarily positive. “What is needed in order to kill well? Completely end the activities and life of a person, which can be achieved in innumerable effective ways. That, however, does not make killing good,” he stresses.

As a further example, he talks of his experience of once living in a town that heightened his love of nature. “I went back five or six years later when a very large mining project was going on, and I found that a lemonade no longer cost 1,000 pesos but 3,000, and only those working in the mine could afford to pay for one. This has such a big effect on people who need to buy a cure or a drink but do not have the means, so they end up stealing. A high rate of prostitution had also resulted.”

One element could be highlighted from this mining activity, namely that it was well carried out in technical terms, but it was clear that the situation had additional impacts. “I



believe that environmental protection is not simply a question of doing it well,” the expert says, repeating that someone can steal efficiently, kill efficiently...or mine efficiently, so it is necessary that this ‘well done’ mining does not alter the social situation or dynamics. “We need to minimize pressures on people and on the environment.”

THE INTRICATE DEPTHS OF ENVIRONMENTAL LAW

As part of his search for a middle ground, Gómez has found a key ally in the interdisciplinary approach. “This work includes all disciplines, and each discipline has a different rationale, and each different rationale impacts on the way in which legal order is seen and how each activity is carried out,” he maintains.

This reality involves an additional ingredient for the case of mining, and environmental law has certain peculiarities that set it apart from other fields of more dogmatic tradition and with more rigid and structured features.

“Environmental law feeds on passions, discourse, emotions; but also on anthropology, sociology, accountants, mathematicians,

economists, and so on. And all this distills into the need to create rules. Such rules must have all the logics of the world, and this makes it very pretty but also somewhat chaotic.”

“It’s not totally subjective either, but it is a little bit more friendly with the changes. It’s a law area that has to react to the untimely alterations in nature (such as the landslide caused in Mocoa, April 2017, by the the overflowing of three rivers), so for this reason it is much more dynamic. And the responsibilities involved in all these disciplines—and, in a flash, passions—make it a much more agile law.”

Returning to the book, *Mining Activity in Moorlands, Wetlands, and Forest Reserves*, Gómez Rey points out that current laws are in place to protect ecosystems, but legal regulations are one thing, while another thing entirely is how they translate into practice. And, here again, many things on the ground depend on the points of view of each agent involved.

“If you ask a biologist studying the interrelation between living beings in moorlands, any mining activity is going to be egregious and make for a very alarming panorama; these tend to be the visions of some organizations. But if you look at it from the point of view of the operator who has managed to extract thousands of tons of gold or coal from a 1000-foot pit, this is the best mining option around! It’s just a little bitty hole for such a tonnage! Obviously they will tell you it’s a great thing.”

The research provides the further example of the surface gravel put down, thanks to mining, on rural roads, and this is



so necessary for farmworkers to transport their products and avoid intermediaries. It’s a requirement for the country, so mining does bring positive aspects. “But you have to conjugate all the variables, and this is the point we are trying to make.”

Bringing three lawyers, two psychologists, and an anthropologist to agree on something is no easy task, Gómez Rey admits. But he summarizes the objectives of environmental law in two fundamental actions: “One, make our behavior apt for the protection of natural resources and to attend to emergencies if they occur. Two. Regulate anthropocentric activities that might affect society and the environment, such as mining, the exploitation of hydrocarbons, and infrastructure.”

A SECOND PART

Mining Activity in Moorlands, Wetlands, and Forest Reserves cannot be less dynamic than environment law itself, so a widening of the text is now being planned, one that could come in the form of a second edition or as a continuation.

Its central axis would be the controversy that has blown up around mining exploitation in the Santurbán moorlands, where—Gómex Rey clarifies—debate focuses include mining activities in the surroundings of the delimited area, those found outside the lines; the role of participation and the voices that should count, since both miners and environmentalists attend these scenes in equal number; and the effects the “war against mining” has on agriculture.

The most important thing about the case right now is for the Constitutional Court to suspend the current demarcation of the moorlands, to the benefit of community participation. “The key question is about who will participate in the new demarcation; if it is to be those already in the moorland, they will want the delimitation of moorlands area reduced so they can carry out agriculture and mining activities; but if it is down to those living on the moorlands perimeters, and they consider it vital for water upkeep and other variables, they will want enlargement of the moorland,” the specialist points out.

So, the continuation of the book will integrate the tension between local and regional participation in defence of the moorland, while studying the dilemma as to whether the environment is so good that it can tumble people’s essential rights.

“We are aware that mining is necessary, but it should be carried out taking in the variables, not necessarily technical points, but aspects that prevent the creation of social conflicts or the destruction of very valuable ecosystems,” concludes the researcher.

AN OBSERVATORY AS A BENCHMARK FOR MINING

One of the problems identified in the area of mining in Colombia is that different agents in the sector (institutions, companies, non-governmental organizations, academia) are not sufficiently joined up. To counter this situation, this past April saw the inauguration of a Colombian Mining Observatory (OCMI), presented at the Paris (France) forum of the Organization for Economic Cooperation and Development (OCDE) on responsible mineral supply chains.

Representing Colombia at the forum were the vice-president of Mines, Carlos Andrés Cante, and the director of the Observatory, Leonardo Güiza Suárez, professor at the Faculty of Jurisprudence of the Universidad del Rosario, the latter a qualified lawyer, biologist, and environmental sanitation expert with a Master's Degree in Industrial Environment Law from the University of Poitiers (France) and yet another Master's in Human Rights from the University of Alcalá (Spain). In addition, he is the author of more than 25 publications on socio-environmental conflicts and mining.

The OCMi Observatory is a virtual management information platform and a center for thinking that aims to become an essential tool for the Colombian mining field. "The key aim is to centralize all the sector's information so that any person wanting to know anything about it does not have to spend hours compiling data from Google. We have a quantity of algorithms that allow one to find info in seconds," claims Güiza, who is currently the director of the Universidad del Rosario's research line on Environment and Human Rights.

Professionals of diverse disciplines work on the Observatory—online at <http://www.ocmi.org.co>; 20 students have recently joined the team from research lines of different faculties of the Universidad del Rosario, the main manager of the project, which also has the support of the OCDE and firms, NGOs, and other universities.

"We decided to make it a virtual platform because we have certain experience through other previously mounted consultation projects—another seven observatories had already been created; this one in particular brings together all the experience we have acquired in recent years," underlines Güiza.

"In this country, plenty of diagnoses are carried out," he adds. "The Observatory is an information management center that means people aren't endlessly repeating what they have already done. It is also a center for thinking, in which we hold a monthly working lunch to discuss the latest developments with 20 people responsible for decisions in the mining sector."

GOLD INSTEAD OF COCA

The Colombian Mining Observatory is just one of the projects Professor Güiza is involved in. He is busy in subjects covering the environment and environmental conflicts, mining, and non-conventional renewable energy forms. Another of his areas to be highlighted is research into armed conflict, according to

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which illegal groups are financed not only through drug trafficking but also mining.

The importance of the issue is such that the US daily paper *The New York Times* (NYT) is currently putting together a major six-page report on this phenomenon for the coming months. While the NYT has already referred to the issue on earlier occasions, this time the situation has a relation on the Trump government's plans to tear down a law restricting the purchase of minerals from nations in conflict.

The research, which took ten months and was funded by the United States Agency for International Development (USAID) and the Ombudsman's Office of Colombia, analyzed how territories were reconfigured after the signing of the peace ac-

cord between the government and the FARC. And, contrary to the expected discovery, it found that the presence of illegal groups increased 10 percent in gold-bearing mining zones. In fact, it is estimated that during the year 2015, these groups received between 100 and 200 million dollars purely from the exploitation of gold.

"That is absolutely proven. We used databases and carried out very important field work, something no one has done with so much support for a very long time. We used nearly all the information available in public institutions for this," stresses Güiza, who was also the director of this project, the results of which are due to be published in an Ombudsman's Office report. ■

Mercury, another study topic

Colombia is the second biggest importer of mercury in the world, after Indonesia, yet it does not have the economic activity to use this metal, so it is not difficult to infer that it is being employed in illegal mining (in legal mining, mercury is not employed).

The issue has grown into a major public health problem, especially since neither diagnosis nor treatment of mercury intoxication is covered by obligatory state health cover plans, so anyone affected by this problem must file for protection to be treated.

Through joint research with McGill University in Canada, the Universidad del Rosario was able to try out a mechanism in Colombia for the detection of mercury intoxication, one similar to tests for glucose levels in the blood. This method is much simpler than those used to date, for which taking samples requires following a rigorous cold chain process before being analyzed in an atomic absorption laboratory.

"Mercury is going to be banned in Colombia in a few months, but my hypothesis is that mining will continue producing the same amounts of gold using this element, except now it will be imported illegally, through trafficking across frontiers," predicts Leonardo Güiza Suárez, professor of the Faculty of Jurisprudence.

The good news is that this work has led to the coming presentation of a proposal for access to royalty resources and to the carrying out of a public health project in the department of Antioquia, which has high mercury contamination levels in half its towns. "This is a project that calls for joining up many efforts, so it will be carried out jointly with the universities of McGill, New York, Javeriana, and Antioquia, but led by the Universidad del Rosario," points out the researcher.