

Sustainability Challenges and Rural Livelihoods in the Aravali Region: Assessing the Impact of Mining – Pathway to Vikshit Bharat 2047

(A Case Study of Girwa Tehsil, Udaipur, Rajasthan)

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Abstract: The Aravalli Hills, among India's oldest geological formations, play a vital ecological role as a natural barrier against desertification and as a protector of biodiversity and groundwater recharge. Extending across nearly fifteen districts of Rajasthan, the range is central to the state's environmental and socio-economic balance. Rajasthan, often termed a "museum of minerals," is one of India's most mineral-rich states, and the Aravalis serve as a significant repository of diverse mineral deposits.

Field research reveals that livelihoods in mining-affected areas of the Aravalis are increasingly under stress. Two critical concerns have emerged: a sharp decline in underground water levels and the loss of flora and fauna essential for ecological stability and animal sustenance. Mining leases within spans of 3–5 kilometers are simultaneously extracting minerals, groundwater, and biological resources, intensifying environmental degradation.

This study highlights the dual role of the Aravalis as both a mineral repository and an ecological lifeline, emphasizing the urgent need for sustainable resource management to safeguard biodiversity, water security, and rural livelihoods.

Keywords: Mining, Aravali, Underground Water, Livelihood

Introduction

The Aravalis represent two distinct environmental concerns based on their eastern and western differentiation. On the one hand, they act as a natural ecosystem regulator, while on the other, they face increasing degradation due to anthropogenic pressures, particularly mining and deforestation.

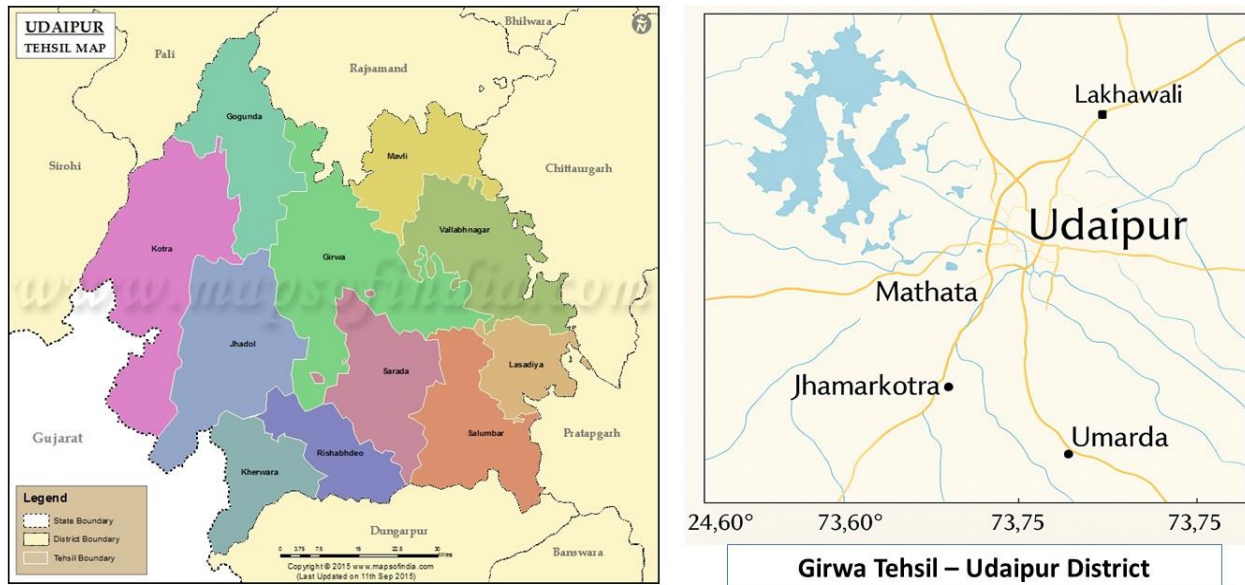
Ecologically, the Aravalis serve as the origin point of several rivers and forest sanctuaries, supporting nearly 80% of Rajasthan's population through water recharge, biodiversity conservation, and livelihood resources. They function as a sustainable balance between environment and human livelihood, providing minerals, forests, and fertile soils while simultaneously acting as a recharge medium for underground aquifers.

However, studies reveal alarming trends. Since 1975, approximately 8% of the Aravali hills have been destroyed or rendered obsolete due to unsustainable practices. If this trajectory continues, projections indicate that nearly 22% of the hills may disappear in the coming decades. Such degradation threatens not only mineral wealth but also biodiversity, water security, and the socio-economic fabric of rural communities dependent on this ecosystem.

In essence, the Aravali Range is far more than a mineral repository. It is a cradle of biodiversity, a regulator of ecological balance, and a lifeline for millions of people in Rajasthan. Its preservation is therefore integral to both environmental sustainability and human development.

Girwa, a tehsil in Udaipur district of Rajasthan, is renowned for its rich mineral resources. The region is particularly notable for its deposits of zinc and rock phosphate. Zawar, often referred to as the “Mother Mines” of zinc, has been a site of zinc extraction since ancient times, underscoring its historical and industrial significance. Equally remarkable is Jhamarkotra, home to Asia’s largest rock phosphate mines, which sustain the livelihoods of local communities both directly and indirectly. Owing to these vast mineral reserves, Udaipur has earned the title of “Zinc City,” serving as a vital hub where mining activities continue to shape the economic and social fabric of the region.

Study Area



Udaipur, a district situated in the southern part of Rajasthan State nestled in the southern Aravalli ranges, the oldest mountain range in World, is a geologically and geographically rich district known for its ancient mining heritage and diverse mineral resources. Udaipur contributes a significant importance in Rajasthan mineral economy, as Udaipur is the basket of ores, major and minor minerals, especially in the production of Zinc, Marble, internationally accepted serpentine known locally as Green Marble and of rock phosphate.

Considering the Analysis part of the research topic “Sustainability Challenges and Rural Livelihoods in the Aravali Region: Assessing the Impact of Mining – Pathway to Vikshit Bharat 2047” the Girwa Tehsil is selected as a Field survey work which is rich in minerals in Aravali range situated in Udaipur District.

Methodology

Field survey in the various mining areas in Girwa Tehsil of Udaipur district of Rajasthan State.

The Primary Data for the field survey has collected through questionnaire method depending upon the information required for the study of the topic selected and group interview of the workers / Local villagers / mining officials / In- charge. The Secondary Data has collected through the Office Records available at the Mining Establishment and various reports published by the Government of Rajasthan. A portion of secondary data has also collected from the articles published in various newspapers from time to time.

The methodology used for the research study is in the form of qualitative and quantitative mode, however, the research is in descriptive way.

Objective of the Study

The primary objective of this study is to critically examine the sustainability challenges associated with livelihoods in mining areas and their adjoining peripheries. Specifically, the research seeks to identify the socio-economic, environmental, and cultural impacts of mining activities on local communities, with a focus on long-term viability and resilience. By analysing the dependence of households on mining-related employment, resource utilization, and ecological conditions, the study aims to highlight the vulnerabilities and risks that threaten sustainable development in these regions. The study aspires to contribute to a deeper understanding of how mining economies can transition toward sustainability, ensuring that livelihoods are preserved without compromising ecological balance and social well-being.

Results and Discussion

A case Study of Girwa Tehsil – Mining Area - Udaipur District - Rajasthan

Village	Mining Lease Name	Category of Minerals	Lease Area (in Hectare)	Source of Water	Employment	Production Per Annum	Dumping of Waste and Overburden (in Hectare)
Umarda	Charbhuj Minerals (P) Ltd.	Masonarystone	10	Underground Water	70	5.50 MT	10
Jhamarkotra	R.S.M.M.Limited	Rock Phosphate	1372	Jhamri River (Reserved Area for RSMM)	1760	2.08 MT	350
Mathata	Delwara Marbles And Granites Pvt. Ltd.	Phyllite, Schist	4.5	Underground Water	55	3.2 MT	5
Lakhawali	Mewar Industrial And Commercial Syndicate	Soapstone	65	Underground Water	18	1.2 MT	25
Lakhawali	Aravali Minerals And Chemical Industries Pvt. Ltd.	Soapstone	58	Underground Water	80	4.50 MT	45

(Source: Data Collection, December '2025 by Ms. Rubi Kumari, Research Scholar)

The study area is located in the Aravali Mountain range within Girwa Tehsil of Udaipur District, Rajasthan. Based on information collected from primary sources, several critical observations have been made regarding land usage, water resources, employment, and environmental impacts. The mining establishments are utilizing nearly 50% more land than the allotted lease area for mineral extraction. Much of this additional land is being used for dumping waste material and overburden, which often encroaches upon agricultural and forest land. This has resulted in significant loss of vegetation and biodiversity. A major concern identified is the depletion of underground water. Mining operations rely heavily on groundwater extraction, with current withdrawal occurring at depths of approximately 400–500 feet. This poses long-term risks to water availability for both villagers and ecological systems. While mining activities provide employment opportunities to local communities, the environmental costs—particularly land degradation and water depletion—raise questions about the sustainability of such practices. The use of agricultural and forest land for waste dumping has led to the destruction of flora and fauna, further intensifying ecological imbalance in the region.

Overall, the findings highlight the pressing need for stricter land-use regulation, sustainable water management, and environmentally responsible mining practices to safeguard both livelihoods and ecosystems in the Aravali region.

The study reveals that while mining establishments are currently extracting resources to the best of their capacity, significant demand–supply gaps persist.

Rock Phosphate (RSMM, Jhamarkotra, Udaipur): Known as Asia's largest rock phosphate mine, RSMM Jhamarkotra contributes only 15–17% of India's total demand. Several fertilizer units located nearby depend heavily on these mines, thereby providing direct and indirect employment opportunities to local villagers.

Masonry Stone Mining: A masonry stone mine and crushing unit produces approximately 5.50 MTPA (Metric Tonnes Per Annum). However, this output meets only about 5% of the overall demand.

Umarda Village: In Umarda, 15 mining leases are engaged in stone extraction and crushing, yet the demand–supply gap remains unaddressed.

Soapstone Mining (Girwa Tehsil): Multiple soapstone mining leases are active and operating at their maximum capacity, but even here, production falls short of meeting national demand.

These findings highlight a critical challenge: despite optimal utilization of available resources, mining establishments are unable to bridge the demand–supply gap. This underscores the need for strategic policy interventions, technological innovation, and sustainable expansion to strengthen India’s mineral resource base.



(Masonry Stone Mines & Crushing, Umarda, Udaipur AND RSMM Rock Phosphate Mines, Jhamarkotra, Udaipur , Photo Courtesy, Ms. Rubi Kumari, Research Scholar)

Impact of Mining on Rural Livelihood

Sr. No.	Parameters	Impact	
		Positive	Negative
01.	Income	(+) ve impact	
02.	Agriculture		(-) ve impact
03.	Animal Husbandry		(-) ve impact
04.	CSR Activities & Govt. Support	(+) ve impact	
05.	Loss of Forest and Land Degradation		(-) ve impact
06.	Water Level		(-) ve impact
07.	Health Issues		(-) ve impact

- a) **Income:** There is a trend of positive Economic growth as the workers are working on regular basis in mining establishment. Subsequently they are also earning through their family owned activities like animal husbandry and agriculture.
- b) **Agriculture:** There is negative trend found in the agriculture especially in the area of 2km – 4km adjacent to mining lease due to of pollution and influents affecting the harvestings. It has also found in reduced fertility of the harvestings.
- c) **Animal Husbandry:** There is negative trend in Animal husbandry as there is declines when grazing land shrinks near the mining lease area. It has also found that there are health issues in domestic animals like shortage in life span of animals, low yield of milking and others.
- d) **CSR & Govt. Support:** Provides compensatory benefits like infrastructure, education, or healthcare. The study reveals that the local residents are availing the government facilities especially the health policies and pension schemes.

- e) **Loss of Forests:** The study shows that there are leads to biodiversity decline, soil erosion, and ecological imbalance. After mining of minerals, there are no plan for reclamation of land as on date even they do not have any techniques for the reclamation of land. It has also found that the mining establishments are using an ample of land which is either forest or agriculture as a dumping yard for the waste and overburden.
- f) **Water Level:** The study shows that areas of 2km to 3km near the mining lease has a depth of 400ft to 500ft of underground water. Mining establishment are using the underground water resulting on deplete groundwater, affecting sustainability.
- g) **Health Issues:** Pollution, dust, and stress from degraded environments increase risks of respiratory and chronic diseases.

Sustainability Challenges in Rural Livelihood

During the course of the study, one of the major challenges identified is the relocation of rural residents living in proximity to mining lease areas to 2 km to 3 km . Villagers who are directly associated with mining—either as employees or through family members engaged in mining activities—generally express satisfaction with the industry. In contrast, those not connected to mining often raise concerns regarding its adverse impacts on their daily lives.

The primary issues highlighted include:

- Dust and air pollution affecting health and surroundings.
- Continuous movement of heavy vehicles through village roads.
- Negative impacts on livestock and agricultural vegetation.
- General disruption of rural life and environment.

Despite these concerns, villagers have limited options to relocate, as their homes, agricultural lands, and livelihoods are rooted in these areas. Their survival, identity, and socio-cultural belonging are inseparably tied to the land.

This situation represents one of the critical sustainability challenges in mining regions, where balancing industrial development with the well-being of local communities remains a pressing concern.

Another dimension of sustainability observed during the study is that many villagers, though not directly employed in mining, derive their livelihood indirectly from mining establishments. The findings highlight several positive contributions of mining companies toward local development, including Revamping and strengthening village schools, Providing drinking water to residents and their livestock, particularly during the summer months, supporting villagers in local festivals, cultural functions, and community activities and Enhancing the overall socio-economic environment of the region.

Over time, the area has become widely recognized for its association with mining, which has shaped both its identity and its developmental trajectory.

During the study, one of the critical sustainability challenges identified is the future of villages and their residents once mining leases expire and operations come to a close. The closure of mining activities presents two major concerns:

1. **Absence of Land Reclamation Plans** – Mining establishments often lack comprehensive strategies for land reclamation, posing serious risks to villagers, their livestock, and the surrounding environment.
2. **Economic and Social Disruption** – The cessation of mining activities directly impacts the income of villagers, leading to sudden economic collapse, persistent environmental degradation, and the breakdown of community social structures.

These challenges manifest in multiple ways, including, widespread job losses, Lack of alternative sources of livelihood, Deterioration of essential public services such as infrastructure, healthcare, and education, Long-term environmental harm affecting agriculture and rural sustainability.

This situation underscores the urgent need for proactive policies and sustainable transition strategies to safeguard rural communities and ensure balanced development beyond the life of mining projects.

Sustainability Challenge – A roadmap to Vikshit Bharat 2047

Viksit Bharat 2047 represents the visionary projection of the present government, focusing on framing policies that will transform India into a developed nation. Mining stands as one of the core sectors contributing to this vision, playing a pivotal role in economic growth and industrial advancement.

The Government envisions India as the world's fourth-largest economy, where the mining of minerals has made significant contributions. High-quality minerals such as marble and soapstone have supported exports, strengthened infrastructure development, advanced healthcare industries, and contributed to agricultural progress. Furthermore, innovations in critical minerals and the promotion of a circular economy align seamlessly with the framework of *Aatmanirbhar Bharat*.

To achieve holistic development, policy alignment must integrate mining with the principles of a green economy. This includes:

- a) Waste reduction and recycling of materials.
- b) Adoption of renewable energy solutions, such as solar power for mining operations.
- c) Deployment of battery-operated vehicles and machinery to reduce emissions.
- d) Optimized extraction of minerals with minimal manpower loss.

In the era of *Digital India* and Artificial Intelligence, the effective use of digitization, automation, and advanced technologies in mining processes can significantly reduce environmental impacts. By embracing these strategies, the mining sector can become a cornerstone of sustainable development, contributing meaningfully to the realization of *Viksit Bharat 2047*.

Conclusion and Suggestions

During the study, one of the most effective solutions for power generation to support mining establishments was identified. In Udaipur district, a floating solar power plant has been constructed on stored rainwater within the closed patch areas of the mines. This innovative approach enables sustainable power generation. According to approximate calculations, the payback period for the incurred cost is 6–7 years, while the overall project life extends to 25 years. This indicates that, beyond the payback period, the cost of power consumption for mining operations becomes minimal.

Such a concept can be replicated in other mines, particularly in closed or abandoned mining leases where water has accumulated for many years without any productive use. The Government should encourage and support the formulation of new policies to ensure the effective utilization of these unused resources. This initiative would significantly contribute to sustainable development in India and stand as a unique step towards achieving the vision of *Viksit Bharat 2047*.

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