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Gendered Socio-Ecological Impacts of Mining in the Sonoran Desert Transboundary Region

**A research report presented to the
Next Generation Sonoran Desert Researchers
(N-Gen) Board**

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EL COLEGIO DE SONORA- THE UNIVERSITY OF ARIZONA

Research Report
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Transboundary Region**

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A. Lutz Ley, L. Velázquez Contreras and S. Buechler

1. Introduction

Mining activities are a traditional component of Sonora State's economy (Servicio Geológico Mexicano, SGM, 2015); however, its characteristics have progressively changed to keep up with increased demand in the global market and, as a consequence, its social-ecological impacts have increased in depth and scope. Currently, Sonora is the top national producer of gold, copper, and molybdenum (metallic minerals), as well as graphite and wollastonite (nonmetallic) (Sonora is the only producer in Mexico of the last three, according to the SGM, 2015). According to data provided by a representative of the mining sector in Sonora, there were approximately 45 active mining units in the state's territory in 2018.¹ Globally, mining provides employment for men and increasingly for women in rural landless households, and semi- or non-agrarian homes (Bebbington et al. 2013, Lahiri-Dutt 2011, Bell and Braun 2010, de Chungara 1978). The fact that female employees access social and economic opportunities through their participation in the mining sector has the potential to modify power relationships in which they interact and their livelihood trajectories in contexts where men are the *de facto* recipients of land and water rights (Deere and León 2001, Rosas-Vargas and Zapata-Martelo 2012).

Mining has historically been considered a masculine livelihood, but there is (usually unrecognized) evidence of female participation in the sector in multiple locations around the world from very early history (Lahiri-Dutt 2011; Mercier and Grier 2007). In Sonora, women's participation in the mining sector up to 2014 was 7.4% of the total workforce in the sector, according to the last economic census by the National Statistics Institute. This equals approximately 1,300 women (INEGI 2016a), which is much less than women's participation in other sectors, although it shows an incremental trend as indicated in the results section of this document. On the other hand, mining does not necessarily provide a stable income, but it shrinks and expands depending, among other things, on the international prices of materials (Bracamonte et al. 1997). With recent labor reforms in Mexico, mining employment is also subject to labor flexibility policies. In interviews conducted by Lutz Ley (2016), women in the rural communities of the San Miguel Watershed, in central Sonora, reported that they worked for companies that offered diverse subcontracted services for mining enterprises in the upper watershed (Cucurpe), and those companies appeared and disappeared quickly, with no chance of obtaining labor benefits or any kind of retirement or social security.

Because women access agricultural jobs much less than men in rural locations, labor options in the mining sector were perceived sometimes as the only way to stay in the communities. The sector also shows a vertical sexual labor division (which is not exclusive of mining) that concentrates women in the lower strata, with less income and more precarious working conditions

¹ Interview with MBC, Director of the Mining Cluster of Sonora. May 22, 2018.

(Belasko 2014, Lahiri-Dutt 2011). Considering all of the above, in terms of socio-economic impacts in communities, mining depicts a gray scale of costs and benefits that researchers need to analyze systematically in relationship with other gendered rural livelihoods.

In terms of environmental influences, mining can produce punctual extreme events; for example, the spill of copper leached solution from the mine *Buenavista del Cobre* in Cananea (the largest copper mine in Mexico), into one of the tributaries of the Sonora River System in 2014 (Díaz-Caravantes et al. 2016). Additionally, depending on the type of mining operations and its extension, it can have more long-term, less obvious effects on the quality and quantity of air, soils and water (Aburto et al. 2015; Romero et al. 2008). Producing one ounce of gold (approximately 31 grams) requires the extraction of 150 tons of rocks, processing 25 to 50 tons of soils through cyanide's leaching, using 100-150 liters of water, 1,300 kWh of power and 450 liters of fossil fuels (with an estimated 650 kg of carbon dioxide emissions to the atmosphere) (Aburto et al. 2015). All of these are critical outcomes for arid and semi-arid areas of Sonora because of the scarcity of water and good-quality soils for productive activities, as well as the projected impacts of global climate change that point to higher temperatures, more aridity, and more frequent extreme weather events in this region (Overpeck et al. 2013).

Environmental risks and impacts also tend to affect each gender group differentially because jobs and occupational roles follow a sexual division of labor, and being a man or a woman implies different levels of dependency on water and other local resources (Buechler 2015). Generally speaking, men develop agrarian activities (ranching, farming), and industrial ones (mining, processing of food); while women group around domestic work, social reproduction activities and other non-paid tasks, although these categories have been more fluid over time, and less dependent on gender than they were before. Literature indicates that, as natural resources become scarcer, women add double or triple journeys, procuring additional livelihood means, as well as water and other inputs for domestic production and reproduction.

Some authors argue that inequality in resources' distribution more than environmental risks is what fosters social conflicts associated with mining (Kotsadam and Tolonen 2016; Loayza and Rigolini 2016). In this research, we applied a feminist political ecology (FPE) approach to analyze gendered social-ecological effects of mining. One of the principles of political ecology (PE) in general is that power relationships and social categories linked with socio-economic strata drive the distribution of environmental resources and impacts, as well as access to decision-making regarding those resources and impacts (Robbins 2012). For FPE this critical differentiating category is gender; therefore, the distribution of resources, risks, impacts and access to environmental decision making reflects the power relationships that women and men participate in (Buechler and Hanson 2015; Rocheleau et al. 1996; Velázquez 1996).

The combined dynamics of socio-economic globalization and global environmental change in the mining sector have the potential to escalate and foster dramatic transformations in the identities of Sonoran rural communities. The outcomes of these multiple expositions on the livelihoods of women and men, and on the sustainability of rural northwest Mexico, have not been systematically studied in the region. This report summarizes the main approaches, data sources, procedures and findings of the research project "*Gendered Socio-Ecological Impacts of Mining in the Sonoran Desert Transboundary Region*", funded by the Next Generation Sonoran Desert Researchers and developed between November 2017 and November 2018.

2. Research question and objective

The general research question guiding this project is: *what are the types and scope of gendered impacts of mining in ecological and social dimensions through different levels of organization (household, community, and watershed) within an arid watershed in the Sonoran Desert transboundary region?*

The objective of this study is *to explore and describe how mining activities interact with the socio-ecological dimensions of an arid watershed in the Sonoran Desert transboundary region, from a FPE perspective*. Two types of dynamics are analyzed at two different scales: a) socio-economic impacts on income, employment and social and domestic re-organization in the households and the community; and b) ecological impacts on water and land at the upper watershed level, where the mining case is located.

3. Methods

The first stage of this multi-method project covered one year of research (Nov. 2017– Nov. 2018) supported by N-Gen and a partial contribution by El Colegio de Sonora (support in kind). Researchers conducted documentary and field work in Cucurpe, where an active gold mine was identified, at the upper San Miguel Watershed (SMW) in central Sonora State, Mexico. The community of Rayón at the mid-watershed was included in the original proposal, but after a rapid rural appraisal, it was found that gold and uranium mining were still under exploration, and no active mine was operating in the site.

The ecological and socio-economic variables of interest and data sources for the community of Cucurpe are shown in the table below. Several documents and secondary sources were utilized in this research, including a brief literature review whose outcomes guided discourse analysis later on. The lead researcher also obtained direct qualitative data from six semi-structured interviews: a representative from one of the three mining associations in Sonora State, two leaders of the community of Cucurpe and three women in different positions of the mining value chain. The three semi-structured interview guides (for mining representatives, inhabitants of the mining community and women working in mining), as well as the informed consent are included in Spanish in Annex A of this document. More interviews with representatives of Las Mercedes Mine in Cucurpe were intended, but one of the informants did not answer several follow-ups and requests made by the lead researcher to participate in this study after the first contact, and after sending him the interview guide for approval of his superiors, and the other informant indicated that she could not answer interviews about her job at the mine. The difficulty to access direct data from mining representatives is further indicated below, in the section about challenges of the research.

From this exploratory project, another larger research proposal on rural water security, mining, and global change in this region was submitted and approved in August 2018 by the Mexican Program for the Professional Development of Professors in Higher Education (*Programa para el Desarrollo Profesional Docente para el Tipo Superior, PRODEP*). This research project is active from August 2018 through August 2019 and will complement the findings of this N-Gen funded research.

Table 1. Research variables and methodological strategies for data collection and analysis

| Dim. | Variable | Source / strategy | Analysis |
|----------------|--|---|--|
| Socio-economic | Women’s labor market participation in mining companies in the area (quantitative). | Official statistics and direct consultation with representatives of the mining sector. | Descriptive analysis, graphical organization of data for years 2004, 2009 and 2014 in Microsoft Excel® |
| | Challenges and benefits of mining employment (qualitative & quantitative). | Interviews with women in mining, supported by literature review. | Discourse analysis using categories derived from literature review in ATLAS.ti® |
| | Changes in work organization in households and communities (qualitative & quantitative). | Interviews with participants in mining, representatives of the sector, and supported by literature review. | Discourse analysis using categories derived from literature review in ATLAS.ti® |
| Ecological | Intensity of water and land resources use (quantitative). | Rights concessions obtained from government records (National Water Commission, and the Mining Agency within the Mexican Ministry of Economy) and secondary data sources (CartoCrítica.org & Heinrich Böll Stiftung for Mexico, Central America and the Caribbean). | Descriptive analysis of secondary data using Microsoft Excel® |
| | Policies for environmental protection related to mining (qualitative & quantitative) | Direct consultation with representatives of the mining sector, and documentary review of frameworks for the mining sector (official sources). | Documentary review and discourse analysis using ATLAS.ti® |
| | Estimated environmental effects according to community perception (qualitative) | Interviews with participants in the community. | Discourse analysis using categories derived from literature review in ATLAS.ti® |

4. Cucurpe and Las Mercedes gold/silver underground mine (Premier Gold)

4.1. Cucurpe

The municipality of Cucurpe is located between 600 and 2,100 meters above sea level (m.a.s.l) (INEGI 2009) approximately at 235 km to the northeast of Hermosillo, the capital city, and less than 140 km south of the United States-Mexico border. Virtually all of the almost 1,570 square kilometers that constitute Cucurpe’s territory lie within the Province of the Sierra Madre Occidental (99.84%). In hydrological terms, 93.81% of the municipality is located within the San Miguel Watershed (SMW), a sub-basin of the Sonora River Basin (SRB) (INEGI 2009). Precipitation oscillates between 300 and 600 millimeters per year on average, while average temperatures range between 14° and 20°C. Up to 2009, 2.19% of the municipality’s lands were agricultural; and most of irrigated arable lands were in the riparian area, along the two main tributaries of the San Miguel River: the Dolores River and Saracachi River. From the main streams of the rivers, water is diverted into the *milpas* through an *acequia* channel system administered by local bodies called “irrigation units” (Lutz Ley 2016).



Figure 1. Partial view of Cucurpe along the San Miguel River (Photo credit: America Lutz, September 2018).

Land tenure is distributed between private and social property. Social property refers to common land administrated through *ejidos* and *comunidades*. The *ejido* is a form of collective land concession created by governmental decree and established in the Article 27 of the Mexican Constitution of 1917. The *comunidad* is a traditional land tenure form based on self-organization of early land colonizers (INEGI 2016b).² In Cucurpe, 26% of the municipal territory is occupied by social property, which includes two *comunidades* (Cucurpe and San Javier), and one *ejido* (6 de enero). The mine studied for this case study is located on private lands.

Table 2. Social property of land in the four main municipalities of the San Miguel Watershed

| Municipality in the SMW | Municipal area (hectares) | Land area managed by <i>ejidos</i> and <i>comunidades</i> (hectares) | % Municipal land managed by <i>ejidos</i> and <i>comunidades</i> | Number of <i>ejidos</i> and <i>comunidades</i> | Number of members of <i>ejidos</i> and <i>comunidades</i> | % of municipal population represented by members |
|--------------------------|---------------------------|--|--|--|---|--|
| Cucurpe | 156,799.00 | 40,448.91 | 26% | 3 | 368 | 38% |
| Opodepe | 223,709.00 | 49,568.15 | 22% | 6 | 757 | 26% |
| Rayon | 88,036.00 | 32,503.90 | 37% | 5 | 641 | 40% |
| San Miguel de Horcasitas | 111,983.00 | 52,857.53 | 47% | 4 | 518 | 6% |

Source: Lutz Ley 2016

² INEGI 2016b. Catastro de la propiedad social. Antecedentes. Available at: <http://www.inegi.org.mx/geo/contenidos/catastro/presentacionpropiedadsocial.aspx> (Access: November 20, 2018).

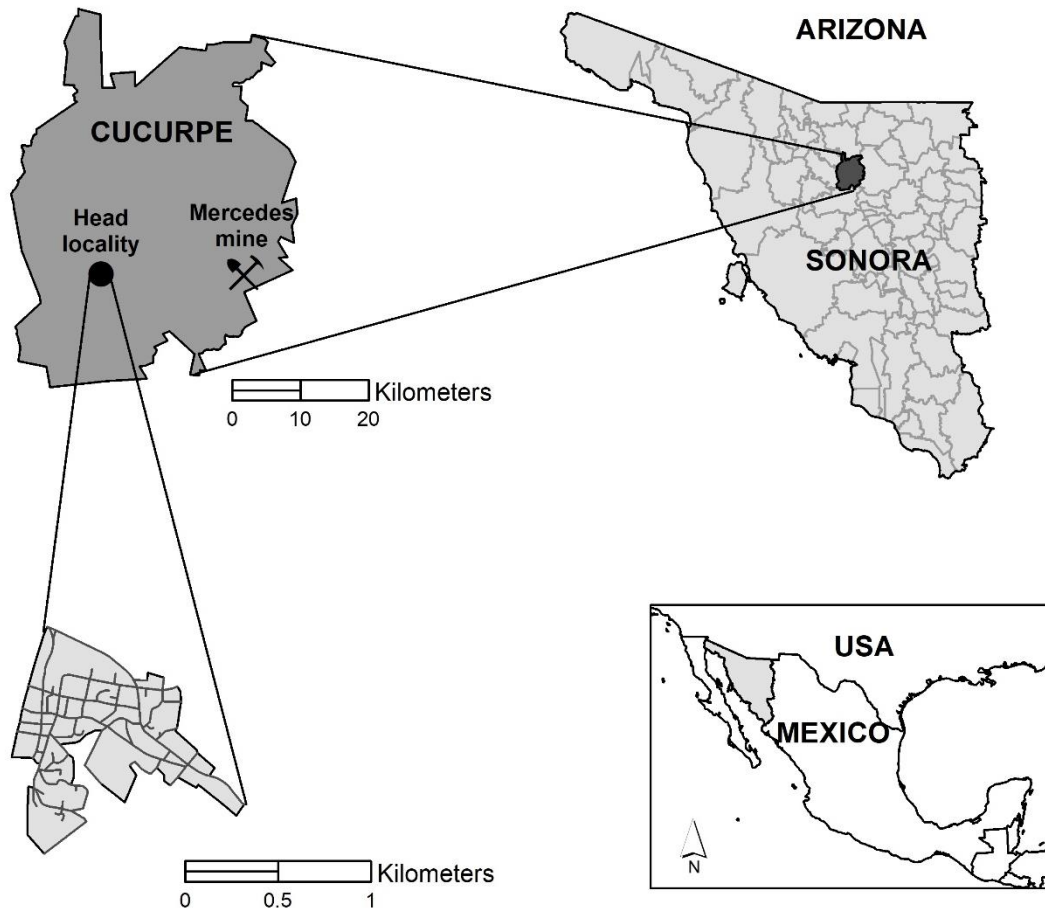


Figure 2. Location of Cucurpe and Las Mercedes Mine (Credit: P.A. Reyes-Castro).

In 2015, a total of 965 people lived in 308 households in the entire municipality, concentrated mostly in the head locality with the same name. From the municipality’s total population, 55.3% are men, and 44.7% are women (INEGI 2015). Livelihoods in the municipality are mainly agrarian (agriculture and ranching) with a smaller contribution of mining and tertiary activities, mostly by local shops and people who work at shops, restaurants, hotels and manufacturing plants in Magdalena de Kino, a 31,000 people “*pueblo mágico*”³ town located less than 50 kilometers to the northeast of Cucurpe, and accessible to the Cucurpeños by a single paved road that is also used by the contractors and operators of the Las Mercedes Mine. The presence of similar types of livelihoods has been previously documented for Cucurpe by Sheridan (1988).

³ *Pueblos Mágicos* is a Mexican federal government program by the Ministry of Tourism in which Mexican towns with remarkable history and cultural traits are given a special denomination together with grants for the development of local tourism services, such as hotels and restaurants. In Sonora, only Magdalena de Kino and Álamos in the southern part of the State, are *pueblos mágicos*.

4.2. Las Mercedes Mine

According to a 2014 technical report released by Yamana Gold Inc., the history of the explorations and development in the Mercedes Mining District (MMD) goes back to late 19th- early 20th century. The most recent known mining was conducted by the Montanan Anaconda Copper Company in 1937 (extinct in the 1980s), the Mexican governmental agency *Fondo Minero* (Mining Fund) in 1994, the Canadian Gerle Gold Ltd in the 1990s, the Irish Mogul Mining Ltd also in the mid-1990s, and finally the *Minera Sortula* (from the Canadian Campbell Chibougamau Mines Ltd) around the years 1999-2000. In 1993, also the Nevada FMC Gold (the antecessor of Meridian Gold Ltd.), started explorations in the Mercedes and Klondike sites, both within the MMD, as part of a regional exploration program. The surface and underground mapping and sampling were completed by Meridian in 2000, and the drilling started in 2001. Further explorations were conducted up to 2005 with successful findings, and drilling expanded in 2006-2007, when Yamana Gold, a Canadian gold mining company that was founded in 2003, acquired Meridian's Mines at the MMD (Yamana Gold Inc., Technical Report, 2014).

The MMD in 2014 consisted of approximately 64,613 hectares covered by 40 mining concession titles by the Mexican government within the municipal boundaries of Cucurpe, 250 km northeast of Hermosillo, and 300 km south of Tucson, Arizona. These titles were valid for a period of 50 years and were owned by the mine Meridian Minerales S. de R.L. de C.V., a subsidiary of Yamana Gold Inc. In September 2016, Premier Gold Mines Ltd acquired Las Mercedes from Yamana Gold. In their 2018 Technical Report, Premier Gold Ltd reported a concessioned area of more than 69,000 hectares, covered by 43 titles. At the year of the purchasing (2016), Mercedes had produced 22,760 ounces of gold and 97,991 ounces of silver (approximately 645 and 2,778 kilograms respectively) (Premier Gold Ltd., Press Release, January 12, 2017). In 2017 Mercedes produced approximately 82,600 ounces of gold and 338,000 ounces of silver (approximately 2,342 and 9,582 kilograms respectively) (Premier Gold Ltd., Technical Report, 2018).

The Mercedes Mine within the MMD is an underground gold/silver development with a mechanized decline access to three separate mines: Mercedes, Klondike and Lagunas-Barrancas. The ore is hauled by a dump truck to stockpiles near the portal. Then is processed in a grinding and gravity circuit, before the Counter Current Decantation (CCD) agitated leach circuit and the INCO SO₂/air cyanide destruction circuit, which produces gold doré. Up to 2014 the plant operated at a capacity of 1,900 tons per day (tpd), although the planned production rate at the time of the Yamana Technical Report was 2,000 to 2,100 tpd (Yamana Gold Inc., Technical Report, 2014). Currently, the processing rate is 2,200 tpd (Premier Gold Ltd., Technical Report, 2018).

The entire operation unit includes:

- Declines and underground series of levels connected by ramps.
- A 2,200 tons per day crushing plant and mill.
- Tailings storage facility (tailings dam or *presa de jales*).
- Administrative building, laboratory, warehouse, and shops.
- Sufficient water supply using mine dewatering and purchased water rights.
- Electric power supply provided from Magdalena de Kino by a 65 km, 115 kV line.

The processing facilities at Mercedes are based on conventional Merrill Crowe process for recovery of precious metals as follows: 1) three-stage crushing with closed circuit tertiary crushing operating at 1,900 tpd; 2) mill in closed circuit with cyclone classifiers; 3) gravity concentration; 4) agitated leach; 5) counter current decantation; 6) Merrill Crowe precipitation; 7) smelting; 8) tailings detoxification, and 9) tailings disposal (Yamana Gold Inc., Technical Report, 2014).

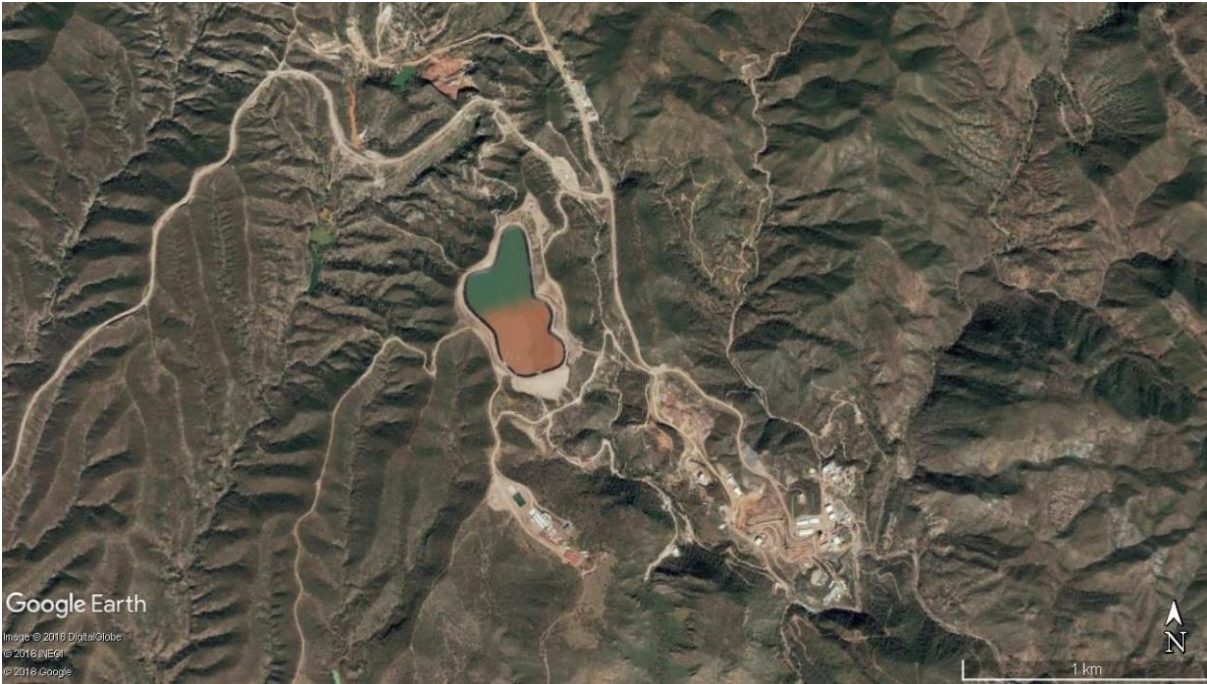


Figure 3. Satellite view of Las Mercedes Mine (Source of image: Google Earth© 2018).

5. Results

5.1. Literature review

The first part of the research consisted of a brief literature review of research regarding gender, mining and socio-economic and environmental dimensions of sustainability. For this purpose, searching was conducted in online databases provided by El Colegio de Sonora, the University of Arizona (two visits to the main library at the campus in Tucson), and in Google Scholar, utilizing combinations of the searching terms “gender”, “mining”, and “sustainability” in the abstract and titles. A total of 81 materials were identified including research articles (63), books (7) or book chapters (1), policy reports and white documents produced by the mining sector, academia and international agencies (9), and a doctoral dissertation (1).

Three issues should be noted: a) studies in the global north are very rare, as most of extractive industries with important socio-economic and environmental visible effects are located in the global south; b) many of the 81 materials found do not integrate an explicit gender dimension (only 58 did), but were still included because of their capacity to illuminate other aspects of sustainability pertinent to this research; and c) there is a difference between large-scale, commercial

mining and Artisanal and Small Scale Mining (ASM). The second type usually attracts more women as workers, especially in developing or poor countries. From the 81 materials, 15 deal with ASM, 58 with large-scale commercial mining, and eight were unspecific in this regard or included both types of mining. This study focuses specifically on gendered issues of large-scale mining. Very little is known about ASM in Mexico in general, and Sonora in particular, which could be an important research vein in the future.

The materials refer to gender, mining, and sustainability in African countries (23), the Americas (30), Asia (7), Europe (1), or Oceania (7). A portion were materials on multiple regions or conceptual papers with no specific geographic reference (13). Only nine of the materials consisted of studies or publications focusing on these issues in Mexico; and from these, only four included an explicit gender dimension.

From the total 81 materials, 18 were chosen and fully revised beyond title and abstract based on their inclusion of a gender dimension in large-scale mining and that were empirically revealing of the Mexican situation in terms of mining, gender and sustainability. This focused revision led to the identification of: a) contextual factors that can enhance or hinder large-scale commercial mining and further its social-ecological gendered impacts (see Table 3); b) effects on social-ecological dimensions in the mining communities and rural gendered livelihoods (see Table 4); c) actions performed by actors in the mining sector or the communities in response to large-scale mining (see Table 5); and d) gendered experiences and impacts of mining on women (see section 5.3 below). In all cases, the concepts and models revealed by literature guided the discourse and documentary analysis that follows in this report.

In terms of contextual factors enhancing (+) or hindering (-) large scale mining developments and gendered implications on communities, these were grouped according to their features as physical/natural factors, economic/technological, or social/institutional (see Table 3). Almost all the materials coincided in the important role of policy and market changes during the second half of the 20th Century as drivers of large-scale mining developments in the global south. Historically speaking, many of these places have been affected by mining in one way or another; but it was until global demand for materials increased and combined with liberal policies that opened up the access to natural resources, with the technological possibilities to extract them at a commercial rate, that mining started to have a much more intensive character, broadening the scale and scope of its impacts. On the social side, the lack of appropriate public services and infrastructure, as well as limited livelihood options for men and women in rural communities, make easier for mining companies to encroach in the communities with almost no opposition or resistance by its inhabitants. This seems to be the case in Cucurpe, where the invisibility of the underground mine, its relative remoteness, and its community support programs made it a desirable partner more than a potentially harming industry (although the 2014 spill disaster in the neighboring Río Sonora was mentioned by some people in interviews conducted by A. Lutz in 2016 and 2018).

The factors that hinder large-scale mining developments are also more frequently found in the social/institutional dimension. The strength of the social capital and the social fabric in a community, and the presence of a highly valued “sense of conservation”, were frequently

mentioned as factors that difficult the advancement of mining into the communities’ territories. In terms of gendered dynamics, the lack of land and water rights by women prevented their full participation in decision-making and negotiations over natural resources with the mine companies.

Table 3. Contextual enhancers (+) or limiting factors (-) for large-scale commercial mining development with gendered implications for communities

| Physical/Natural | Economic/Technological | Social/Institutional |
|---|--|---|
| Important mineral reserves in the country (+) | Period of operation of the mine (+) | Lack of public services in the communities with mining (+) |
| Type of mineral reserve and availability of the corresponding infrastructure for geomorphology of reserve (- and +) | Increasing international demand of metals in emerging and developing economies (+) | Liberal institutional reforms (+) |
| Distance between the mine and the human communities (- and +) | Expanding dynamics of capitalism in mining (D. Harvey’s accumulation by dispossession) (+) | Lack of water and land rights by women (+) |
| Decreasing precipitation (-) | New, cheaper, and more powerful and intensive technologies of extraction (+) | Social practices that limit capacities of women for resources’ decision-making (+) |
| | Poverty and lack of investment in the communities where mining operates (+) | Lack of information and information’s transparency in the mining sector regarding impacts (+) |
| | Lack of policies in rural communities for women’s and men’s livelihood diversification (-) | Low educational levels in the community (+) |
| | | Indigenous prevalence in the community (- and +) |
| | | A consciousness about territory’s local appropriation (-) |
| | | History of social movements defending local interests (-) |
| | | Elevated sense of nature’s protection by communities (-) |
| | | Collective land tenure (-) |
| | | Strong social fabric and local organization (-) |
| | | Increasing violence in Mexico (-) |
| | | Feminine and masculine participation in labor unions (-) |
| | | Environmental protection laws (-) |

The effects on socio-economic and ecological sustainability found in literature were also divided in three dimensions, as in the case of contextual factors above: physical/natural, economic/technological, and social/institutional and those fostering sustainability (+) or hindering it (-) were indicated (see Table 4). In this case, the physical/natural effects mentioned in the literature are all negative, except for punctual conservation policies and programs that mining companies sometimes perform in the regions where they are located. For example, in Sonora, Grupo Mexico has a strong reforestation program and a conservation program for the endangered species *Canis lupus baileyi* or Mexican wolf. However, it is debatable how much this type of

punctual actions can counteract the degradation of entire ecosystems when landscape modifications and water impacts are profound.

In socio-economic terms, the investment by the mining companies in services and infrastructure in the communities is also frequently indicated in the literature. In some case, mines’ programs are entirely beneficial (i.e. building schools or health centers), but in other cases, these effects are, in the best case, a double-edged sword for the long-term sustainability of the community. For example, building a paved road connects communities with their surroundings, enhancing commercial exchange and opening economic and educational opportunities for the habitants, but also fosters in-migration into rural communities, which usually do not have the capacity to provide public services at the rate of migration increases. Higher incomes in the community and new job openings are among the strongest arguments by mine companies and the governments to welcome mining operations in rural communities; however, many times this can produce some sort of “poverty with money” situation (Salazar and Rodríguez 2015). Increasing incomes due to household’s participation in mining in developing countries can be associated to lifestyles of low quality with high consumption when they are not accompanied by other capacity-building, sustainable development, and educational programs in the communities.

When referring to social-ecological sustainability, another very frequently mentioned effect in the literature is the losing of traditional agrarian livelihoods of women and men when mining operations take important portions of land and water resources. In the case of women, because they do not access easily to alternative rural livelihoods or even a job in mining, the losing of land and water for domestic and economic activities can transform their situation into one with much less security, autonomy and empowerment (both economic and natural).

Finally, another set of effects occur over the social and institutional functioning of the communities. The conflicts for resource control and access can lead to polarization between those in town that access money from mining, and those who do not. In turn this is associated in literature with disintegration of social fabric and decreasing social capital, as well as increasing social problems related to higher incomes (from the economic dimension) and higher in-migration, such as alcoholism, drug addiction, sexual diseases, and violence. Summarizing this analysis of mining effects, with mining presence in rural communities there is an improvement in local access to human and produced capital, while access to natural and social capital decreases (Bury 2004).

Table 4. Effects that can decrease (-) or increase (+) socio-economic and ecological sustainability in the mining rural communities with special focus on gendered livelihoods

| Physical/Natural | Economic/Technological | Social/Institutional |
|---|--|---|
| Environmental protection policies by mine companies (reforestation, protection of endangered species) (+) | Mining companies’ investment in local development and infrastructure (+) | Development of training and human resources (+) |
| Impacts on water quality and quantity (-) | Improvements in the households’ infrastructure and goods (+) | Influence on social networks within the community and between this and outside actors (- and +) |
| Losing lands of agricultural quality for food production (-) | Increasing income in households directly or indirectly connected to mining (- and +) | Social conflicts for mines’ affectations on natural resources (- and +) |

| Physical/Natural | Economic/Technological | Social/Institutional |
|---|---|---|
| Landscape affectations and decreasing biodiversity in flora and fauna (-) | Impacts on rural agrarian livelihoods (- and +) | Internal social divisions in rural communities by economic polarization due to differential access to mining income (-) |
| Effects on health due to punctual risks associated with mining (dust and water pollution) (-) | Displacing of agrarian livelihoods for mining employment or land rent collection (- and +) | Accelerated demographic growth (due to migration mostly) (-) |
| Increasing trash production and disposal due to higher incomes and consumption in communities (-) | Decreasing food and economic security among agrarian households (-) | Increasing rates of alcoholism and violence in households with higher income from mining (-) |
| | Increasing land prices due to mines' demand and impacts on farmers' access to arable land (-) | Changing purposes of local land management institutions (from managing food production to monopolize land rents) (-) |
| | Decreasing economic autonomy of women whose livelihoods are affected by mining (-) | Competition and conflicts for water among sectors (-) |
| | | Increasing sicknesses and professional risks for miners (-) |
| | | Increasing risks of sexual diseases for increased promiscuity in communities with high male miners' presence (-) |
| | | Erosion of indigenous/native lifestyles and worldviews (-) |
| | | Psychological and sociological problems in communities due to miners' sicknesses and deaths (-) |

Finally, in terms of actions by actors involved in the mining-community dynamics, the literature indicated mostly actions performed by community's habitants that consisted in political mobilization to stop mining advancement in their communities (see Table 5). In doing this, usually habitants organized socially and looked for support from the government and/or NGOs. In these movements, women are particularly noticeable as leaders or political actors defending their territories and livelihoods.

Table 5. Mitigation actions by actors involved in the mining sector and the communities, which are performed to foster mining (+) or to hinder the activity and its effects (-)

| Economic/Technological | Social/Institutional |
|--|---|
| Livelihoods' diversification (- and +) | Dialogues with the government (- and +) |
| | Creation of labor unions with varying degrees of feminine participation (- and +) |
| | Gender equity policies by mining companies (- and +) |
| | Cooperation with the mine corporations (- and +) |
| | Protesting and advocacy against mining (-) |
| | Formation of associations to pursue legal actions (-) |
| | Searching for governmental institutional support (-) |
| | Searching for non-governmental support (mostly legal and in advisement) (-) |

5.2. Mining in Mexico and Sonora

5.2.1. Socio-economic features: a subcontracted sector

Mining is an important component of Sonora’s economy since, at least, colonial times. Mining contributes 17% of the state’s GDP (Sonora State Government 2018).⁴ According to the last available report by the Mexican Geological Service (SGM 2017), and confirmed by interviews with representatives in the sector, Sonora has more than 40 plants for processing metallic and non-metallic minerals, and the total processing capacity in the state is around 200,000 tpd that, up to December 2017, was operating at the 90% of this capacity.

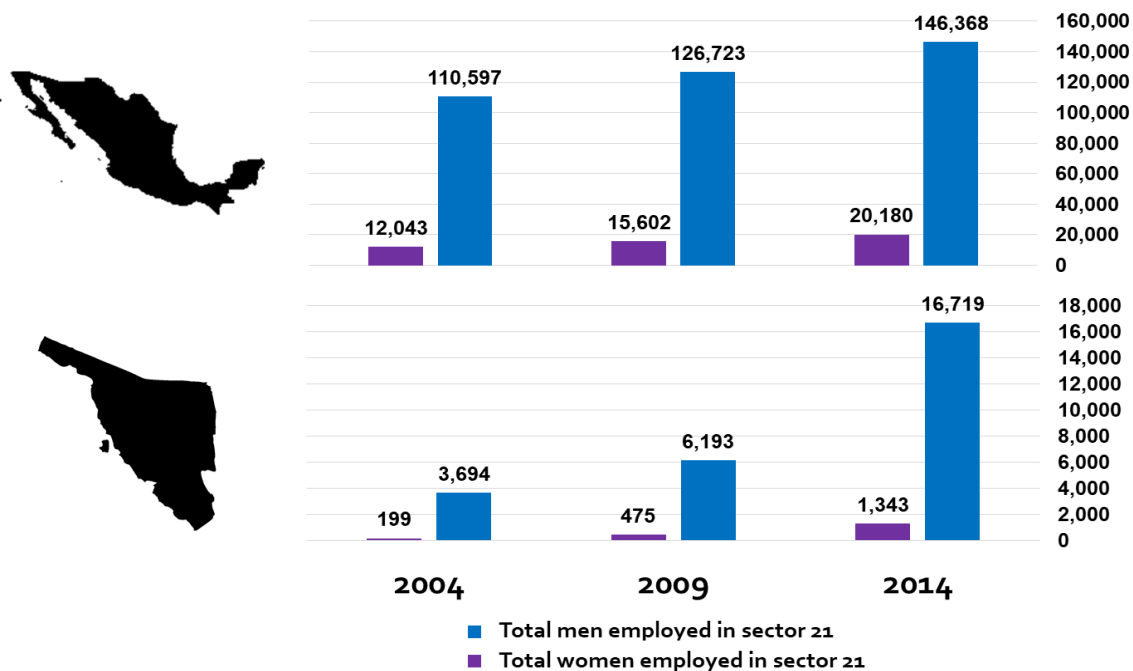


Figure 4. Men and women’s participation in the mining sector (Source: elaborated by author with data of INEGI’s economic censuses of 2004, 2009, and 2014).

According to the economic censuses conducted by INEGI in 2004, 2009, and 2014, the number of people employed in the mining sector (sector number 21, according to the national classifications) has progressively increased for both, feminine and masculine participation, which happened for almost all the economic sectors in this period (except by primary activities, such as agriculture). The upper part of figure 4 presents the number of men and women employed in the sector from 2004 and 2014, and the lower part shows these numbers for Sonora State in the same years. Although mining has shown a notable growth in general, the number of women working in mining in Sonora has doubled twice in these 10 years (from 2009 to 2014 it increased more than

⁴ Ministry of Economy of Sonora State. 2018. *Sonora en la Minería*. Available at: <http://economiasonora.gob.mx/portal/minero> (Access: November 19, 2018).

100%), which has not happened in the case of the entire country. This in part reflects the dynamism of the mining sector in Sonora, and probably points to its high integration into global markets, because the growth is accompanied by important participation of international companies (SGM 2017), with more dependency on global demand requirements and supported by highly specialized processes and technologies. Technologies that foster a mining more dependent on capacity and training than on physical effort, make more probable for women to integrate into the production process. The gold mine with the largest feminine participation in Mexico is actually La Herradura, located in San Luis Río Colorado, in northwest Sonora (Belasko 2014).

Figure 5 supports this argument from another point of view. In this case, we show the proportion of men and women employees that depend on the mining company’s name and those who do not. This is a measure of the outsourced services and goods accompanying the mining activities in Mexico and Sonora. Again, the Sonoran numbers present a different situation from the entire country: while in Mexico, in general, the numbers of people out of the contractual responsibilities of mining companies have increased progressively and proportionally, in Sonora, since 2009 there seems to be an abrupt change of conditions and around half of men and women that work in the mining sector are hired for subcontracted jobs.

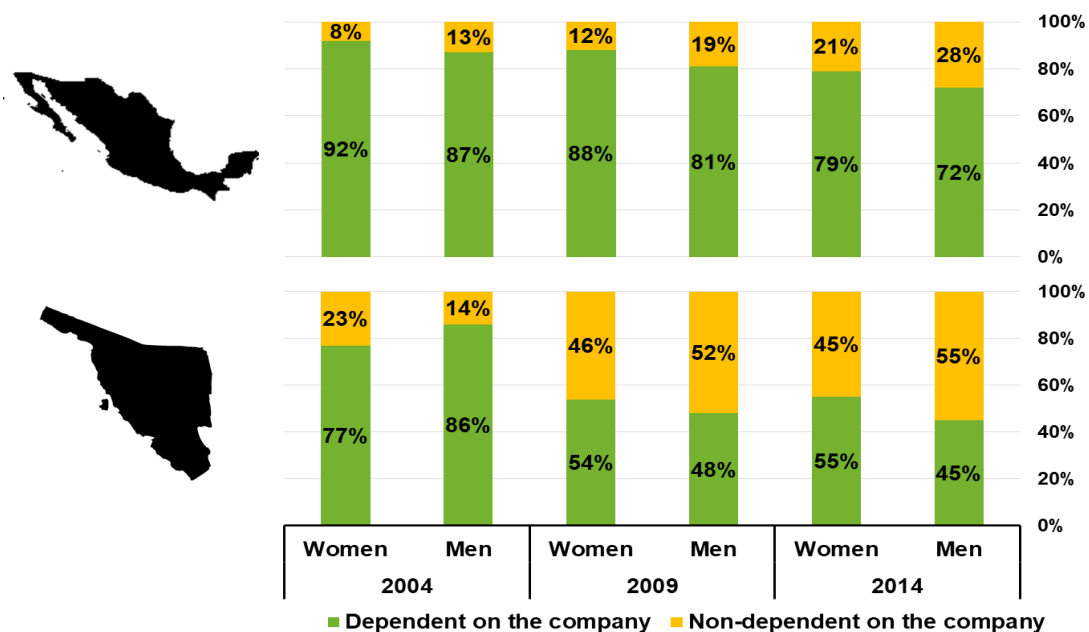


Figure 5. Men and women’s participation depending on their dependency on the mine company’s name (Source: elaborated by author with data of INEGI’s economic censuses of 2004, 2009, and 2014).

This means, among other things, lower salaries and less job security for outsourced people, as well as lack of long-term job benefits, such as retirement, health insurance, and social security services. In interviews conducted by A. Lutz in 2016, a woman working for one of these subcontractors of the Mercedes Mine, indicated that she had worked for “the same” cleaning company, but that this company had changed names a couple times, suggesting that no long-term contracts (and therefore no long-term job benefits) were available for the employees, even though

they were continuously hired. Interestingly, these employees were mostly medium-age and older women, with low educational levels (the woman answering the interview in 2016 did not know how to read or write) and from low socio-economic strata. Nonetheless, according to figure 5, in 2009 and 2014 there were more men than women non-dependent on the mine company’s name.

The Mercedes Mine in turn had a total of 715 employees working in their operations in 2017, but from these only 428 (60%) were dependent on the company’s name and 287 (40%) corresponded to outsourced manpower (see Table 6). Unfortunately, no gendered data was obtained from the company itself since the representative of the mine contacted for an interview did not answer the follow up communications of the PI, and the person contacted in the mine’s human resources department was not able to answer the interview either.

Table 6. Employees of the Mercedes Mine in 2017 (Premier Gold Ltd.)

| Department Description Summary | Owner Dec – 2017 | | Contractors Dec - 2017 | | 2017 Totals | |
|--|---------------------|------------|---------------------------|------------|-------------|------------|
| | Budget | Actual | Budget | Actual | Budget | Actual |
| Mining | | | | | | |
| Mine Operations | 181 | 164 | 315 | 287 | 496 | 451 |
| Mine Maintenance and Services | 43 | 47 | | | 43 | 47 |
| Paste Plant | 26 | 22 | | | 26 | 22 |
| Geology | 29 | 22 | | | 29 | 22 |
| Engineering | 21 | 15 | | | 21 | 15 |
| Mining Subtotal | 300 | 270 | 315 | 287 | 615 | 557 |
| Process Plant | 105 | 95 | | | 105 | 95 |
| General and Administration | | | | | | |
| Management and New Projects | 5 | 3 | | | 5 | 3 |
| Health, Safety, Environmental & Security | 20 | 19 | | | 20 | 19 |
| Accounting (IT, Human Resources, Legal) | 26 | 26 | | | 26 | 26 |
| Purchasing/Warehouse | 19 | 15 | | | 19 | 15 |
| G&A Subtotal | 70 | 63 | | | 70 | 63 |
| Project Totals | 475 | 428 | 315 | 287 | 790 | 715 |

Source: Premier Gold Ltd., Technical Report, April 2018, chapter 21, p. 6

The municipal authority of Cucurpe interviewed in this research (September 08, 2018) indicated that approximately 40 to 50 people from the town were working at the mine in 2018 dependent on the company’s name, and other 50 Cucurpeños were subcontracted, which totals around 100 people from Cucurpe working at the Mercedes Mine. A miner woman working there also confided that the mine originally had “given a chance” to many more miners from Cucurpe, but later several of them were not able to keep working because they did not pass the antidoping and breathalyzer testing that the mine conducted from time to time without warning. In her words, these procedures were necessary due to the high security standards of an underground installation like Mercedes. She opined that the firing of Cucurpeños was due to their personal lack of responsibility, “...we had never been subject to this much responsibility, I think (...), of a schedule like the mine’s one. You should have a lot of responsibility and dedication to mining. And they (the mine authorities) are very strict with security issues. That’s why a lot of people got fired”. (Miner woman from Mercedes, interview on September 09, 2018).

5.2.2. Environmental features: land and water for mining

- *Land*

This section deals with the land and water rights in Sonora and the San Miguel Watershed municipalities for mining activities, and the potential social-ecological implications that this has for the sustainability of the watershed system. Overall, up to August 31 of 2016, there were 5,974 land title concessions for mining, covering 5,548,707.0723 hectares, or approximately one third (29%) of Sonora State's territory (SGM 2017). A concession title is needed any time that a company or individual wants to explore, prospect or develop an extractive operation in Mexican territory, and this is regulated at the constitutional level by Article 27 (on land tenure), and by the Mexican Mining Law. Not all the territory covered by the titles means active operations, but only land that is authorized to be potentially used for extractive purposes.

In figure 6, we present the map of Sonora with the four main municipalities within the SMW highlighted, and below a graphic with the number of titles issued between 2006 and 2017 for the four municipalities (left axis) and Sonora State in general (right axis). Cucurpe and Opodepe in the upper SMW were the municipalities with the most titles issued in this period in the watershed, which is no surprise considering that they are located at higher elevations in a mountainous landscape. Although the titles have a very irregular behavior; overall, there seems to be a decreasing trend. Importantly, the years of 2007 and 2008 that have peak numbers, are coherent with the economic census of 2009 that shows the shift in outsourced human resources in the mining sector in Sonora. Also, in Hermosillo, it is evident a boom in exploration and building companies and machinery and equipment suppliers for the mining sector during the last decade. From the 5,974 mining titles reported by the SGM (2017), more than 3,000 were issued in this 10-year period. In Annex B at the end of this report we present the numbers of titles issued per year and the actual number of months reported.

The type of land tenure is very important in the analysis of mining property. In the case of the Mercedes Mine, all land belongs to a private ranch "Los Pinos"; therefore, all negotiations and land concessions for the more than 69,000 hectares under the MMD property were treated between private owners and a surface access agreement has been in place since year 2000 (Premier Gold Ltd., Technical Report, 2018). The 43 titles of the MMD are valid for 50 years since the date of issuing. In cases where the land belongs to a community or ejido, this process is more complicated, and literature indicates that strong collective land tenure is an obstruction to appropriation by mining companies. Also, when the collective bodies are highly divided, it is easier for mining companies to negotiate on a one-by-one basis with the landholders. According to the municipal authority interviewed in Cucurpe, the only case in which the Mercedes Mine dealt with collective bodies for land management was during the construction of the power line from the town of Magdalena to the mine site. The line crosses lands of the community of Cucurpe and several private ranches. However, the informant said that the mine compensated economically to each landholder to allow the power poles to be installed in their lands.

The municipal representative also reported that several women landholders ("*comuneras*") also participated in the decision-making process, and that they were good at negotiating their rights

(“*ellas no se dejan*”). However, according to the database of the National Agrarian Registry (Registro Agrario Nacional, or RAN) less than one fourth of all members of ejidos and comunidades in Mexico are women, and Cucurpe is no exception.

The lack of legal access to land and water rights by women is an obstacle to negotiate their interests and benefits with mining companies even if their livelihoods and their access to critical natural resources can be compromised by the presence and operations of those. This is the same case of landless men that cannot negotiate either, but whose environment and general wellbeing in their communities could be equally affected.

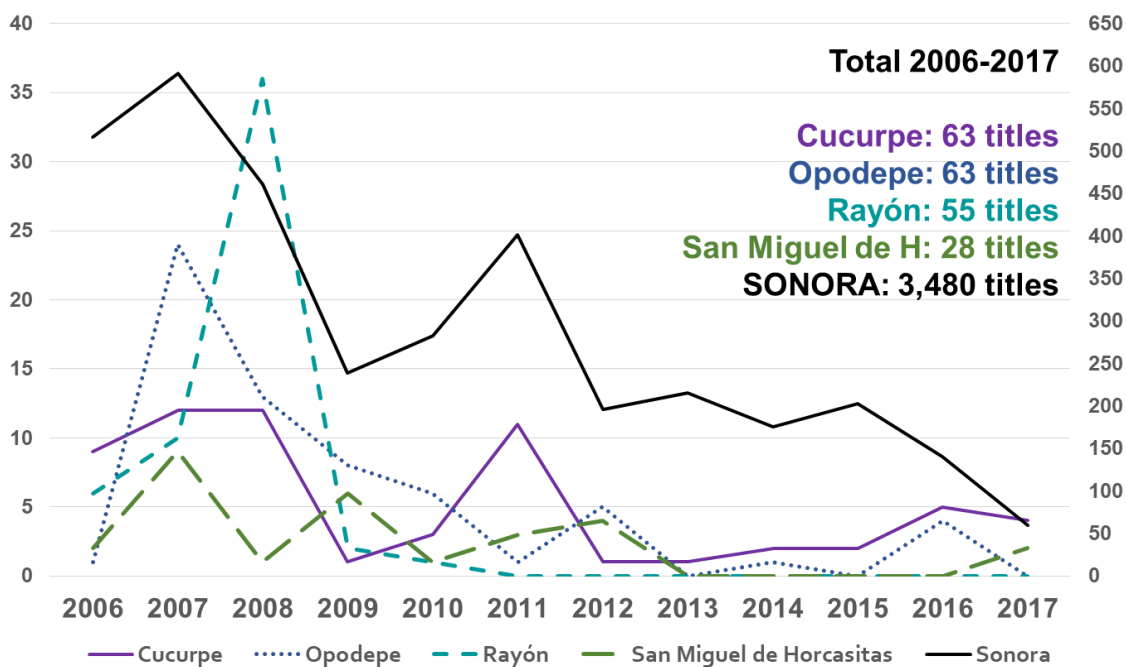
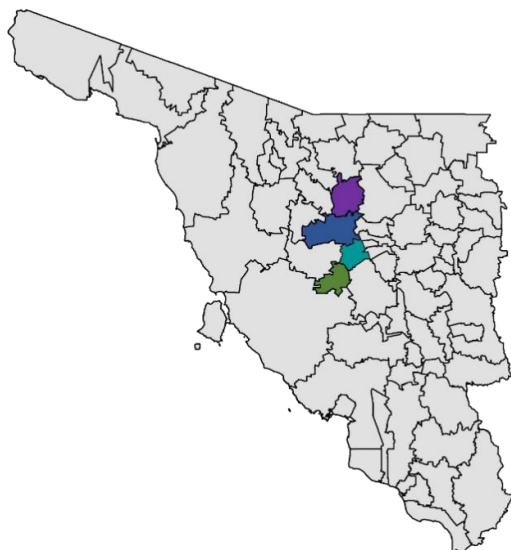


Figure 6. Land title concessions for mining in the municipalities of the San Miguel Watershed (including Cucurpe) 2006-2017 (Source: elaborated by author with data from the Ministry of Economy. Map credit: P.A. Reyes Castro).

- *Water*

The water rights situation of the mining sector is much less clear than their land rights. Several difficulties arise when trying to calculate water consumption by the mining sector because mines can have rights under several categories of uses: industrial, multiple or diverse uses, services, among others. There is no specific category to nominate “mining” uses. They can also have discharge permits attached to their water rights titles. Another problem is that the Public Registry of Water Rights (REPDA in Spanish) managed by the National Water Agency (CONAGUA), lacks systematic updating of titles (purchases, rights’ extinctions and newly issued rights are not registered right away), and the surveillance of compliance is very weak (Lutz Ley 2016).

The organization CartoCrítica.org together with Heinrich Böll Stiftung for Mexico and the Caribbean, conducted a study on water consumption in the mining sector by using data from REPDA in 2014.⁵ The main findings of this analysis were that the mining industry in Mexico has 1,036 right titles distributed among 417 mining companies, who are grouped in 230 mining corporations. They extracted around 437 Million cubic meters (Mm³) of water in 2014. This is enough to cover human demands of the entire populations of Baja California Sur, Colima, Campeche and Nayarit during the same period, or approximately 3,229,000 people. Half of the total volume concessioned for mining was extracted in only three states: Sonora (202 titles, 107.9 Mm³/year), Zacatecas (98 titles, 55.8 Mm³/year), and Michoacan (9 titles, 44.4 Mm³/year). These findings should be taken with reserve, since both organizations indicate the data opacity in the mining sector, the difficulties for identifying mining users and volumes assigned in REPDA, the irregular standards for information treatment in the registry, and the absence of integrated frameworks by the government to report all the pertinent data of resources’ consumption by the mining companies.

In this research, no water titles were found in REPDA under the names of Meridian Minerales, Yamana Gold, or Premier Gold corresponding to the Mercedes Mine in Cucurpe. Only a discharge permit was found georeferenced to the mine under the name of “Minera Meridian Minerales S. de R.L. de C.V.” issued on March 1st, 2013. This allows the company to discharge up to 148.49 m³/day of human effluent generated in their administrative and services buildings. In their most recent technical report, Premier Gold Ltd indicates that the Mercedes project consumes approximately 9,000 to 15,000 m³ of water per month, and that their main sources are the tailings dam, wells, and dewatering from the underground mining areas. The three major consumers are the plant (67%), the offices (17%) and the man camp (16%) (Premier Gold Ltd., Technical Report, 2018, chapter 18, p. 6). The technical report does not give more information on the purchased water rights or whether the water coming from dewatering of the mines is properly registered and authorized under Mexican legislation. No further information could be obtained directly from the mine’s representative either, as indicated above. The technical report of April 2018 describes the dewatering system of the mine as follows:

“The underground dewatering system of the Mercedes mines has been designed to handle an average water inflow of 55 L/s including groundwater and mine activity sources

⁵ Available at: <https://mx.boell.org/es/2016/02/17/concesiones-de-agua-para-las-mineras> (Access: November 20, 2018).

(drilling, washing, etc.). The mine dewatering system for Mercedes was designed by Yamana and consists of a main sump with three 300 hp sump pumps capable of pumping a 120 m head. Secondary 44 kW pumps are located in sumps situated at 60 m vertical intervals in the main ramp system (main level accesses for truck loading). In addition, a series of 15 kW face pumps are used at individual development headings or mining fronts. Mine water is pumped from the secondary sumps up to the primary sumps on the 1040 level and 960 level; and then up to a surface cleaning pond where the water is then transferred to a surface storage pond.”

(Premier Gold Ltd., Technical Report, 2018, chapter 16, p. 24).

Another important water issue is related to the tailings dam. The current dam (see the greenish-maroon pond in figure 3 above), will be at its maximum storage capacity in 2018. Premier Gold Ltd commissioned Golder Associates Inc. to build another tailings dam (tailings storage facility or TSF) adjacent to the existing one. The new TSF will be built in two phases. In the first phase it will have a capacity of 670,000 m³, and in the second phase it will have a capacity of 1,120,000 m³, which is enough for 4.9 years of production (Premier Gold Ltd., Technical Report, 2018, chapter 18, p. 4).

- *Social-ecological effects*

When asked about the potential impacts of mining on the landscape, the social functioning of the town, and its natural resources, a 50-year-old woman who is a local leader and member of the board of the Comunidad de Cucurpe, said that they have not had any issues regarding land or water access and distribution, because the mine has its own concessions. She commented that the mine has not removed rural livelihoods in town, but has actually helped in creating other livelihood options for men, but especially for women.

The inhabitants of Cucurpe have been able to negotiate in-kind benefits, such as support for schools, sports’ teams, scholarships for 34 students that are relatives of the Comuneros, and hours of machine-work for lands and roads. The woman also indicated benefits related to the flux of people working in the mine as subcontractors. For example, the town now has three hostels, stand-alone available rooms for rent, two diners managed by local women, among other small businesses. They now have a gas station (the only one in town), a Telecomm shop, and a water purification shop. With the increase in community’s income connected to mining, in words of the informant, “...things have changed for the better... For example, in the past a woman was limited by the money that her husband gave her. It is not like that now. They (the women) have their cars, they even build their own houses, their own businesses, because many of them work and do business with the money they earn”. At the end, when asked if she wanted to add something else to the interview, she answered... “Nothing. That the mine continues for more years; that it is not over”.

In coherence with the above, in the last technical report, the company states that...

“The Mercedes operation is in production and operating within the environmental framework of Premier. Premier operates under a corporate responsibility program that includes corporate responsibility, community relations, environment, and health and safety (...) Premier has a comprehensive and strong Community Program in the

Community of Cucurpe, Sonora, approximately 22 km west of the Mercedes Mine. Although the mine site is located within a private land, previously purchased from a local rancher, different social and economic programs have been established at the Community of Cucurpe.”

(Premier Gold Ltd., Technical Report, 2018, chapter 1, p. 14).

The municipal official that participated in this study also indicated that thanks to the higher incomes from the mining activities, now more young people can obtain higher educational degrees because families have money to support them to move out of town to study. Before the mine was purchased by Premier Gold, Yamana Gold had a program called “Alliances Seminar” (Seminario de Alianzas) through which the mine called for local applications to support local development and businesses. In this way, many women and men opened shops, such as a tortillería, diners, hostels, or a pharmacy. During the last two years the program has not been active, and he thinks it is due to the change in the mine’s ownership.

In a more social sense, organization of community’s life has changed a little due to the presence of the mine and women’s participation in it. According to the municipal official interviewed, women rely heavily on their social capital (family networks) in order to perform multiple roles as mothers, miners, and community actors when they want to participate in the sector. The informant calculates that around 30 to 40 women from Cucurpe work in the mine, considering both direct and subcontracted employees. Women that work in the mine also use this position to advocate for benefits for the community, such as employment for relatives and support for schools. There is a miners’ union that also serves as a platform to negotiate these community benefits. The informant commented that it is easy to identify those women who work for the mine directly or are subcontracted because they have more disposable income, they can purchase goods for their homes and families, and they even look better dressed than those who work without pay in their homes as housewives or as micro-entrepreneurs or small-scale farmers.

In addition to these local programs and support, at the federal level since 2014 mining companies contribute taxes to the *Fondo Minero*, or Fund for the Sustainable Regional Development of Mining States and Municipalities (Fondo para el Desarrollo Regional Sustentable de Estado y Municipios Mineros). The fund is managed by SEDATU, the Ministry of Agrarian, Territorial and Urban Development (Secretaría de Desarrollo Agrario, Territorial y Urbano), and has the purpose of fostering (or “compensating”) development in regions where the mining companies are operating. In 2014 Cucurpe received \$9.3 million pesos; in 2015 it received \$29.3 million pesos; in 2016 the amount was \$18.8 million pesos; and in 2017, the municipality received \$20.5 million pesos.⁶ In words of the municipal official interviewed, this money is already “tagged” for development of physical infrastructure (roads, public buildings, electric networks, paving, water infrastructure, landfills, etc.) and the people have little or no participation in these decisions beyond indicating their community’s infrastructural needs. At the time of the fieldwork, the researcher witnessed the developments of three of these projects (see figure 7-A, B, and C).

⁶ Available at: <https://www.gob.mx/sedatu/acciones-y-programas/fondo-minero-para-el-desarrollo-regional-sustentable> (Access: November 22, 2018).



A)



B)



C)

Figure 7. Infrastructure development funded by the Fondo Minero in Cucurpe: A) paving of main street; B) hydraulic concrete paving of sloping streets in neighborhoods; and C) Building of roofing and parking lot adjacent to the town’s church (Photo credit: America Lutz, September 2018).

The municipal official stated that the wells for the community and for agricultural production were working regularly, suggesting that up to this moment, there are no impacts on the groundwater table, even though the mine utilizes the water coming from their own underground perforations at the mine’s tunnels. There are two other mining projects in exploration in the municipality: Cerro Prieto and Santa Gertrudis. The second one has been purchasing water from individual right holders in the watershed.

On the other hand, beyond the obvious economic benefits of mining in the locality of Cucurpe, and the lack of prominent environmental impacts, there are social-ecological uncertainties associated to the presence of mining. As a public official, the informant asked CONAGUA what kind of process the federal agency follows to watch over tailings facilities, especially during rainy season, to prevent a potential spill. CONAGUA’s answer to this was that they have satellite surveillance, but the municipal officer is not entirely confident that this is the case... “Who can guarantee us that we won’t have the type of problems that the Sonora River had and have pollution occur here? (referring to the spill of copper leaching solution from the mine *Buenavista del Cobre* in Cananea, in 2014). We want some document that states that monitoring is happening and everything is in order.” However, when asking if he considers a spill from the mine’s tailings dam as an imminent risk, he answered negatively since the mining is already in process of improving the tailings storage, he says, and a spill has never happened in the past.

5.3. Women's lived experience: "We do not break the glass ceiling even if wearing a miner's helmet"...

From literature review and fieldwork it was evident that women participate in the mining sector in diverse ways, each of which has its own set of socio-economic and environmental effects. At least five different roles were identified: 1) women miners, or those who work directly in the production process of the mine (as miners) or in administrative chores; 2) women who work as outsourced human resources for companies that offer services and inputs for mining companies; 3) women who produce and reproduce the domestic sphere in households that have, at least, one miner (a son, brother, husband, etc.); 4) female partners of men working in managerial positions in mining companies; and 5) women who are political subjects or leaders in the mining communities. This study will focus particularly on roles 1) to 3), since the interviews and literature provided the most of information regarding these roles. *However, these interconnected roles can be a promising approach for future studies in the sector. The idea behind the multiple roles is to observe how distinctive labor positions in combination with diverse socio-economic features of women can have varying socio-economic and environmental outcomes.*

5.3.1. Socio-economic dimensions

- *Income and professional development*

Lucía is a 32-year old miner who operates heavy machinery inside the Mercedes underground mines.⁷ She is a mother of two young girls and completed secondary school (9 years of schooling in the Mexican system). When she came to the company around seven years ago, she started doing cleaning chores for almost one and a half years, since she had never worked before in mining activities. However, she says, later the company offered job opportunities and the training for performing those jobs. She considers herself lucky that she was able to benefit from these training opportunities, and she stills try to do that in her job every time that an opportunity arises. Many Cucurpeños were given this opportunity, but fewer remained being employees of the mine because they failed the antidoping and breathalyzer tests that the company applies continuously and unexpectedly as part of their security policies.

For Lucía, one important reason for staying in this job is to provide her daughters with the economic and educational opportunities that she did not have. Her salary as an operator could not be better in any other job in town, considering her educational level and the low availability of jobs for women in rural localities. The payment is relatively high, and she has several benefits (i.e. a full coverage health insurance) because her activities are risky, and the journeys are long. She wakes up every day around 3:40 am, the mine's bus departs at 4:40 am from Magdalena, where she and her husband -also a mine's machinery operator- sometimes stay because their eldest daughter (14 years old) lives there with a relative so she can attend school in Magdalena, while her youngest girl (2 years old) stays with Lucia's mother in Cucurpe. She works from 7 am to 7 pm

⁷ Pseudonyms have been given to protect respondents' identities.

and is usually back home around 9 pm. She is in a 6 x 3 shift, which means working six days with this time schedule and then resting three days. The family goes back and forth between Cucurpe and Magdalena depending on the couple's work shifts and free days.

Under similar working conditions, Marta has played several of the roles in the mining sector during her entire productive life. She has worked for mining companies, both directly and indirectly as a subcontracted consultant. She is also in a leadership position in a Sonoran miners' association, and she is the partner of the director of this association; so, Marta knows the sector in its multiple dimensions, and she states proudly that "I love mining". Currently, she is the president of the mining association ladies' club, a group within the association composed of the wives and partners of the managers and devoted mostly to charitable actions. She says that she is not completely happy with this, since it responds to very traditional worldviews; women should be in managerial and more decision-making positions too. The thing she feels prouder of in this club is the program of scholarships for 51 college students, both men and women, who come from mining communities to study mining and geology-related careers. The best grades, she says, are those of women students: "you have to believe in yourself! Look at these good grades, there is a reason for that" she says to the female supported young students. Marta was a dedicated student herself, completing a bachelor's, and then a social sciences Master's degree, and this has helped her in understanding community's relationships and improving her work as social consultant for mining explorations and operations.

For Marta, as for Lucía, the mining sector is full of professional opportunities for women and men (even for those with a low educational degree), and the pay is incredibly high in comparison with the rest of jobs; but "this is not a job for anyone". It requires a lot of commitment, time, effort, courage, and dedication. It teaches you another work ethics because the job happens in remote places, subject to long journeys, uncomfortable installations and risky conditions. Beyond this, Marta comments that women present in mining occupy usually operational positions, but not the top ones, but this happens in other sectors too... "I have a very bright female friend that works in finance, but she has been long time in the same position without going up" ... "we can't break the glass ceiling yet". In the mining association she belongs to, there are approximately 600 members, from which around 100 are women. She tries to encourage them to speak out, to say what they think and to take leadership, even if the room is full of old men.

- *Empowerment and autonomy*

Knowing that she can move a 22-tons machine with just her hands is something that definitively changes life's perspective, according to Lucía. Marta says that women are really empowered through their work in the mining sector, but that the outside world can be shocking when women go back to it, because... how it comes that a woman can move a huge machine at work and when she is back home has to pick dirty socks up from the floor?

Maybe empowerment and autonomy are two of the biggest achievements that women feel the mining work has given them. Like Marta, Lucía thinks you need to be brave enough to enter an underground mine, therefore, this type of job is not for just any woman, but neither is it for just

any man. One of her biggest changes at the personal level is the capacity for decision-making being practical and strong in character, and, according to her, this comes from being a miner woman.

Also, the high incomes that come with mining are a big factor in building a woman's autonomy from her family or husband. Karla is a 39 years old woman with a bachelor's degree in ecology who recently founded her own consultant firm that serves mining and other types of companies through advisement in topics of social responsibility certifications for the industry. She thinks that her high income when she started her career in mining was among the factors that ended her first marriage; in the first place because it gave her certain "empowered attitude" towards her partner, and secondly, because her former husband was resentful and behaved in a very dependent way because she was the breadwinner of the home, and she could buy a car, wear nice clothes and purchase what she wanted.

In terms of gendered treatment in the mining jobs, Lucía expresses that she has never felt like she was mistreated or treated unequally because of gender reasons as an operator in the Mercedes Mine. She believes that opportunities depend on your performance, not on who you are. However, Marta, in her more managerial position in the mining industry, states that women are not reaching decision-making positions, and this is because women limit themselves due to fear, large domestic workloads, and cultural impositions. Throughout her career, she had to deal with cases in which she entered a masculine environment in managerial meetings and she could feel the rejection and that they treated her as if she were in a lower category, even if she was a manager too. Marta had to demonstrate that she could learn and perform as well as a man in this environment, while defeating prejudice about the emotional tone of women or the incapacity for rough work such as mining. In this sense, she says "the worst bullying I have ever received in my life, came from other women, rather than from men". She remembers when she got a managerial position, some women said to her face "you slept with the boss" (*"le diste las nalgas al gerente"*) for this job... "It has been difficult" to deal with men and women all together, Marta reflects, "... there is a lot of gender discourses out there, good intentions, some gender equality policies in a few companies and society... but when the time comes, we (women) are not considered... I think men do not even notice these things. They are used to doing things their way". Sometimes "people accuse me of being 'aggressive' in my work and communications" Marta says, but it is the way she has learned to be effective in this sector.

Receiving unsupportive and disempowering attitudes from women co-workers has also been experienced by Karla. When she started working for Peñoles, an opportunity for traveling to Chile for training was offered to her because of her good performance. Her boss told her to think about it better because, as she was recently employed, the other women in the department could be angry that she received this opportunity, "because you are the new one, you do not understand this system just yet." She still decided to go, and when she was back in the office, her female co-workers gossiped about her and her "immoral" relationship to her boss. This was very difficult to understand and overcome, she says, because she was very young and naïve. She cried a lot. Karla also remembers not so long ago, in 2010, she was offered another dreamy job in the community relations department of a mine company in central Sonora State. However, when she got to the company to complete paperwork, the manager handed her an agreement promising she won't get pregnant in the next five years, otherwise she could lose the job because of non-compliance. At that moment,

she said to him –“It is not in my plans to be pregnant in the next five years, but I am not signing this because that is a personal decision”. Karla rejected the position altogether and left the office of the surprised manager. “I do not want to work with somebody with such a poor mentality” she concluded.

This type of experience happens to women in other productive sectors too, however, they are more accentuated in the mining sector due to the highly masculinized identity of the field. The experience of women in mining can be progressively improved thanks to more open leadership styles, something that is coming slowly but continuously to the mining sector, thanks in part to generational changes. For example, Mariana, another woman in a managerial position in a mining association, shared during a WIM workshop that the PI attended, that when she was first hired by a large mine in northern Sonora, she was invited to one of the executive meetings. The room was full of older engineers. When the manager introduced her, one of them, without even looking at her once, questioned the manager “has she seen the mining installations yet? ...” the manager responded “I think she knows them better than you do” (“*creo que las conoce mejor que usted, ingeniero*”). The shift in attitudes can be encouraged by managers in this way, a factor that literature has highlighted as a game changer for women in the sector. Karla and Marta indicated that support from their superiors was important in achieving higher positions, but also said that for women it is several times more difficult than it is for men to access these places because of all the physical, but mostly cultural and psychological barriers they had to overcome.

- *Family and social relations*

Lucía needs to rely on her family network to have her young child taken care of while she is working. Also, the household domestic chores are distributed between her, her husband, and her mother. When asked how she manages her several responsibilities as miner, mom, daughter and partner, she expressed “...well, I make myself an octopus (laughing), I “extend” myself. When I am in town (Cucurpe), my mother makes dinner for us (her and her family), she helps us in that way. If that is not the case, my husband and I make dinner. One thing that I have is that my husband helps me a lot”. In terms of social life, it is difficult to keep connections with people with the long workdays at the mine. And the three days that you are free, Lucía mentions, they are for washing clothes, doing household chores, go groceries’ shopping, and being with your family.

Marta says that the mining sector is very demanding of your time “*la minería es muy celosa*” (“mining is very jealous”). She was sure since a young age that she did not want to have children, and this helped her in advancing in her career in mining. For most women who are mothers and miners, it is very complicated because they must run for their children after school and taking them to multiple activities while dealing with very long journeys and sometimes very demanding shifts, unless they receive or hire help. This is also a very hard issue for men who have family, “the youngest male co-workers receive in their cell phones videos of their little girls taking their first steps and their eyes fill with tears... this is a very hard part... they miss all that”. Marta also confides that recently she has seen a lot of single fathers working in the mines and requesting “gender equality” to see their children, go to school meetings, and take them to the doctor. The mines usually allow this for mothers, not for fathers. Mining is a highly masculinized world, and more than that, a very corporatized sector, she says.

Karla was also aware of these dynamics when she worked in mining companies. After her experience in her first marriage, she decided to quit mining and develop consultant activities in searching for a more stable family life because her work in a mine was always very time-demanding and complicated, no matter that the payment was higher. In general, to be a successful woman in mining, as in other economic sectors, a person needs important support from relatives and social networks. Help and a fair share of responsibilities and obligations between them and their partners was pointed as a critical success factor by the three women miners interviewed in this research.

5.3.2. Environmental and health dimensions

In the case study of the Mercedes Mine in Cucurpe, no further environmental effects were reported in the interviews and no displacement of livelihoods was identified so far. On the contrary, according to one of the local woman leaders, the mine's arrival has brought new economic opportunities for the landless women in town. It is questionable if the situation will stay like this, since two other mine projects are under exploration, totaling three mining companies in the municipality. The effects of mining and global climate change on water security and water competition will be explored by the PI in this same region between 2018 and 2019, through another project funded by PRODEP, but fostered by the N-Gen funded exploratory research reported here.

Marta states that it is very important for the mining association she belongs to that academic centers document the successful cases of mining in Sonora, which are out there. For academia, "...mining is the worst, the worst, and the worst (sic), and we are not that bad, you know?" "...it would be interesting for me to have academics study successful cases too". "I had a colleague in FLACSO and I told her: "academic and activists go to the communities with their placards protesting mining companies, saying NO, NO, NO, and then they leave very pleased, leaving the communities all *fucked up* without access to anything, when, in reality, it is completely their decision if they accept a mine or not". "I agree that this should be an informed decision by the community, and if a community does not want you to go in, you can't and shouldn't go in".

In terms of security and exposure to hazards, from the mining women whose cases are presented here, Lucía is the most exposed to physical risks due to her work in an underground mine. She confided that her mother is always worried about her going inside the mine. She is also conscious that one day she might not go out of the tunnel. She remembers that the hardest challenges faced while being underground was a small fire, and gas intoxication, events that could be fatal if you are underground. However, she is proud because "the same things that they do (the men) I am doing them too".

For Marta, going to exploration camps in the countryside represents several social and personal risks. She explains that it is difficult to be a woman in a place full of men. Using the bathroom, wearing the overall that is made for men, and establishing respectful relationships with male co-workers (even if drunk) can be challenging. Another factor increasing risks in her work as a consultant in mining rural locations is the increasing presence of drug dealers and cartels in the communities. She told the researcher several stories of how she has learned to deal with all sorts of people, including *narcos*. Marta says that you learn to "feel no fear of anything" when you are out there away from cities and people. Karla shares a similar story from when she was working in an exploration project in Chihuahua "...we arrived and found ourselves surrounded by ten boys

holding AK-47... they surely thought -these people come to invade us, and they are women!-” Sometimes Karla was told by people “what are you doing here? Go home and have children! Aren’t you scared that somebody is going to steal your husband from you?” Karla says that mining sometimes “is the most dangerous thing you have, and at other times is the most beautiful thing in your life”. For women it is even harder because they need they carry not only the rocks and dirt (figuratively speaking), but all the barriers and cultural impositions that still openly remain in rural communities, and subtly in mining companies.

A summary of these factors regarding women’s roles and experiences in mining is presented in Table 7 below.

Table 7. Socio-economic and environmental/health effects of mining on women

| Roles of women in mining | Socio-economic effects | Environmental and health effects |
|---|--|---|
| Women who work directly in the production process of the mine (as miners or office workers) | <ul style="list-style-type: none"> • Access to non-agrarian income (+) • Empowerment and autonomy (+) • Professional Development (+) • Inequities persist (-) • “Glass ceiling persists” (-) • Personal and family costs (-) | <ul style="list-style-type: none"> • Access to health services and insurance (+) • Effects on personal health: higher risks of accidents and chronicle professional diseases (-) • Sudden death more probable due to accidents (-) • Lower environmental quality in the job and the community (-) |
| Women who work in companies that offer outsourced services and inputs for mining companies | <ul style="list-style-type: none"> • Access to non-agrarian income (+) • Inequalities persist (-) • Job insecurity (both genders) (-) | <ul style="list-style-type: none"> • Effects on personal health: higher risks of accidents and chronicle professional diseases (-) • No medical insurance, retirement benefits or social services (-) • Lower environmental quality in the job and the community (-) |
| Women who produce and reproduce the domestic system in mining households | <ul style="list-style-type: none"> • More resources available (+) • Improved educational opportunities (+) • Unequal loads at home and child rearing (-) | <ul style="list-style-type: none"> • Impacts on water and land for small-scale production (-) • Food insecurity (-) • Impacts on environmental quality (-) |

6. Main lessons and study conclusions

In summarizing the findings of the research, we group here the lessons and general conclusions for each of the study's main themes or dimensions, as well as a brief list of the main challenges faced during the research.

Socio-economic effects

- The socio-economic effects of mining in rural communities most of the time are double-edged swords: unexpected negative impacts together with obvious improvements in income and infrastructure. Higher incomes and better infrastructure can contribute to the sustainability of mining communities if accompanied by integral capacity building and education. This could prevent the “poverty with money” situation, or low-quality lifestyles with high consumption.
- With mining presence in communities, usually there is a shift in the availability of rural resources: more access to produced and human capital, and less access to social and natural capital.
- The high proportion of people subcontracted in the mining sector, particularly in Sonora, indicates that mining's socio-economic benefits are progressively concentrating in ever less people and households.
- Special taxes contributed by mining companies to fund community development in Mexican mining towns compensate partially their social-ecological impacts, and only in terms of infrastructural development.

Environmental effects

- Lack of systematic and integrated data on resources' access and consumption by mining companies obstructs appropriate evaluation of impacts in the short and long term.
- In relation to the point above, water situation of mine companies is less clear than their land rights' situation, and this is the same situation of the study case, the Mercedes Mine in Cucurpe.
- Up to the date of the interviews, the community of Cucurpe does not report any environmental effects derived from the mine that risk their livelihood resources; however, if mining activities keep increasing in the coming years (as seems to be the case), this situation may shift regionally.
- The environmental outlook of the community regarding the mine is blurred and uncertain. Because the mine is relatively far away from the community, and it is an underground development, people are not aware of the actual impacts this could have on their resources in the long term.

The gendered experiences

- Working in mining can represent the only viable alternative in rural communities with few livelihood options for poor, uneducated women. This brings them higher incomes, purchasing power, empowerment for making decisions, and autonomy from their families. However, they also pay a high cost in their personal and social life, and in certain positions of the mining value chain, they can even lose their lives.
- Due to the long labor journeys, women need to rely heavily on help from their partners and their family members to perform multiple roles as they participate in the mining activities.

- In the case of women who are also mothers or are responsible for caring of family members, the mine companies not only extract the surplus of their personal capacity, but also the value of their social networks that make possible cheaper baby sitting and child care if they want to continue as miners.
- Women experience segregation and disempowering attitudes towards her incursion in mining as they do in other sectors. However, these are more accentuated in the mining sector due to the highly masculinized character of the field.

Challenges of the research

- During all stages of the research, the lack of socio-economic and environmental data at the required scale of analysis was a challenge that, in most cases, the researchers had to overcome by relying on indirect sources. Matching data at different scales of analysis (the individual and household experiences versus the watershed and community's impacts in two main dimensions) was also a challenge related to this; however, comprehensive cross-scale studies on the mining sector and its connection to arid social-ecological systems are much required.
- Not at all times it is easy to know what sensitive linkages between the socio-economic and environmental dimensions of the watershed system to include or consider when inquiring people's or mines' features and dynamics in the communities. Sometimes, a very small element in one of the sectors could have important spillover effects on unexpected components of the entire social-ecological system.
- Projecting the sustainability trajectory of the town was identified as a necessary goal of future research. Longer-term studies are recommended to localize historic dynamics that can foster or hinder the resilience of the overall system. For example, small and large-scale mining have been present since early times in Sonora, and expectedly, they have had environmental and socio-economic impacts, but also people have historically developed coping and adapting mechanisms that they update and re-adapt to each new challenge. Knowing this resilience and sustainability trajectory can be the source of important insights towards future stressors.
- In two cases, it was impossible to obtain direct data from mining representatives because they did not follow up on the continuous requests for interviews. In one case, the person answered that she could not respond interviews about her job (she was a Human Resources representative of the mining company), and the remaining case simply responded to messages without any commitment to an interview date until he stopped answering. Maybe the cause of this is, in part, the difficulties that mining has had in the State due to the spill from a tailings dam of Grupo México in Cananea. "Opacity" of the sector has been mentioned in other research reports, and this one is no exception. In general, locating clear and updated information to integrate a "big picture" image about the mining sector in Sonora has important difficulties that will be taken into account in future projects in the region.

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ANNEX A:
INSTRUMENTS FOR DATA COLLECTION

Carta de consentimiento informado

Proyecto: “Impactos Socio-Ecológicos de la Minería en la Región Transfronteriza del Desierto de Sonora Desde un Enfoque de Género”

Fecha: ___/___/___

Yo, _____, certifico que he sido informada(o) con claridad y veracidad sobre las actividades de investigación de la Doctora América Nallely Lutz Ley, como parte de su proyecto “Impactos Socio-Ecológicos de la Minería en la Región Transfronteriza del Desierto de Sonora Desde un Enfoque de Género”, en el cual me han invitado a participar. Asimismo certifico que estoy de acuerdo con ser grabada(o) durante la entrevista; y que participo libre y voluntariamente en este procedimiento. Soy conoedor(a) de la autonomía que poseo para retirarme u oponerme a esta participación cuando lo estime conveniente y sin necesidad de justificación alguna. También se me ha informado que puedo optar por no ser grabada(o) y esto no es condición para excluir mi participación en el proyecto.

Estoy informada(o) de que se respetará la buena fe, la confiabilidad e intimidad de la información por mí suministrada, lo mismo que mi seguridad física, psicológica, emocional y laboral. Asimismo, estoy consciente de que dicha información será utilizada para fines estrictamente académicos, y que en cualquier momento puedo solicitar su remoción de la base de datos de la mencionada investigadora o su no utilización.

Nombre y firma de enterada(o)

Si requiere más información sobre este proyecto o tiene comentarios, puede comunicarse con:

- **Investigadora Responsable:** Dra. América Nallely Lutz Ley: alutz@colson.edu.mx
Afiliación: Centro de Estudios del Desarrollo, El Colegio de Sonora.
- **Colaboradoras del Proyecto:**
 - Dra. Lorenia Velázquez Contreras (El Colegio de Sonora): lvelaz@colson.edu.mx
 - Dra. Stephanie Buechler (University of Arizona): buechler@email.arizona.edu
- **Información de Financiamiento:** [http://nextgensd.com/es/n-gen-beclas-de-investigacion/beclas-colaborativas/impactos-socio-ecologicos-de-la-mineria-en-la-region-transfronteriza-del-desierto-de-sonora-desde-un-enfoque-de-genero/](http://nextgensd.com/es/n-gen-becas-de-investigacion/beclas-colaborativas/impactos-socio-ecologicos-de-la-mineria-en-la-region-transfronteriza-del-desierto-de-sonora-desde-un-enfoque-de-genero/)

Guía de entrevista semiestructurada para representantes del sector minero
Proyecto: “Impactos Socio-Ecológicos de la Minería en la Región Transfronteriza del Desierto de Sonora Desde un Enfoque de Género”

Fecha: ___/___/_____

Nombre: _____
 Afiliación: _____
 Puesto: _____

A) Aspectos operativos y generales

1. ¿En qué consiste su trabajo en esta organización?
2. ¿Cómo entiende usted el desarrollo sustentable?
3. ¿Cuál es su opinión respecto al rol que desempeña su organización en la promoción del desarrollo sustentable en Sonora?

B) Dimensiones socio-económicas por género de la actividad minera

4. ¿Cuáles considera que son los impactos socio-económicos más notables (tanto positivos como negativos) de la minería en Sonora
 - a. ¿A nivel del hogar?
 - b. ¿A nivel de comunidad?
 - c. ¿A nivel de cuencas?
5. ¿Considera Usted que los impactos socio-económicos de la minería son diferentes para hombres y mujeres en estas tres escalas? ¿De qué manera?

| Escala | Impactos para mujeres | Impactos para hombres |
|-----------|-----------------------|-----------------------|
| Hogar | | |
| Comunidad | | |
| Cuenca | | |

6. ¿Qué hace su organización para potenciar los efectos socioeconómicos positivos y aminorar los negativos?
 - a. ¿Hay un enfoque de género en estas estrategias?
 - b. ¿Si es el caso, cómo se aplica?

C) Dimensiones ambientales por género de la actividad minera

7. ¿Cuáles considera que son los impactos ambientales más notables (tanto positivos como negativos) de la minería en Sonora
 - a. ¿A nivel del hogar?
 - b. ¿A nivel de comunidad?
 - c. ¿A nivel de cuencas?

8. ¿Considera usted que los impactos ambientales de la minería son diferentes para hombres y mujeres en estas tres escalas? ¿De qué manera?

| Escala | Impactos para mujeres | Impactos para hombres |
|-----------|-----------------------|-----------------------|
| Hogar | | |
| Comunidad | | |
| Cuenca | | |

9. ¿Qué hace su organización para potenciar los efectos ambientales positivos y aminorar los negativos?
- ¿Hay un enfoque de género en estas estrategias?
 - ¿Si es el caso, cómo se aplica?

D) Dimensiones socio-ambientales combinadas y cambio global

- ¿Usted considera que hay interacciones entre aspectos sociales y ambientales en las comunidades mineras? ¿Cómo se manifiestan estas interacciones y cómo afectan o benefician la actividad minera?
- ¿Cómo considera usted que los cambios en los mercados globales, y/o los cambios ambientales globales (por ejemplo, el cambio climático) pueden afectar a la minería en Sonora?
- ¿Conoce usted alguna planeación estratégica en el sector para hacer frente a estos cambios?
 - Si existe dicha planeación, ¿hay un enfoque de género en su desarrollo?
- Algo más que quiera agregar:

Notas para investigadora:

- Solicitar a representante información sobre la participación laboral de hombres y mujeres en la organización que representa y los cambios en esta participación en los últimos diez años en términos del número de mujeres y los puestos que tienen.
- Solicitar información sobre posible representante minero para siguiente(s) entrevista(s).

Guía de entrevista semiestructurada para habitantes de la comunidad
Proyecto: “Impactos Socio-Ecológicos de la Minería en la Región Transfronteriza del Desierto de Sonora Desde un Enfoque de Género”

Fecha: ___/___/___

Localidad y municipio: _____

Domicilio del(a) entrevistado(a): _____

Nombre: _____

Ocupación: _____

Género: _____ Edad: _____

A) Uso del territorio y de los recursos naturales

1. ¿Ha cambiado el uso de la tierra de la comunidad con la minería? ¿De qué maneras?
2. ¿Cómo ha sido la interacción o negociación entre la mina y la comunidad en relación con el uso de la tierra?
 - a. ¿Quiénes toman las decisiones?
 - i. ¿Cómo han participado las mujeres en estas interacciones o negociaciones?
 - b. Si ha habido cambios en el uso del suelo ¿han afectado éstos a la comunidad?
 - i. ¿De qué maneras?
 - ii. ¿Los hombres y mujeres han sido afectados de modo distinto?
 - c. ¿Han existido conflictos al interior de la comunidad, o entre la comunidad y la mina por la tierra?
 - i. ¿Quiénes y cómo han participado en estos conflictos/movilizaciones?
 - ii. ¿Cómo han participado las mujeres en estos conflictos?
3. ¿Cómo ha sido la interacción o negociación entre la mina y la comunidad en relación con el uso del agua?
 - a. ¿Quiénes toman las decisiones?
 - i. ¿Cómo han participado las mujeres en estas interacciones o negociaciones?
 - b. Si ha habido cambios en el uso del agua ¿han afectado éstos a la comunidad?
 - i. ¿De qué maneras?
 - ii. ¿Los hombres y mujeres han sido afectados de modo distinto?
 - c. ¿Han existido conflictos al interior de la comunidad, o entre la comunidad y la mina por el agua?
 - i. ¿Quiénes y cómo han participado en estos conflictos/movilizaciones?
 - ii. ¿Cómo han participado las mujeres en estos conflictos?

B) Ocupación, empleo e ingresos

4. ¿Cómo ha cambiado la situación económica del pueblo desde que llegó la mina?
5. ¿Cómo ha cambiado el desarrollo de la comunidad y la vida comunitaria con la llegada de la mina?
6. ¿Cómo se ha modificado la migración hacia el interior y hacia afuera del pueblo con la mina?
7. ¿Cómo han cambiado los empleos disponibles para hombres y mujeres en el pueblo?
 - a. ¿Hay otras nuevas ocupaciones, además de la mina, disponibles para hombres y mujeres?
 - b. ¿Cuál es la situación salarial y laboral de los hombres y mujeres que trabajan en la mina?

c. ¿Y para quienes trabajan fuera de ella?

C) Medio ambiente y salud

8. ¿Cuáles son los principales impactos ambientales de la mina en la comunidad, si es que los hay?
9. Estos impactos, ¿afectan de manera distinta a hombres y mujeres?
10. ¿Qué han hecho los habitantes, el gobierno o la mina para atender estos efectos? ¿Ha sido suficiente?
11. ¿Cuáles son los principales impactos de la mina y sus actividades sobre la población? ¿son distintos para hombres y mujeres, para niños(as) o adultos(as) mayores?
12. ¿Qué han hecho los habitantes, el gobierno o la mina para atender estos efectos? ¿Ha sido suficiente?
13. Los hombres y mujeres que trabajan en la mina o empresas relacionadas con ella, ¿tienen problemas de salud particulares?
14. En general, ¿cómo ha cambiado la calidad de vida desde que llegó la mina?

D) Relaciones de género en el trabajo, el hogar y la comunidad

15. ¿Han cambiado los roles y actividades de las mujeres de la comunidad desde que llegó la mina? ¿De qué maneras?
16. ¿Ha cambiado el acceso de las mujeres a recursos o servicios de la comunidad? ¿Cómo?
17. ¿Ha cambiado la participación de las mujeres en la toma de decisiones del hogar y la comunidad a raíz de la llegada de la mina? ¿Cómo?
18. ¿Cuáles cambios, si es que hay, se han dado en la vida personal y el empoderamiento de las mujeres de la comunidad? ¿Es distinto entre las que trabajan en la mina y aquellas que no?
19. Las mujeres que se han incorporado al trabajo directamente en la mina, o en empresas que trabajan para la mina indirectamente, ¿Cómo han tenido cambios en su vida personal, en su hogar y en su comunidad?
20. Las mujeres que no trabajan en la mina o en empresas que sirven a la mina, ¿han cambiado su vida personal, en su hogar o en su comunidad de alguna manera?

Notas para investigadora:

- Iniciar la entrevista con la lectura y firma del consentimiento informado. Dar una copia al (la) entrevistada(o).
- Usar hojas adicionales para las respuestas y notas de cada pregunta.
- Preguntar a la entrevistada(o) si le interesaría participar en un seguimiento potencial. Pedir datos de contacto.
- Preguntar a la entrevistada(o) por otros(as) potenciales participantes de la entrevista en la comunidad.
-

Guía de entrevista semiestructurada para mujeres en el sector minero
Proyecto: “Impactos Socio-Ecológicos de la Minería en la Región Transfronteriza del Desierto de Sonora Desde un Enfoque de Género”

Fecha: ___/___/___

Localidad y municipio donde vive: _____

Nombre: _____ Edad: _____

Compañía u organización: _____

Ocupación o puesto: _____

¿Qué hace en el puesto? _____

Último grado de estudios: _____ Carrera (si cursó estudios superiores): _____

Estado civil: _____

¿Con quién vive?

Sola: _____

Esposo/esposa/pareja: _____

Hijos (y edades): _____

Padres (y edades): _____

Otras personas (especificar): _____

A) Antecedentes personales y profesionales

1. ¿Trabajó en otra actividad antes de incorporarse al sector minero?
2. ¿Su trabajo previo o su preparación profesional le han resultado adecuados para el trabajo que tiene en el sector minero?
3. ¿Estudió usted algún programa o carrera que se considera “típico” o “más común” para los hombres? ¿Cómo fue su experiencia?
4. ¿Qué diferencias encuentra entre sus trabajos previos y el trabajo actual en el sector minero? (ingresos, riesgos, equidad, retos y dificultades, satisfacciones)

B) Ocupación, empleo e ingresos

5. ¿Usted considera que el trabajo en el sector minero es mejor para las mujeres que en otros sectores?
6. ¿Existe algún reto o dificultad en los trabajos del sector minero que se complique por el hecho de ser mujer? ¿De qué maneras?
7. ¿Usted considera que ha sido tratada con equidad en su trabajo del sector minero, con respecto a los empleados del sexo masculino?
8. ¿Cómo distribuye su tiempo entre la jornada laboral en el sector minero y el resto de sus actividades domésticas y personales? ¿Esto es distinto para mujeres que no trabajan en la minería?
9. ¿Usted considera que la empresa en la que trabaja realiza acciones para mejorar las condiciones laborales de empleados hombres y mujeres de modo equitativo?

C) Dinámicas de género en el trabajo, el hogar y la comunidad

10. ¿Ha hecho cambios en sus roles y actividades cotidianas desde que comenzó a trabajar en el sector minero?

11. ¿Cuáles cambios, si es que hay, se han dado en su vida personal y en sus relaciones cercanas? ¿Usted cree que hay diferencias en esto entre las mujeres que trabajan en el sector minero y aquellas que no?
 - a. Con sus hijos
 - b. Con su pareja
 - c. Con el resto de la familia
 - d. Con otras personas cercanas
12. ¿Cómo ha cambiado su sensación de empoderamiento desde que trabaja en el sector minero (tomar decisiones, ser autónoma, participar en el espacio doméstico, público o laboral, etc.)?

D) Efectos sobre la salud laboral y global

13. ¿Ha cambiado su salud física desde que trabaja en el sector minero? ¿De qué maneras?
14. ¿Ha cambiado su salud mental y emocional desde que trabaja en el sector minero? ¿De qué maneras?
15. Estos cambios en la salud, ¿cómo afectan sus actividades laborales, domésticas y personales?
 - a. Cambios en salud física:
 - b. Cambios en salud mental:
16. ¿Ha tomado alguna medida para atender estos problemas, si es que existen?
 - a. Salud física:
 - b. Salud mental:
17. ¿Usted considera que la empresa en la que trabaja realiza acciones para mejorar...?
 - a. El bienestar físico de sus empleados hombres y mujeres
 - b. El bienestar mental de sus empleados hombres y mujeres

Notas para investigadora:

- Iniciar la entrevista con la lectura y firma del consentimiento informado. Dar una copia a la entrevistada.
- Usar hojas adicionales para las respuestas y notas de cada pregunta.
- Preguntar a la entrevistada si le interesaría participar en un seguimiento potencial. Pedir datos de contacto.
- Preguntar a la entrevistada por otras potenciales participantes de la entrevista.

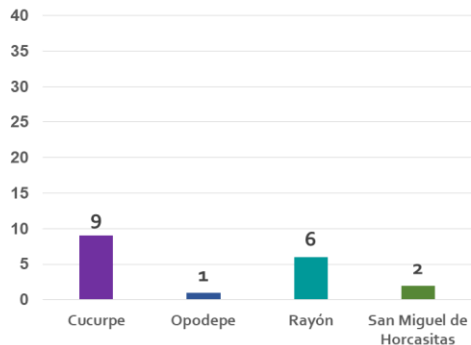


ANNEX B:

**LAND TITLES FOR MINING IN SONORA AND THE SAN
MIGUEL WATERSHED MUNICIPALITIES**

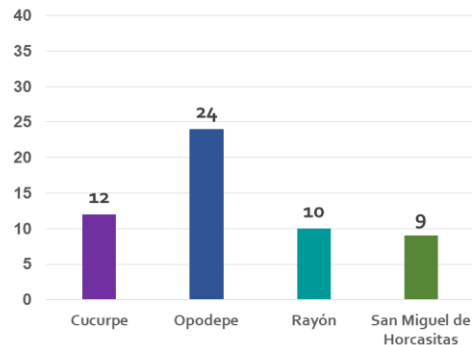
2006-2017

2006



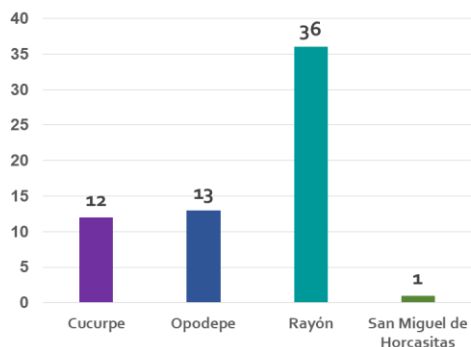
Total in Sonora: 516 titles
Months reported: 12

2007



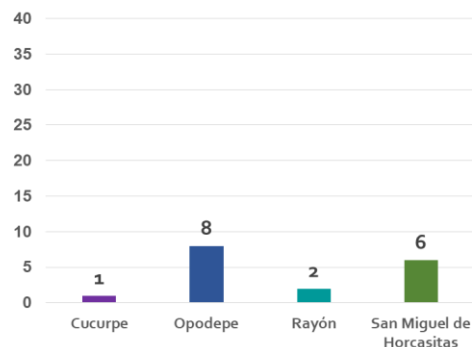
Total in Sonora : 591 titles
Months reported: 12

2008



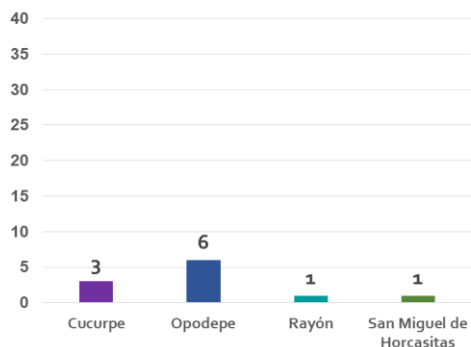
Total in Sonora: 461 titles
Months reported: 11

2009



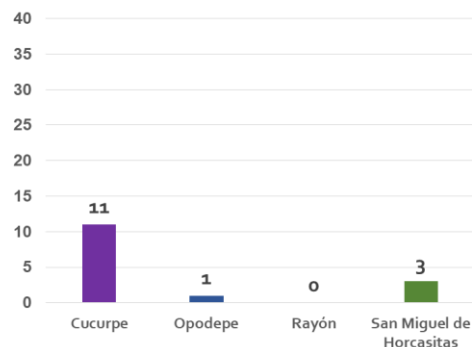
Total in Sonora: 239 titles
Months reported: 7

2010



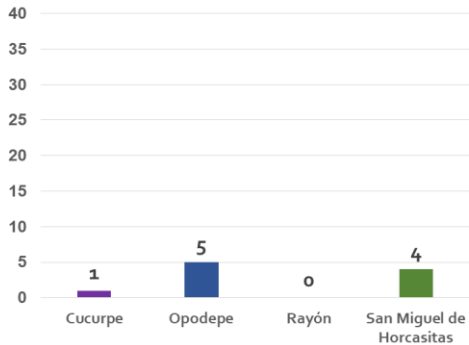
Total in Sonora: 283 titles
Months reported: 11

2011



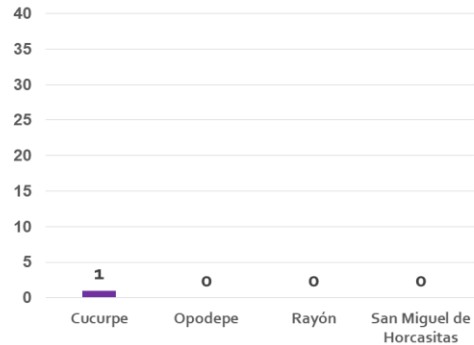
Total in Sonora: 401 titles
Months reported: 10

2012



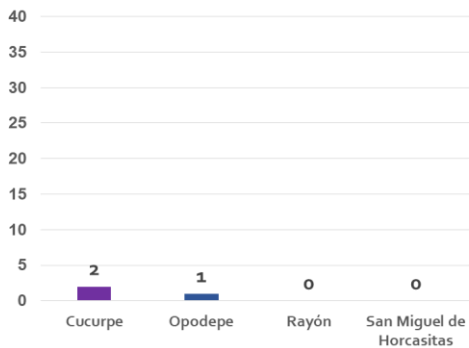
Total in Sonora: 196 titles
Months reported: 5

2013



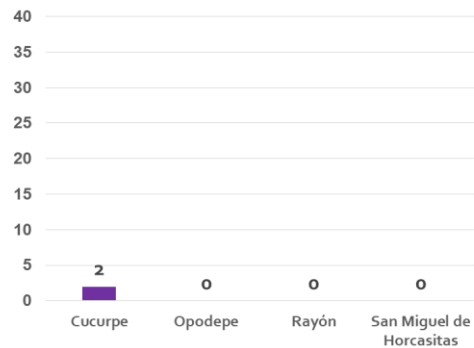
Total in Sonora: 215 titles
Months reported: 12

2014



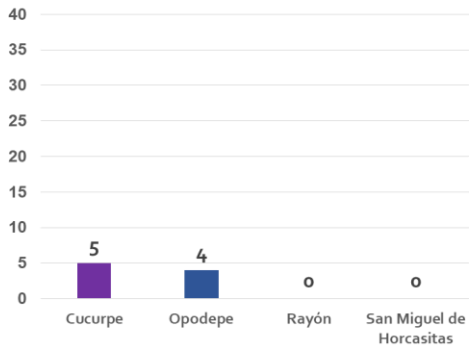
Total in Sonora: 175 titles
Months reported: 10

2015



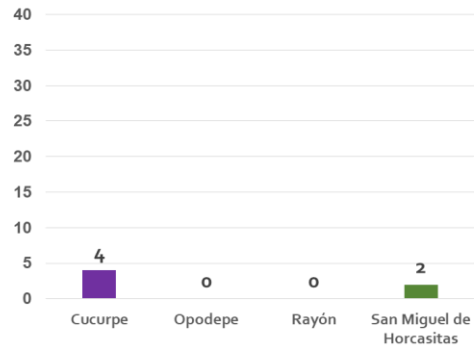
Total in Sonora: 203 titles
Months reported: 10

2016



Total in Sonora: 140 titles
Months reported: 12

2017



Total in Sonora: 60 titles
Months reported: 8