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HUMAN GEOGRAPHY

Human Geography
2020, Vol. 13(1) 74–84

DOI: 10.1177/1942778620910901
journals.sagepub.com/home/hug
SAGE

Mining and women in northwest Mexico: a feminist political ecology approach to impacts on rural livelihoods

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Abstract

Women's participation in large-scale mining (LSM) has been increasing in Mexico and worldwide; however, few comprehensive studies exist on the socioeconomic effects of mining on women depending on the specific roles they play in this activity. The objective of this study was to analyze, from a feminist political ecology perspective, the effects of mining on women in a rural community in Sonora State, in arid northwest Mexico, a region with important participation of LSM in the country. For this purpose, we developed a mixed methods approach combining literature review on gender and LSM, semistructured in-depth interviews, and analysis of secondary government data. Most literature on women and mining treats them conceptually as a homogeneous social group or focuses on only one role women play in mining. We address this gap by identifying several roles women can play in their interactions with the mining sector and then analyzing and comparing the effects of mining associated with these distinctive roles. In doing so, we unravel the gendered complexities of mining and highlight the socio-ecological contradictions embedded in these dynamics for individual women who are faced with significant trade-offs. Mining can provide economic and professional opportunities for women of varying educational and socioeconomic levels in otherwise impoverished and landless rural households. At the same time, women are unable to, as one interviewee phrased it, "break the glass ceiling even if using a miner's helmet," especially in managerial positions. Extraction of natural resources in the community is accompanied by the extraction of social capital and personal lives of miners. We give voice to the social–ecological contradictions lived by women in these multiple roles and offer potential insights both for addressing gender-based inequities in mining and for avenues toward collective action and empowerment.

Keywords

women in mining, feminist political ecology, rural livelihoods, northwest Mexico, extractivism

Minería y mujeres en el noroeste de México: Un acercamiento desde la ecología política feminista a los impactos sobre medios de vida rurales

Resumen

La participación de las mujeres en la minería de gran escala se ha incrementado en México y alrededor del mundo; sin embargo, existen escasos estudios comprehensivos de los efectos socioeconómicos de la minería sobre las mujeres dependiendo de los roles específicos que ellas juegan en esta actividad. El objetivo de este estudio es analizar, desde la perspectiva de la ecología política feminista, los efectos de la minería sobre mujeres de una comunidad rural del estado de Sonora, en el noroeste árido de México; una región con importante participación de la minería de gran escala en el país. Con este propósito desarrollamos un acercamiento metodológico mixto, combinando el análisis de literatura sobre género y minería de gran escala, con entrevistas semiestructuradas y análisis de datos secundarios producidos por agencias gubernamentales. La mayoría de los estudios sobre mujeres y minería las concibe

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conceptualmente como un grupo social homogéneo, o se centran solamente en uno o dos roles de las mujeres en la minería. En este trabajo se cubre esta brecha mediante la identificación de múltiples roles que las mujeres pueden desempeñar en sus interacciones con el sector minero y el análisis comparativo de los efectos de la minería asociados con estos distintos roles. De esta manera, se desentrañan las complejidades de la minería vistas desde el género y se enfatizan las contradicciones socio-ecológicas inmersas en estas dinámicas para mujeres que enfrentan costos individuales significativos. La minería puede proveer oportunidades económicas y profesionales para mujeres de distintos niveles educativos y socioeconómicos en hogares rurales empobrecidos o sin tierras productivas. Al mismo tiempo, las mujeres no han podido, en palabras de una minera, "romper el techo de cristal ni usando un casco minero", especialmente en posiciones de mando. La extracción de recursos naturales en la comunidad se acompaña de la extracción de capital social y el tiempo de vida personal de las mineras. Se da voz a las contradicciones socio-ecológicas vividas por mujeres que ocupan estos múltiples roles y se ofrecen visiones potenciales para atender estas inequidades basadas en el género en la minería, así como posibles caminos hacia la acción colectiva y el empoderamiento.

Palabras clave

mujeres en la minería, ecología política feminista, medios de vida rurales, noroeste de México, extractivismo

Mining and women in northwest Mexico

Mining provides employment for men, and increasingly women, in rural semi- or nonagrarian households (Bell and Braun, 2010; Lahiri-Dutt, 2011). Although globally mining is considered a masculine livelihood, there is historical evidence of female participation (Lahiri-Dutt, 2011; Mercier and Gier, 2007). Today women constitute a major workforce in artisanal and small-scale mining (ASM), participating comparatively less in large-scale mining (LSM) (Jenkins, 2014). Women's enhanced access to socioeconomic opportunities through employment in both ASM and LSM could modify power relationships and gendered livelihood structures in predominantly agrarian contexts where mostly men hold land and water rights (Castro-Ramírez et al., 2015).

Women's participation in LSM in arid northwest Mexico is increasing, yet women's experiences in this sector have not been systematically studied. The objective of this article is to address this gap by analyzing, from a feminist political ecology (FPE) perspective, how mining affects livelihood dynamics in a rural community in Sonora State. Informed by literature review, in-depth interviews, and secondary data analysis, the main contribution of this article is to explore and describe mining's livelihood effects on women's lives as a function of the roles they play related to LSM, emphasizing social–ecological contradictions and personal and professional trade-offs they face due to different types of relationships to mining activities.

In Mexico, the number of female employees working in LSM (sector 21) grew significantly in 2004–2014 (see upper part of Figure 1), especially in Sonora (see lower part of Figure 1). Sonora is the country's top producer of gold, copper, molybdenum, graphite, and wollastonite, with mining contributing 17% of Sonora's GDP via over 40 mines, many in rural municipalities (Servicio Geológico Mexicano, 2017).

For Sonoran women participating in contemporary LSM, access to stable income is not assured; remuneration and availability of jobs shrink and expand according to minerals' international prices (Bracamonte Sierra et al., 1997) and labor is also subject to wage caps and flexibility policies that favor high levels of subcontracting (Lutz-Ley, 2016). Subcontracting, in addition to creating uncertain livelihoods, also hinders formation of collective action, dividing permanent and temporary workers (Tetreault, 2016). However, LSM is sometimes perceived as the only option to remain in communities, because women's access to paid agricultural labor is much lower than men's (Buechler and Lutz-Ley,

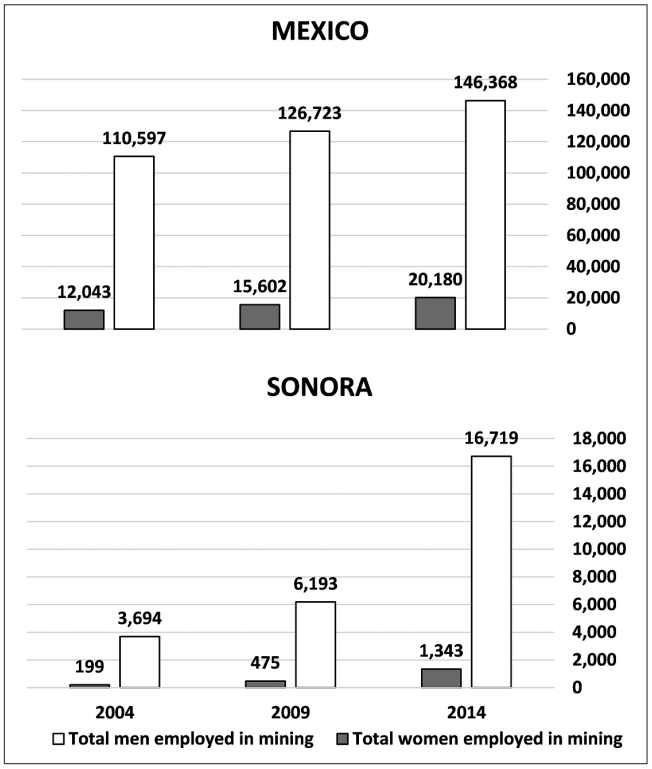

Figure 1. Numbers of men and women in mining in Mexico and in Sonora State. (Source: elaborated by authors with data of INEGI's economic censuses of 2004, 2009, and 2014.)

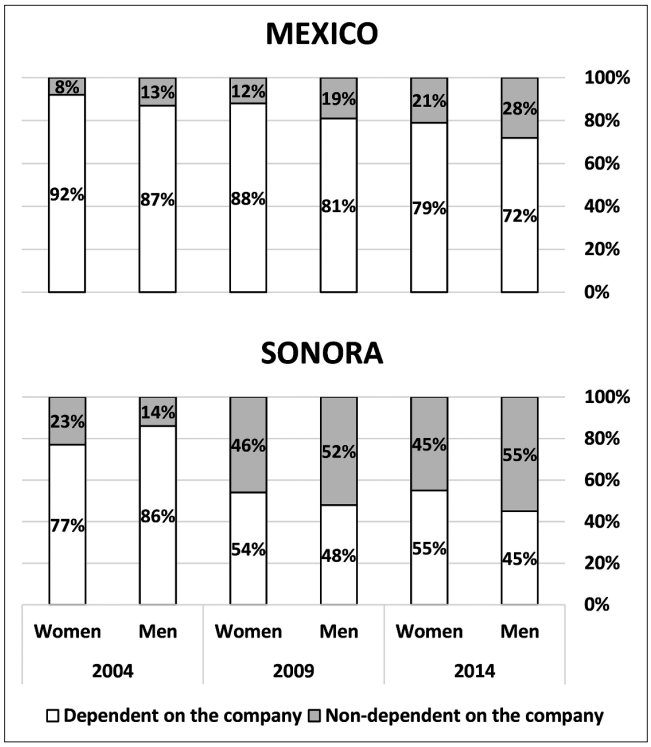

Figure 2. Proportion of male and female employees depending directly and indirectly on mining companies in Mexico and Sonora. (Source: elaborated by authors with data of INEGI's economic censuses of 2004, 2009, and 2014) ("Non-dependent on the company" are subcontracted employees).

2019). Figure 2 shows the proportion of male and female employees who depend directly and indirectly (outsourced) on mining. In Sonora, an abrupt change occurred with approximately half the workforce hired via subcontracted jobs in 2009–2014 (Instituto Nacional de Estadística y Geografía, 2016). This indicates a high integration into global markets, with significant participation of international companies (Servicio Geológico Mexicano, 2017).

For women not participating directly in mining, impacts on community's resources and landscape have important effects on their livelihoods and household water and food security. Environmental risks and impacts tend to affect each gender differently because occupational roles follow a gender division of labor, with different levels of dependency on local resources (Buechler, 2015). As natural resources become scarcer and more polluted, women's work in procuring inputs for domestic production and reproduction increases (Browning-Aiken, 2000). On the other hand, literature and our own interviews reveal gains in rural livelihoods' diversification and income for women when a mine opens in their communities. However, these positive effects depend importantly on women's capacity to negotiate with the mines, and their social and work positions in communities and companies.

A feminist political ecology of women in LSM

FPE frames gender as a crucial differentiating social category and views the distribution of natural and material resources, risks, impacts, and access to environmental decision-making as reflecting gendered power relationships (Buechler and Hanson, 2015; Rocheleau et al., 1996). FPE is a useful though underutilized theoretical framework for the analysis of women's roles in LSM (Lahiri-Dutt, 2015a, Lahiri-Dutt, 2015b; Binoy, 2017) especially in Latin America (Brain, 2017; Viteri, 2017). FPE helped analyze women's positionings in gendered power relationships within mining and their community, particularly those related to (1) women's access and rights to natural resources and natural resource-based employment; (2) mining women's agency within their households, communities, and workplaces; and (3) physical and social impacts and risks of mining for women.

In building our literature review, most of the studies we found on mining, rural livelihoods, and gender referred to ASM (e.g. Hilson et al., 2017; O'Faircheallaigh and Corbett, 2016), although we purposely focused only on LSM studies. A major proportion of those were studies on rural communities in Asia (Behzadi, 2019; work by Lahiri-Dutt in multiple years; Grobmann et al., 2017; Mukherjee, 2014); Africa (Akiwumi, 2011; Kaggwa, 2019; Kotsadam and Tolonen, 2016); and Oceania (Lozeva and Marinova, 2010; Mayes and Pini, 2014), with fewer empirical contributions in Latin America (Brain, 2017; Himley, 2011). FPE analyses of LSM effects on livelihoods found, among other things: (1) women's disadvantage in negotiations between mining companies and land tenure-related communal organizations; (2) undermining of women's roles as food and clean water providers due to environmental impacts and/or work overload when they participate in LSM; and (3) gender inequities in wages, working conditions, and career advancement in mining jobs (Lozeva and Marinova, 2010).

In Mexico, one study incorporating feminist analysis of mining is Salazar and Rodríguez's (2015) work on Oaxaca, Guerrero, and Hidalgo examining women's increasing work in mining, political involvement in anti-mining social movements, and deleterious environmental effects on housework. Castro-Ramírez et al. (2015) studied land dispossession due to mining in Zacatecas, Mexico, and found that women had much less power in negotiations with mining companies due to low legal entitlement to land. Belasko (2012, 2014) revealed how women have progressively integrated into LSM with higher workloads, yet had difficulties accessing managerial positions in a sector with significant subcontracting. An in-depth study on women in mining communities in Sonora is the dissertation of Browning-Aiken (2000), which documents the formation of a political front by miners' wives and daughters, to protest insufficient and polluted domestic water caused by Buenavista del Cobre in Cananea, one of the

largest copper mines in the world. Despite this nascent interest on mining in Mexico from a feminist perspective, according to Belasko (2014: 18), "the situation of Mexican women in the mining and metals' sector is among the most unknown and ignored in the Mexican mining industry."[1]

Our literature analysis agrees with other authors (Brain, 2017; Jenkins, 2014) who found that most studies dealt with single roles or positionalities of women in mining or saw them as a homogeneous group sharing similar incentives, motives, and impacts. Jenkins' (2014) review of studies in the Global South, in particular, points to the lack of recognition of the different roles women can play in their relationships with mining and how other positionalities, such as socioeconomic status, education, age, and ethnicity, modify mining's impacts on women. We examine women's different roles and also how these other positionalities impact their relationship to mining in rural Mexico. We analyzed, from an FPE perspective, women's diverse experiences with LSM especially related to career and livelihood advancement, gendered workplace politics, and household dynamics in Cucurpe, Sonora.

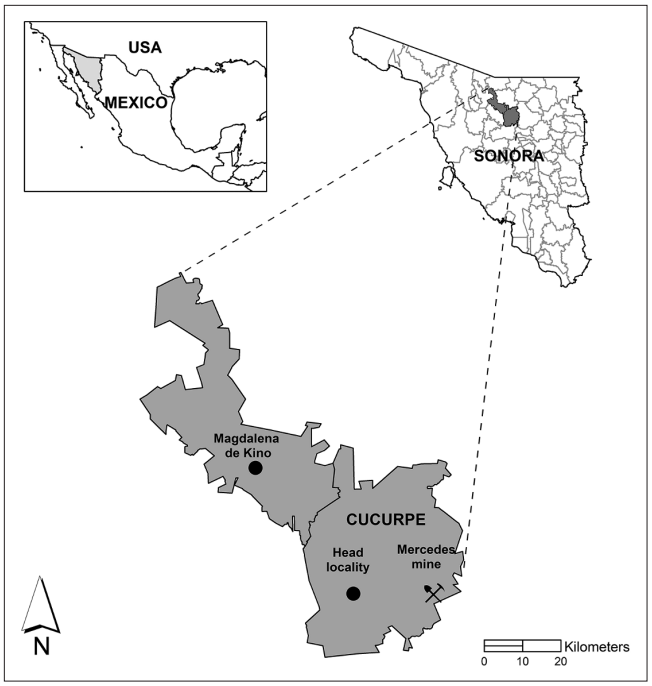

Figure 3. Cucurpe and the Mercedes mine (map credit: Dr. P. A. Reyes-Castro, El Colegio de Sonora. Source of data: INEGI).

Research methods

Identification of women's roles in relation to mining

We analyzed 90 sources on mining, livelihoods, and gender, collected through systematic online database searches in English and Spanish of the terms "rural," "livelihood," "women," "gender," "mining," and "extractivism" in titles and abstracts. Materials included peer-reviewed articles, policy reports, books, book chapters, and dissertations. We excluded studies on ASM, aiming to understand lesser-studied feminist issues in LSM. Our purpose was understanding how women's experiences associated with mining work, and issues regarding intersections of mining and environment in Sonora and Cucurpe, compared to other areas.

Through analysis of literature we identified five distinctive roles of women in relation to mining, each associated with diverse trade-offs and social–ecological contradictions: (1) women miners, or those who work directly in the production process under contracting by the mines; (2) women offering outsourced services and inputs for mining companies; (3) women working in the domestic sphere in households located in the community which may or may not have at least one miner; (4) women working in managerial positions in mining; and (5) women who are politically active as leaders in mining communities. Most literature focuses only on one or two of these roles; this study, however, examined the effects that mining has on women depending on these different positions.

Study site

Cucurpe municipality is less than 140 km south of the United States–Mexico border. In 2015, 965 people lived in 308 households, concentrated mostly in the head locality with the same name (Instituto Nacional de Estadística y Geografía, 2015). Livelihoods are primarily agrarian with smaller contributions from mining[2] and tertiary activities in Magdalena de Kino, population 31,000, less than 50 km from Cucurpe (see Figure 3). Land and water are administered through collective organizations and private ownership, and many households have diversified livelihoods (Lutz-Ley, 2016). Although some land is managed collectively, the greatest effort is focused on individually owned plots; this individualism is mirrored in the current lack of collective action in mining. Indeed, some farming households have part-time or full-time miner members.

The Mercedes Mining District (MMD) where the Mercedes mine is located (approximately 20 km from Cucurpe town) consisted until 2014 of approximately 69,000 hectares covered by 43 mining concession titles. These titles or access permits are valid for 50 years and were purchased from a private individual landowner by the first company (Canadian-based Yamana Gold Inc.) before the mine was acquired by the current owner, US-based Premier Gold Ltd. In 2017, Mercedes produced approximately 2,342 kg of gold and 9,582 kg of silver, representing 4.93% and 2.23%, respectively, of Sonora's production of these metals (Premier Gold Ltd, 2018; Servicio Geológico Mexicano, 2017). The mine had 715 employees in 2017; 428 (60%) were dependent on the company and 287 (40%) were outsourced. A Cucurpe municipal official indicated that approximately 40–50 people from the town worked directly for the mine in

2018 and 50 were subcontracted; 40 were females performing low-wage chores (i.e., cooking, cleaning).

Semistructured interviews

To obtain empirical data for exploring the diverse roles and their effects, we conducted participant observation in Cucurpe and also recorded and analyzed the content of 14 semistructured interviews of women miners (both directly hired by the mine and outsourced), miners' wives, women in mining managerial positions, and women living in the community without ties to mining. These were conducted between March and November 2018 with follow-up and new interviews in 2019. We draw on the case of several women and excerpts from interviews with two mining representatives and two local leaders, all identified by snowball techniques from previous fieldwork. Interactions with the community have occurred since 2014 due to another project on livelihood adaptation that also informed this study. Lutz-Ley engaged in participant observation of activities of the newly constituted Sonoran chapter of the UK-based nonprofit *Women in Mining* (WIM).[3]

This study obtained most of the empirical evidence for roles 1–4 through semistructured interviews. Women activists represent a role of utmost importance because of the ecological citizenry implications and empowerment capacities these activities embody in rural and indigenous women (Binoy, 2017). This study was conducted when there was no concrete conflict in town (e.g., environmental effects were not reported at the time of the study), and we did not identify cases of women acting as sociopolitical leaders in confrontations with the mine. Our interviewees were assigned pseudonyms to protect their identity.

Results: positioning women in mining

The narratives of several women illustrate how their different positions translate into both similar and diverging effects on income and professional development, empowerment and autonomy, family and social relations, and environmental and health hazards.

Income and professional development

Lucia (32 years old) operates machinery inside the Mercedes mine (role 1). She is a mother of two young girls and completed secondary school (9 years of schooling). She entered the company 7 years ago to perform cleaning chores; however, the company offered her technical training for mining work.

For Lucia, one important reason to stay in mining is to provide her children with better opportunities. Her salary is higher than any other she could obtain considering her education (one sector representative interviewed said average salaries in mining for both men and women are 35% above regular salaries in the state) and the low availability of paid rural jobs for women. She enjoys several benefits (i.e., full coverage health insurance) but her activities are risky and the journeys long. She rises every day around 3:40 am and the mine's bus departs at 4:40 am from Magdalena, where she and her husband—also a mining machinery operator—sometimes stay. Their 14-year-old lives in Magdalena with a relative so she can attend school, while her 2-year-old girl is cared for by Lucia's mother in Cucurpe. She works from 7 am to 7 pm, returning home around 9 pm. She is in a 6 × 3 shift, working 6 days and 3 days of rest.

Marta (52) (currently, role 4) is an unmarried woman with a master's degree. She has played several roles in mining, working directly for companies and indirectly as a subcontracted consultant in her own firm founded in 2007. She is the partner of the director of a major mining association in Sonora, with headquarters in Hermosillo, the capital city. Marta knows mining in its multiple dimensions and states proudly "I love mining," indicating a strong identity with the sector. Currently, she is president of the mining association ladies' club, a charity group composed of wives and partners of the association's male members. She is not completely satisfied with this role, stating that women should also be in decision-making positions. What she feels proudest of is the club's scholarship program for 51 low-income female and male college students from Sonoran mining communities to study mining-related careers.

For Marta and Lucia, mining is full of professional opportunities, and the pay is incredibly high in comparison with other jobs; but "this is not a job for just anyone." It requires significant commitment, time, effort, and courage. The job is carried out in remote places, subject to long journeys, uncomfortable installations, and risky conditions. Marta comments that women in mining usually occupy operational positions, but not the top ones: "… we can't break the glass ceiling even if wearing a miner's helmet." In the mining association she belongs to, 100 out of approximately 600 members are women. Marta encourages them to speak their minds and to take leadership roles, even if the room is "full of old men"; if more women take leadership roles within this association, they may begin to engage in collective action in the future.

For female outsourced employees (role 2), conditions can be equally risky but without the benefits mines provide for direct employees. This puts them in the most vulnerable position with respect to other women miners, especially if they have other socioeconomic characteristics magnifying the effects of these disadvantages, such as having low educational attainment, younger or older age, or being single mothers. This is the case of Laura (27), a single mother who started working 3 years ago as an outsourced safety personnel at Mercedes, and later office cleaning, also outsourced. She did not have as many benefits as directly hired women (i.e., social security, better pay, retirement savings, and health insurance). She stopped

working there when her son started attending school and her mother was not able to take care of him anymore. She currently has her own food stall outside the home she shares with her mother and relayed that she prefers it because she manages her own time. However, given the remoteness of Cucurpe, her chances to grow her business and improve financially are lower than if she was offered a position back in the mine.

For those women who do not work in the mining sector but live in a mining community, livelihood improvements depend on community programs the mine promotes, or benefits women can negotiate. Carmen (50), a librarian and board member of the local land organization (role 3), said that the mine has not hurt livelihoods, but actually helped in creating alternatives for men and women through financial support; for example, a water purification shop, hostels, dinners for mine employees, and other businesses. Other benefits are scholarships for miners' and the local communal landholders' children, support for local sports' teams, and investments in infrastructure (paved roads, improvements in public buildings, lighting, etc.) through a federal tax for physical improvement of mining communities (*Fondo Minero*, or mining fund). Carmen hopes the company does not leave, since, for her, the economic benefits of the mine on women's lives is evident: "they (women in town) look better dressed," "they have their business," and "they do not have to wait for their husbands to give them money." However, these financial impacts are not permanent; interviewees also reported that programs stopped when the mine's ownership changed.

Benefits women can negotiate with the mine usually transpire through formal decision-making structures (i.e., the municipal government, the communal land organization). For example, Carmen is knowledgeable of the support provided by the mine to the local communal land organization because she is a *comunera* (landholder) herself. Women with no access to formal local decision-making structures are less lucky. For example, Sara (44; also role 3), whose family's income is nonsteady and nonagrarian, has not seen changes in her condition because of the mine. Her family is landless, and her two adult sons have applied for a job in the mine without success. Women's participation in decision-making regarding municipal infrastructure remains limited too because of traditional arrangements of local decision-making that privilege men's opinions; therefore, even if women can derive livelihood benefits from the mine, those depend importantly on their personal position and capacity to negotiate.

Empowerment and autonomy

Empowerment and autonomy are two of the biggest achievements women feel mining has given them. Lucia thinks bravery is needed to enter an underground mine. One of her biggest personal transformations due to mining is her new capacity for decision-making that builds on her prior practical and strong character. Also, the high income is a factor in building women's autonomy from family members.

Karla (39) has a bachelor's degree in ecology and recently founded her own consultancy firm on corporate social responsibility, after holding several positions in mining companies (shifting from role 1 to 2). She confides that her high income was a factor in ending her first marriage; it gave her a certain "empowered attitude" toward her partner as the main breadwinner. Although she works offering outsourced advising services to mines (role 2), in comparison to outsourced miner Laura (also role 2, above), her higher educational level, lack of children, and better socioeconomic endowments allowed her to benefit more professionally and economically from the sector.

In terms of gendered treatment, Lucia expresses that she has never felt like she was mistreated or treated unequally as a mine operator. She believes that opportunities depend on performance, not on who you are. However, Marta, in her managerial experience, states that women are not achieving decision-making positions, and this is because women are limited due to fear, large domestic workloads, and gender role impositions. Marta herself had to demonstrate that she could perform as well as any man in this environment, while defeating prejudice about women's emotional tone or the belief in women's incapacity for hard physical work. She relays: "the worst bullying I have ever received came from other women." She remembers when she got a managerial position, some women said to her face "you slept with the boss." Marta reflects,

> There are gender discourses, 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.

Karla also experienced unsupportive and disempowering attitudes from women co-workers. When she started working in mining, traveling to Chile for training was offered to her because of her good performance. Her boss told her to consider it carefully because the other women in the department could be angry that she received this opportunity because, he said, "you are the new one, you do not understand this system yet." She still went, and her female co-workers started gossiping about her relationship to their boss. "This was very difficult to understand and overcome, I cried a lot." She also remembers that she was offered a job in the community relations department of a mine. However, when she was completing paperwork, the manager handed her an agreement promising she wouldn't get pregnant in the next 5 years, otherwise she could lose the job. Karla rejected the position and left the office of the

surprised manager because she "did not want to work with somebody with such a poor attitude." Other women interviewed (not reported here) and some women informally contacted during WIM Sonora events concurred with this perception about structural gender inequalities in mining. WIM, as a nonprofit, serves currently as a collective action platform for women in higher positions working toward improved visibility, acceptance, and opportunities within mining; it has the potential, however, to broaden its scope to incorporate all mining women's interests regarding effects on sustainable livelihoods.

Family and social relations

Lucia needs to rely on her family to have her young child cared for while she is working. Also, household chores are distributed between her, her husband, and her mother. When asked how she manages her multiple responsibilities, she laughs: "…I convert myself into an octopus, I 'extend' myself." It is difficult to maintain friendship networks with the long workdays. Free days are dedicated to laundry, cleaning, grocery shopping, and being with family.

Marta also says that "mining is very jealous" of one's time. She believes not having children helped her advance in her career. Most women who are mothers and miners must deal with family responsibilities, very long journeys, and demanding shifts, unless they receive or hire help. Mine managers also don't recognize the different workloads and responsibilities assigned to men and women outside the companies that limit women's capacity to access top positions. These are very hard issues for men with families too. Marta confided that she has seen a lot of miner fathers requesting "gender equality" to see their children, attend school meetings, and take them to the doctor. The mines usually permit this for mothers, not fathers. "Mining is a macho world, and more than that, a very corporatized sector," she says. This lack of recognition by mining companies of fathers' roles in parenting and the perpetuation of *machismo* within many rural households continue to place most child-rearing and housework on women's shoulders.

Karla was also aware of these dynamics. After her first marriage ended, she decided to quit mining and develop consultancy activities while searching for a more stable family life because mining work was time-intensive. Some told her during fieldwork "what are you doing here? Go home and have children! Aren't you scared that somebody is going to steal your husband from you?" Even as a young girl growing up in Cananea, a mining town, Karla wanted to be a geologist, but her father told her that was a "man's career." While mining is a difficult job, it is made even harder for women because of cultural impositions that openly persist in rural communities, and subtly persist in mining companies. In general, to be a successful woman in mining, as in other economic sectors, support from social networks is vital.

Environmental, social, and health hazards

Both men and women face physical, social, and environmental risks related to mining. Of the women presented here, Lucia was the most exposed to physical risks due to her work in an underground mine. She is conscious that one day she might not emerge from the 1.5-km-deep tunnel. She remembers that the hardest challenges faced underground were a small fire and gas intoxication; both could have been fatal. However, she feels proud because "the same things they (men) do, I do too." Lucia has good medical insurance that allowed her to receive better gyneco-obstetrician care when her youngest daughter was born, something her female townspeople (role 3) or her female subcontracted colleagues (role 2) do not have.

Marta explains it is difficult to be a woman in a place full of men. Using the same bathroom, wearing male miner clothes, and establishing respectful relationships with male co-workers (especially if drunk) are challenging. Another factor heightening risks is the increasing presence of drug traffickers (*narcos*) in the rural communities. Marta says that you learn to "feel no fear of anything" when you are out there. Karla shares a similar story from when she was working in an exploration project: "…when we [first] arrived and were surrounded by ten boys holding AK-47s… they surely thought: these people have come to invade us, and, on top of that… they are women!" These are both social and potentially bodily (physical) impacts women face in mining. For women not working directly in mining, but living in the community (role 3), the main environmental/health effects are impacts on water and land, and consequently on their livelihoods, and health effects of current and long-term pollution.

For the Mercedes mine, all land was part of a private ranch, therefore all negotiations were between private owners (Premier Gold Ltd, 2018). According to the Cucurpe municipal authority interviewed, the only case in which the mine dealt with the collective land organization was during power line construction; then the mine financially compensated each landholder. Several women also participated as members of the organization. However, far fewer women than men own land here which is similar to elsewhere in Mexico, where slightly fewer than 30% of rural landholders are women (Instituto Nacional de las Mujeres, Gobierno de Mexico, 2019). This is an obstacle to women's negotiation with mining companies over access to livelihood resources (Castro-Ramírez et al., 2015; Salazar and Rodríguez, 2015).

There are also social–ecological risks associated with the mine's presence and uncertainty about the reliability of government monitoring of water quantity and quality.[4] The municipal representative interviewed did not trust the federal water

Table 1. Summary of roles of women in mining and their related positive (+) or negative (-) effects.

Roles of women	Socioeconomic and livelihood effects	Environmental and health effects
1. Women who work in the mining production process directly dependent on the mining company	• Nonagrarian income (+) • Professional opportunities (+) • Empowerment (+) • Persistent inequalities (–) • Persistent glass ceiling (–) • High social and family costs (–)	• Better health services and insurance (+) • Higher risks of sickness or sudden death (–) • Lower environmental quality in the workplace and the community (–)
2. Women who work for outsourcing companies in the mining sector	• Nonagrarian income (+) • Persistent inequalities (–) • Job insecurity (–)	• Higher risks of sickness or sudden death (–) • Lower environmental quality in the workplace and community (–) • Little or poor social and health insurance services (–)
3. Women who live in a mining community and/or reproduce domestic life in households which may or may not have one member who is a miner	• More financial and material resources available (+) • Better educational opportunities (+) • Better infrastructure and public services (+) • Child-rearing overload (–)	• Impact on resources for livelihoods and/or domestic reproduction (+/–) • Food/water insecurity (–) • Impacts on environmental quality of the community (–)
4. Women who are in managerial or decision-making positions within the mining sector	• Professional opportunities (+) • Empowerment (+) • Persistent inequalities (–) • Persistent glass ceiling (–) • High social and family costs (–)	• Better health services and insurance (+) • Exposure to long-term stress and burnout (–) • Lower environmental quality in the workplace when working in the mining site (–)
5. Women who are political subjects in conflict/cooperation relationships with mines	• Loss or deterioration of livelihoods and/or property (–) • If in cooperation, improved access to resources for alternative livelihoods and better community infrastructure (+)	• Impacts on physical, mental, emotional, or sexual health (–) • Exposure to environmental hazards (–) • Exposure to increased violence (–) • Exposure to long-term stress and burnout (–) • If in cooperation, improved access to public services, which can include health and care (+)

agency (CONAGUA) surveillance of the Mercedes tailings dam.

> Who can guarantee that we won't have the problems the Sonora River had? (referring to a large copper leaching solution spill in the neighboring Sonora River in 2014). We want an official statement that monitoring is happening and everything is in order.

However, he did say that the mine is improving tailing storage. Although we did not interview CONAGUA's officials at the time, previous research points to the lack of personnel and surveillance as major problems (Lutz-Ley, 2016).

Table 1 summarizes the different effects associated with the roles identified. While we could find empirical evidence in Cucurpe for roles 1–4, the fifth one was not possible to find in this community in particular, but it exists in other places of Sonora and Mexico (Browning-Aiken, 2000; Salazar and Rodríguez, 2015). Role 5 is described through evidence from literature review.

Diverse roles, fair trade-offs?

Women's involvement in LSM in Latin America and Mexico is increasing, yet there is little literature on this topic in the region (notable studies were identified for Australia, Africa, and Asia). Women in mining have been treated as a rather homogeneous group, and most literature focuses on women's participation in ASM. Our study addressed both a geographic and a conceptual gap, identifying through literature review five roles women play in LSM and finding empirical evidence via semistructured interviews for the first four roles in Cucurpe, Sonora, a small village in arid northwest Mexico. Sonora is a major mining region lacking in-depth studies on women in this sector. We also contribute to FPE by analyzing how these roles shaped women's experiences with LSM related to career and livelihood advancement, gendered workplace politics, and household dynamics. In general, we found that the higher wages women earned in a limited agrarian labor market, in part, silenced opposition to the longer-term environmental and livelihood impacts of mining in this community, but these benefits and dangers were not equally distributed within the community and among women.

Women working in regular and outsourced positions in mining (roles 1, 2, and 4), including operational and managerial jobs, are exposed to safety risks in their work, lack adequate facilities and clothing in remote exploration areas, and must also contend with new dangers like drug

traffickers in rural locations. Women in these positions indicated that mining gives them a strong identity and sometimes empowers them within their households and communities. However, they pay high costs to arrange their family responsibilities around their jobs. Women in outsourced positions, part of neoliberal flexibility policies of globalized mining operations, had less agency and were more vulnerable: they were even less likely to advance within mining than women in regular positions. Recent networks of women miners within the national Mexican mining labor union formed with women in other industries for greater gender equality offer a glimmer of hope for women in Cucurpe (Solidarity Center AFL-CIO, 2017); it remains to be seen if both permanent and temporary women miners could benefit.

Using an FPE analysis, we examined the ways in which these material relationships and experiences were mediated by challenging political environments for women who must stand their ground vis-á-vis mining companies, miner colleagues, and their own household and community members. All women miners interviewed mentioned major impediments to career advancement, because of a macho work culture and lack of recognition of gendered workloads outside the mines. Women are able to exert some pressure on mining companies and the government to use mining revenue to bring scholarships, infrastructure and income-generation projects to their communities, but their influence also depended on their capacity to participate in formal, community decision-making structures, which are characterized by traditional, gender-based inequalities related to decision-making capacity.

For those women who depend more on agrarian livelihoods and do not work directly in the mine (role 3), lack of legal access to resources is a major obstacle to their ability to negotiate with mining companies even though their livelihoods can be compromised. In rural Cucurpe considerable volumes of scarce groundwater are diverted for mining with inadequate water pollution prevention measures developed. Similarly, land concessions are extensive and long-standing, favoring land use for extractive industries, in the hands of companies instead of communities, much less in the hands of women.

Despite the problematic position of mines in rural communities, they play an important role for some women. This is due to low remuneration for agricultural jobs and for crops, paucity of available rural nonagricultural employment for women, and lack of jobs with comparable remuneration to mining. Even women with low educational attainment can earn more. Women hired directly by the mine receive superior benefits than subcontracted workers do. This labor market context makes them less likely to overtly resist the entry and persistence of extractive activities in their community. Some women like Marta and Karla have been able to develop higher-end businesses like consulting firms related to mining, but they were more educated than most women and men and even said that career advancement was more difficult for women.

Women who endure and are promoted in mining are those who negotiate a more equal distribution of housework and childcare among themselves, spouses, and others. However, they sometimes face resentment and resistance from family and community members for their courage to enlarge the public space they occupy due to their mining jobs and from female mining colleagues for any upward mobility. Inclusion of their voices and FPE analysis shed light on the dynamic interconnections between the social, economic, and environmental impacts of LSM on Sonoran women in their careers, homes and communities, and their agency to shape these spaces.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The authors are grateful for the collaborative research seed grant received in 2017–2018 from the Next Generation Sonoran Desert Researchers (N-Gen) to initiate this research.

Notes

1. Our translation from original in Spanish.
2. Mining has been a historic, although nondominant activity in Cucurpe (Sheridan, T. 1988. *Where the Dove Calls. The Political Ecology of a Peasant Corporate Community in Northwest Mexico*. Tucson: The University of Arizona).
3. See http://wimmexico.org.mx/ (accessed July 11, 2019).
4. Although we did not find official data for water consumption, Premier Gold's 2018 technical report states that the mine uses 9,000–15,000 m^3 of water per month, most of it groundwater extracted from the mine tunnels' perforations. This is a significant volume for a mine in a semiarid region like Cucurpe. The local municipal representative and Carmen (role 3 above) reported no impact so far on the water sources for agriculture in the community.

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