

Climate change will challenge mining operations in Mexican arid lands and push human water security to the limits

Policy brief prepared for decision-makers in the mining sector in Sonora, Mexico*

SUMMARY.- This policy brief describes research conducted to understand the relationship between large-scale mining and water security in a context of climate change in Sonora and provides knowledge regarding how host rural communities are potentially in a double exposure situation: first they are exposed to the impacts of climate change, and second, to the impacts of large-scale mining operations on their water resources. Methodology integrates quantitative and qualitative techniques for collecting and analyzing spatial and statistical data at various scales. Findings indicate that 1) most of the land and water mining concessions in Sonora are in zones with important water limitations; 2) the Sonoran mining sector has annual water concessions equivalent to the volume supplied to Hermosillo, the capital city, with almost one million people; 3) mining representatives surveyed report that they already see the effects of climate change in higher temperatures and altered seasons and precipitations; 4) however, corporative plans for addressing climate change lie short in scope as they refer mostly to resource-saving strategies in the internal productive processes, with little or no attention to the community context. The conclusions point to the importance of inter-sectoral collaborations between mining, the government, and society, to achieve water security for host communities in face of climate change, and mining that is truly sustainable and respectful of local people's wellbeing.

1) BACKGROUND

- Sonora state is a climate change hotspot in Mexico.
- All climate projections found for the region show a tendency to increased heat, and less conclusive projections for precipitation; although researchers expect a long-term decrease in rainfall volumes and changes in temporality.
- Other extreme events are expected to increase in frequency and severity (e.g., droughts, wildfires, hurricanes, etc.).
- Almost all studies regarding climate change and mining focus on mines as greenhouse gases emitters; less research exists on the impacts of climate change on mining.
- Another knowledge gap exists in the effects that climate adaptation strategies of mines will have on their host communities, specially in terms of access and distribution of water for domestic and small agricultural uses in arid lands.

2) OBJECTIVE

To investigate and understand how climate change impacts the Sonoran mining sector, how the sector responds to such impacts, and how this, in turn, can generate cascading detrimental effects on water security of host mining rural communities.

Primary concepts

Climate Change: "... a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." (UNFCCC, 1992, Article 1).

Water security: "...the sustainable availability of water in sufficient quantity and quality for resilient societies and ecosystems in the face of uncertain global change..." (Scott et al. 2013).

Mitigation: "Human intervention to reduce the sources or enhance the sinks of greenhouse gases" (IPCC, 2014). It addresses causes.

Adaptation: "The process of adjustment to actual or expected climate and its effects" (IPCC, 2014). It addresses consequences.

3) METHODS AND DATA

A: Geo-statistical analyses of secondary official data

Spatial and statistical analysis of mines' land and water concessions, active mining units as of Dec. 2017, and status of water availability in aquifers and river basins of Sonora, by using Geographic Information Systems.

B: Online survey of climate change perceptions and responses in mining

25 representatives of mining operations in 6 different municipalities, responded a 22-items online survey regarding 1) their perceptions on climate change, 2) stressors and impacts on their operations, and 3) current or planned responses to those. Descriptive statistics were obtained.

3) RESULTS (A)

Use of water by the mining sector and potential impacts on water security

- Up to 2017, 46 mining units were active in Sonora; 22 extracting metallic minerals (SGM, 2017).
- According to data from the Ministry of Economy, in 2015 the land concessions for mining activities (from exploration to extraction) covered 3.8 million hectares, or 21% of the state's surface.
- Water titles were identified in the Public Registry of Water Rights (REPDA, 2019) for only 22 of the 46 units. Together they sum up 123.3 Million Cubic Meters (MCM) of water per year; roughly equivalent to the concessions of Hermosillo, the state's capital city.
- This is most probably underestimated, since mining companies are not obliged to report water obtained from their works, even if used. Three companies concentrate 74% of the concessioned volume: Buenavista del Cobre, Mexicana de Cobre, and Fresnillo.
- 29 of the 46 active mines are in areas corresponding to aquifers that according to information from CONAGUA (2015a), still have water availability. However, in terms of distribution of concessions, 54% of the volume granted to mining is extracted from areas where aquifers show a deficit (i.e., more extraction than recharge) (Table 1).
- When considering the status of watersheds in Sonora, 26 mines and 52% of the volume of water granted to mining correspond to watersheds with a federal ban decree on extractions (CONAGUA, 2015b) (i.e., basins where no new water extractions are granted) (Fig. 1 and Table 2).

Table 1. Water concessions for mining and status of aquifers in Sonora.

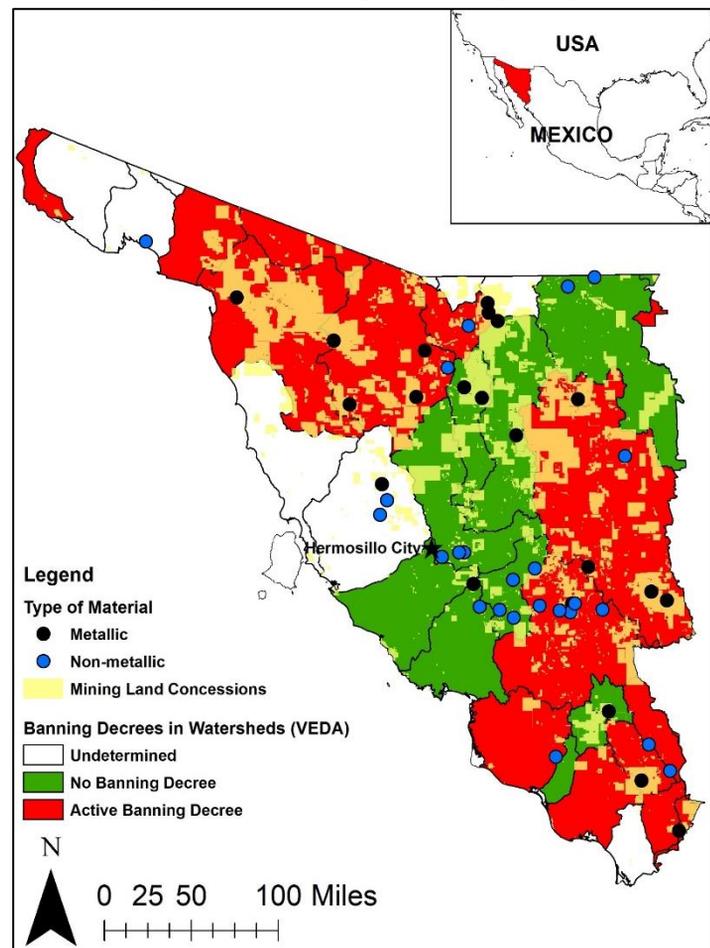
Aquifer status	# Metallic mines	# Non-metallic mines	Concessions in MCM/year
No availability	5	12	66.64
Availability of water	17	12	56.64
TOTAL	22	24	123.28

Table 2. Water concessions for mining and watersheds' banning decrees on extractions (veda).

Watershed status	# Metallic mines	# Non-metallic mines	Concessions in MCM/year
Active banning decree	15	11	64.40
No banning decree	6	10	57.58
Undetermined	1	3	1.30
TOTAL	22	24	123.28

Fig. 1. Active mining units and status of watersheds' banning decrees on extractions.

(Source: translated from Lutz-Ley 2020).



3) RESULTS (B)

Perceptions and preparedness of the mining sector to face climate change

- A group of 25 representatives from the mining sector in Sonora answered an online survey distributed through the platform SurveyMonkey®. Although the number of participants is relatively low, it represents professionals from environmental and community relationships departments, members of professional mining associations, and professionals in supply and services companies, so it provides an adequate first exploratory approach to these issues in Sonora.
- From the total 25 participants, 72% indicated that climate change is already happening in the localities where their businesses are located. The three effects of climate change most reported were: 1) higher temperatures (60%), 2) variability in precipitations (56%), and 3) altered seasons (52%).
- Also, 56% answered they think climate change is already affecting their businesses; while 76% think climate change will affect their businesses in the future.

- Participants were asked to rank from 1 to 5 the severity of current and future affectations of a series of climate-related stressors, where 1 is “it does not affect us at all”, and 5 is “it affects us to the point that we would have to close business”.
- The main climate-related stressor both currently and in the future refers to the impacts of climate change of water availability (a mean score of 3.87 currently, and a higher perceived severity in the future, with 3.91) (Fig. 2).
- Other stressors asked for but not included in Fig. 2 were: impacts on local infrastructure, on ecosystems, on local economy, on the landscape, higher temperatures, and altered precipitations and seasons. These stressors had all mean scores above 3.0 both currently and in the future.

Fig. 2. Top climate stressors by perceived severity for mining businesses currently and in the future.

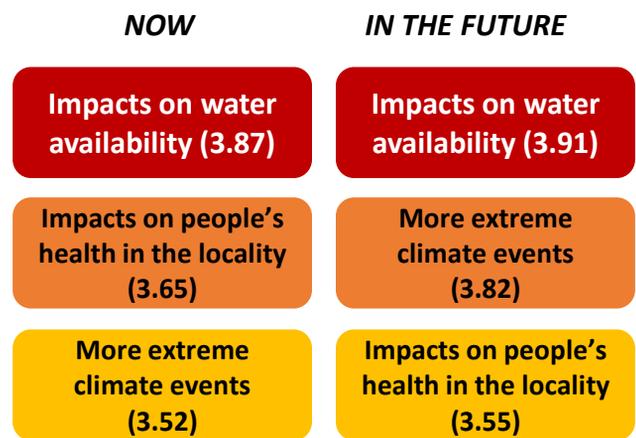


Table 3. Strategies to mitigate or adapt to climate change.

STRATEGIES	Current	Future
Corporate programs for resource recycling and savings	60%	48%
Corporate programs for adequate use of water	56%	64%
Implementing better strategies and technologies for the use and management of energy	52%	36%
Corporate programs for the proper use of energy	52%	60%
Review of procedures to respond to emergencies and development of contingency plans	44%	40%
Community programs for recycling materials and saving resources in the locality	44%	44%
Corporate programs to educate employees about climate change	32%	56%

- From the 25 participants, 72% said their organizations were already responding to climate change.
- When offered a checklist of 23 potential responses to indicate if their organizations perform them now, or plan to have them in the future, the most frequent responses referred to corporate programs for resource recycling and savings (60% responded that is happening currently and 48% that is planned in the future); for adequate use of water (56 and 64%); and for the use and management of energy (52 and 36%). Table 3 lists the seven most frequently mentioned strategies, current and planned.
- More attention to water and energy is planned for the future. Reported strategies refer to secondary aspects, such as resource use and efficiency, and focus much less on direct aspects, e.g., understanding and projecting climate impacts on mining.

4) CONCLUSIONS AND RECOMMENDATIONS

- Water concessions in the mining sector in Sonora equal those of the capital city with almost one million people, and occur in the context of historic water limitations, both from surface and groundwater. This is expected to get worse as climate change advances.
- The most frequently reported strategies to face climate change impacts now and in the future in the mining sector, refer mostly to corporate processes to manage resources such as water and energy, and neglect community context and relationships. Understanding and projecting climate change impacts on mining and supply and demand chains is neglected too.
- The restrictive water conditions of most of the Sonoran territory, and specially in places where mining operations coexist with rural and agrarian communities, could foster important socio-environmental conflicts regarding water access and distribution in the near future.
- Social and corporate responsibility can be an initial framework to foster collaborative actions to advance climate adaptation in partnership, and not in competition, with host communities.
- Stronger inter-sectoral collaborations are required between mining, the government, and society, to achieve human water security and mining that is truly sustainable, and respectful of local people's wellbeing.



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6) ADDITIONAL RESOURCES

- Environmental resilience programs and guidelines by the ICMM: <https://www.icmm.com/en-gb/our-work/environmental-resilience>
- Knowledge Platform of the United Nations' Sustainable Development Goals (SDGs) on mining: <https://sustainabledevelopment.un.org/topics/mining>
- Resources of Business for Social Responsibility (BSR) on climate change. For example: https://www.bsr.org/reports/BSR_Climate_Adaptati on_Issue_Brief_Mining.pdf

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