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SUSTAINABLE DEVELOPMENT AND MINING IN THE ARAVALLI HILLS: A CRITICAL ANALYSIS OF ENVIRONMENTAL LAWS

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Abstract

The Aravalli Hills, one of the oldest mountain ranges in the world, play a crucial ecological role in maintaining environmental stability in north-western India. Stretching across states such as Rajasthan, Haryana, and Delhi, the region functions as a natural barrier against desertification, supports biodiversity, and contributes significantly to groundwater recharge. However, extensive and often illegal mining activities have severely degraded this fragile ecosystem. This research paper critically examines the conflict between sustainable development and mining practices in the Aravalli Hills, focusing on the effectiveness of environmental laws and regulatory frameworks in India.

The study adopts a doctrinal research methodology, analyzing constitutional provisions, statutory laws such as the Environment (Protection) Act, 1986 and the Forest (Conservation) Act, 1980, along with key judicial pronouncements of the Supreme Court of India and the National Green Tribunal. The paper evaluates whether existing legal mechanisms adequately address environmental concerns while balancing developmental needs. Particular emphasis is placed on recent judicial developments, including the Supreme Court's order dated 20 November 2025 in *In Re: Protection of Aravalli Hills*, *Suo Motu Writ Petition (Civil) No. 10 of 2025*, which took cognizance of ongoing environmental degradation and illegal mining in the region and underscored the need for stricter enforcement and technological monitoring.

The paper argues that despite a robust legal framework, enforcement gaps, administrative inefficiencies, and economic pressures have undermined sustainable development goals in the Aravalli region. While judicial intervention has played a significant role in curbing environmental violations, the persistence of ecological degradation highlights the limitations of reactive governance. The study concludes that sustainable development in the Aravallis requires not only strong legal provisions but also effective implementation, institutional

accountability, and community participation, supported by technological advancements and integrated policy approaches to ensure long-term ecological preservation.

1. Introduction

The Aravalli Hills, one of the oldest fold mountain systems in the world, stretch across north-western India, primarily covering the states of Rajasthan, Haryana, and parts of Delhi and Gujarat. Historically, the Aravallis have served as a natural barrier against desertification from the Thar Desert and have played a vital role in sustaining ecological stability in the region.¹ Their geological antiquity and rich mineral deposits have also made them a focal point for extensive mining activities over decades.²

Ecologically, the Aravalli Hills are indispensable for maintaining environmental balance and climate regulation. They function as a green buffer, moderating extreme climatic conditions, aiding groundwater recharge, and supporting biodiversity, including numerous endemic flora and fauna.³ The forest cover in the Aravallis contributes significantly to carbon sequestration, thereby playing a role in mitigating climate change impacts.⁴ Moreover, the hills act as a crucial watershed, feeding rivers and sustaining agricultural productivity in adjoining areas.⁵

However, the rise of mining activities—both legal and illegal—has led to severe environmental degradation. Unregulated extraction of minerals such as granite, marble, and sand has resulted in deforestation, soil erosion, loss of biodiversity, and depletion of groundwater resources.⁶ The fragmentation of habitats and the destruction of natural landscapes have further intensified ecological imbalance and increased vulnerability to climate variability.⁷ Despite the existence of environmental laws and judicial interventions, enforcement gaps and administrative inefficiencies continue to exacerbate the situation.⁸

The gravity of this crisis has been recently reaffirmed by the Supreme Court in its order dated 20 November 2025 in *In Re: Protection of Aravalli Hills*, *Suo Motu Writ Petition (Civil) No. 10 of 2025*.⁹ Taking suo motu cognizance of ongoing environmental degradation and rampant illegal mining in the Aravalli region, the Court highlighted the persistent failure of regulatory authorities to implement earlier judicial directives and statutory safeguards. The Court emphasized that the continued ecological destruction of the Aravallis poses a direct threat to the constitutional right to life under Article 21, while also undermining the State's obligations

under Articles 48A and 51A(g). By directing stricter monitoring mechanisms, including the use of technological tools such as satellite surveillance and GIS mapping, and imposing accountability on administrative authorities, the judgment underscores the urgent need for effective environmental governance.

The central research problem of this study lies in examining the effectiveness of environmental laws in regulating mining activities in the Aravalli Hills and assessing whether these legal frameworks adequately address the challenges of sustainable development. The study aims to critically analyze the interplay between environmental protection and economic interests, particularly focusing on the adequacy of statutory provisions and judicial responses in safeguarding the fragile ecosystem of the Aravallis.

The research is guided by key questions: (i) To what extent have environmental laws been successful in regulating mining activities in the Aravalli region? (ii) What are the major lacunae in the legal and regulatory framework governing mining and environmental protection? (iii) How have judicial interventions shaped environmental governance in the Aravallis? and (iv) What reforms are necessary to ensure sustainable development in mining practices?

This research adopts a doctrinal methodology, relying primarily on the analysis of statutory provisions, judicial decisions, policy documents, and scholarly writings. It involves a critical examination of legislations such as the Environment (Protection) Act, 1986, and relevant judicial pronouncements concerning mining in the Aravalli Hills. Secondary sources, including books, journal articles, and government reports, are also utilized to provide a comprehensive understanding of the subject. The doctrinal approach enables a systematic evaluation of the legal framework and its practical implications, thereby facilitating an informed critique of environmental governance in the context of sustainable development.

2. Conceptual Framework: Sustainable Development & Mining

The concept of sustainable development has evolved as a normative framework aimed at reconciling economic growth with environmental protection and social equity. The modern articulation of sustainable development is commonly traced to the *Brundtland Report* (1987), which defined it as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.¹⁰ Over time, this concept has been

integrated into international environmental law and domestic legal systems, including India, where it has been judicially recognized as part of the right to life under Article 21 of the Constitution.¹¹ The evolution of sustainable development reflects a shift from anthropocentric development models to a more ecocentric approach that emphasizes balance and long-term ecological stability.

Central to sustainable development are key principles that guide environmental governance. The principle of intergenerational equity mandates that natural resources must be used in a manner that preserves them for future generations.¹² This principle is particularly relevant in the context of mining, which involves the extraction of non-renewable resources. The precautionary principle, another cornerstone, requires that in cases of environmental uncertainty, preventive measures must be taken even in the absence of scientific certainty.¹³ This principle has been endorsed by Indian courts, especially in cases involving ecological degradation. Additionally, the polluter pays principle imposes liability on those who cause environmental harm, ensuring that the cost of pollution is borne by the responsible party rather than society at large.¹⁴ Together, these principles form the backbone of environmental jurisprudence and are essential for achieving sustainable mining practices.

Mining, as an economic activity, plays a crucial role in industrial development, infrastructure growth, and employment generation. In regions such as the Aravalli Hills, mining has historically contributed to local and national economies. However, the environmental cost associated with mining is substantial. Activities such as deforestation, soil erosion, groundwater depletion, and biodiversity loss have severely impacted the ecological integrity of mining regions.¹⁵ The Aravalli range, being one of the oldest mountain systems, is ecologically fragile and serves as a natural barrier against desertification. Unregulated mining in this region has exacerbated environmental degradation, raising serious concerns about sustainability.

The conflict between development and conservation is thus at the heart of the sustainable development discourse. While economic growth necessitates resource extraction, environmental conservation demands restraint and regulation. This tension is evident in legal and policy frameworks, where competing interests often lead to inadequate enforcement of environmental laws. Courts in India have attempted to strike a balance by imposing restrictions on mining activities in ecologically sensitive areas, emphasizing the need for sustainable practices.¹⁶ However, challenges remain in implementation, monitoring, and compliance.

In conclusion, the conceptual framework of sustainable development in the context of mining highlights the need for a balanced approach that integrates economic, environmental, and social considerations. The principles of intergenerational equity, precaution, and polluter accountability provide a robust foundation for regulating mining activities. Yet, the persistent conflict between development imperatives and environmental conservation underscores the need for stronger legal mechanisms and effective governance.

3. Ecological Significance of the Aravalli Hills

The Aravalli Hills, one of the oldest fold mountain systems in the world, possess immense geological and environmental significance. Stretching across northwestern India, primarily through Rajasthan, Haryana, and Delhi, these hills date back to the Proterozoic era and are rich in mineral resources such as marble, granite, limestone, and quartzite.¹⁷ Their geological antiquity has contributed to a complex terrain that supports diverse ecosystems and acts as a natural barrier against climatic extremes. The region's unique geomorphology influences soil formation, groundwater recharge, and microclimatic conditions, making it ecologically indispensable.¹⁸

One of the most critical ecological roles of the Aravalli range is its function in preventing desertification. Acting as a natural green wall, the hills obstruct the eastward expansion of the Thar Desert.¹⁹ By stabilizing sand dunes and maintaining vegetation cover, they mitigate the spread of arid conditions into fertile regions of Haryana, Delhi, and western Uttar Pradesh. However, extensive deforestation and mining activities have weakened this protective function, leading to increased vulnerability of surrounding areas to desertification and climatic instability.²⁰

The Aravalli Hills are also a biodiversity hotspot, supporting a wide range of flora and fauna despite their semi-arid location. The forests comprise dry deciduous and thorny vegetation, hosting species such as leopards, hyenas, nilgai, and numerous bird species.²¹ The region also serves as an important ecological corridor, particularly for wildlife movement between fragmented habitats. Forest cover in the Aravallis contributes significantly to carbon sequestration, soil conservation, and maintenance of ecological balance.²² However, illegal encroachments and mining have led to large-scale degradation of forest areas, threatening biodiversity and disrupting ecological continuity.

Mining activities in the Aravalli region have had severe environmental consequences. Open-cast mining has resulted in deforestation, soil erosion, and irreversible land degradation.²³ The removal of vegetation and topsoil has diminished the land's productivity and increased susceptibility to erosion. Water resources have also been adversely affected; mining disrupts natural drainage patterns and reduces groundwater recharge, leading to declining water tables in surrounding regions.²⁴ Air pollution is another significant concern, as dust and particulate matter generated from mining operations degrade air quality, posing health risks to local populations.²⁵

Several case examples illustrate the extent of environmental degradation in the Aravalli Hills. The region around Faridabad and Gurugram in Haryana has witnessed rampant illegal mining despite judicial interventions, including directives from the Supreme Court banning such activities.²⁶ Similarly, in Rajasthan, extensive marble and granite mining has led to deforestation and landscape fragmentation.²⁷ These instances highlight the gap between environmental regulations and their enforcement, underscoring the urgent need for sustainable mining practices and stricter legal compliance.

4. Legal Framework Governing Mining and Environment

The legal framework governing mining and environmental protection in India is a composite of constitutional mandates, statutory enactments, and regulatory mechanisms aimed at balancing economic development with ecological sustainability. At the constitutional level, environmental protection has been read into the fundamental rights regime through judicial interpretation. Article 21, which guarantees the right to life and personal liberty, has been expansively interpreted by the judiciary to include the right to a wholesome and pollution-free environment.²⁸ This interpretation has been instrumental in addressing environmental degradation caused by unregulated mining activities, particularly in ecologically sensitive regions like the Aravalli Hills.

Complementing this fundamental right are the Directive Principles of State Policy and Fundamental Duties. Article 48A mandates the State to protect and improve the environment and safeguard forests and wildlife,²⁹ while Article 51A(g) imposes a duty on citizens to protect and improve the natural environment.³⁰ Although non-justiciable, these provisions guide legislative and executive actions and have been frequently invoked by courts in environmental

jurisprudence.

At the statutory level, several key legislations regulate mining and its environmental impacts. The Environment (Protection) Act, 1986 serves as an umbrella legislation empowering the central government to take measures to protect and improve environmental quality.³¹ It provides the basis for various rules and notifications, including the Environmental Impact Assessment (EIA) Notification, which mandates prior environmental clearance for mining projects.³² The EIA process aims to assess potential environmental consequences before project approval, although its effectiveness has often been questioned due to procedural lapses and inadequate public participation.

The Forest (Conservation) Act, 1980 plays a critical role in regulating the diversion of forest land for non-forest purposes, including mining.³³ It requires prior approval from the central government, thereby acting as a check against indiscriminate deforestation. Similarly, the Mines and Minerals (Development and Regulation) Act, 1957 governs the allocation of mineral resources and lays down conditions for mining leases.³⁴ However, its primary focus on resource extraction has often led to conflicts with environmental objectives.

Additionally, the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974 address pollution arising from mining operations.³⁵³⁶ These statutes establish standards and empower pollution control boards to monitor and regulate emissions and effluents.

Regulatory authorities play a crucial role in implementing these laws. The Ministry of Environment, Forest and Climate Change (MoEFCC) oversees policy formulation and grants environmental clearances,³⁷ while the Central and State Pollution Control Boards ensure compliance with pollution norms. Despite this elaborate framework, enforcement challenges, institutional weaknesses, and regulatory overlaps often undermine effective environmental governance in mining sectors, particularly in fragile ecosystems like the Aravallis.

5. Judicial Intervention and Case Law Analysis

Judicial intervention has played a pivotal role in regulating mining activities in the Aravalli Hills, particularly in light of administrative failures and weak enforcement of environmental

laws. The Supreme Court of India and the National Green Tribunal (NGT) have emerged as crucial guardians of environmental protection, often stepping in to uphold the principles of sustainable development and ecological balance.³⁸ Through Public Interest Litigations (PILs), the judiciary has addressed the adverse environmental impacts of indiscriminate mining, including deforestation, loss of biodiversity, and degradation of water resources.³⁹

One of the landmark cases in this regard is *M.C. Mehta v. Union of India*, wherein the Supreme Court imposed a ban on mining activities in parts of the Aravalli range, particularly in Haryana.⁴⁰ The Court recognized the ecological fragility of the region and emphasized that economic development cannot come at the cost of environmental destruction. It directed the closure of illegal mines and mandated environmental impact assessments (EIAs) for future activities.⁴¹ This case exemplifies the Court's proactive stance in enforcing environmental norms and protecting ecologically sensitive zones.

Similarly, in *T.N. Godavarman Thirumulpad v. Union of India*, the Supreme Court expanded the interpretation of "forest" and brought vast areas under regulatory protection, including parts of the Aravalli Hills.⁴² The case led to continuous monitoring by the Court through a series of orders, effectively transforming it into an ongoing environmental governance mechanism.⁴³ The Court's directions significantly curtailed unauthorized mining and reinforced the applicability of the Forest (Conservation) Act, 1980.

A central principle underlying these judicial interventions is the doctrine of public trust, which posits that natural resources are held by the State in trust for the public and future generations.⁴⁴ The judiciary has consistently invoked this doctrine to prevent the exploitation of natural resources for private gain, particularly in ecologically sensitive areas like the Aravallis.⁴⁵

However, the rise of judicial activism in environmental matters has also sparked debate. While such intervention has filled regulatory gaps and ensured accountability, critics argue that excessive judicial involvement may encroach upon the domain of policy-making and administrative discretion.⁴⁶ Nonetheless, in contexts where governance mechanisms are ineffective, judicial oversight has proven essential in advancing sustainable development goals and ensuring compliance with environmental laws.⁴⁷

5.1 Recent Developments: Supreme Court Suo Motu Intervention (2025)

A significant recent development in the environmental governance of the Aravalli Hills emerged through the Supreme Court's order dated **20 November 2025** in *In Re: Protection of Aravalli Hills*, Suo Motu Writ Petition (Civil) No. 10 of 2025.⁴⁸ In this matter, the Court took suo motu cognizance of large-scale environmental degradation and continued illegal mining activities in the Aravalli region, particularly in the States of Haryana and Rajasthan, despite earlier judicial prohibitions. The Court expressed serious concern over the failure of State authorities to enforce environmental regulations and comply with previous directives. Emphasizing the constitutional mandate under Articles 21, 48A, and 51A(g), the Court reiterated that the protection of ecologically sensitive zones like the Aravallis is integral to the right to life and environmental sustainability.

The Court issued stringent directions, including the constitution of monitoring committees, mandatory use of satellite surveillance and GIS-based mapping to detect illegal mining, and strict accountability mechanisms for administrative officials failing to prevent environmental violations. It further underscored the application of the public trust doctrine and the precautionary principle, holding that economic interests cannot override ecological preservation. The judgment also highlighted the alarming pace of deforestation and groundwater depletion in the Aravalli region, warning that continued inaction could lead to irreversible ecological damage, including accelerated desertification.

This suo motu intervention marks a renewed phase of judicial activism, where the Court has moved beyond adjudication of disputes to proactive environmental governance. However, it also reflects the persistent institutional failure in enforcing environmental laws, necessitating continuous judicial oversight. The 2025 order thus reinforces the judiciary's role as a guardian of environmental rights while simultaneously exposing the structural deficiencies in India's regulatory framework governing mining and ecological conservation.

6. Critical Analysis of Enforcement Failures

The enforcement of environmental laws in the Aravalli Hills has been persistently undermined by widespread illegal mining activities and inherent regulatory loopholes. Despite judicial interventions and statutory prohibitions, unauthorized extraction continues due to ambiguous licensing frameworks, weak compliance verification, and manipulation of environmental clearances.⁴⁹ These loopholes are often exploited by mining operators to bypass legal restrictions, thereby diluting the efficacy of environmental governance.

Administrative challenges further aggravate enforcement failures. Regulatory bodies frequently face shortages of trained personnel, inadequate technological resources, and limited logistical capacity to conduct effective inspections.⁵⁰ Corruption within enforcement agencies also contributes significantly to the problem, as illicit financial incentives often lead to deliberate inaction or selective enforcement, enabling illegal mining operations to flourish with impunity.⁵¹

Another critical issue is the lack of coordination among multiple authorities, including state pollution control boards, forest departments, and district administrations. The fragmented institutional framework results in overlapping jurisdictions and diffusion of accountability, which hampers timely and decisive action against violations.⁵² This institutional dissonance weakens the overall enforcement mechanism and allows offenders to exploit gaps between regulatory bodies.

Moreover, the penalties imposed for environmental violations are often insufficient to act as deterrents. Fines are relatively minimal compared to the economic gains from illegal mining, and prosecution rates remain low due to procedural delays and evidentiary challenges.⁵³

Monitoring systems, including periodic inspections and environmental audits, are also ineffective due to reliance on outdated methodologies and lack of real-time surveillance.

Finally, socio-economic pressures play a pivotal role in perpetuating illegal mining. Local communities, driven by poverty and lack of alternative livelihoods, often engage in or support such activities.⁵⁴ This creates a complex enforcement environment where strict legal action may conflict with livelihood concerns, necessitating a more integrated and sustainable policy approach.

7. Sustainable Solutions and Policy Recommendations

Achieving sustainable development in the Aravalli Hills requires a multi-pronged approach combining legal, technological, and participatory frameworks. Strengthening enforcement mechanisms is imperative, particularly through stricter compliance monitoring and accountability of regulatory bodies under existing environmental statutes such as the Environment (Protection) Act, 1986 and the Forest (Conservation) Act, 1980.⁵⁵ The integration of advanced technological tools such as Geographic Information Systems (GIS) and satellite -

based monitoring can significantly enhance real-time detection of illegal mining activities and ecological degradation.⁵⁶

Equally crucial is the promotion of community participation and decentralized governance through Panchayati Raj Institutions, ensuring that local stakeholders play an active role in environmental decision-making and conservation efforts.⁵⁷ Sustainable mining practices, including controlled extraction, land reclamation, afforestation, and adherence to Environmental Impact Assessment (EIA) norms, must be rigorously implemented.⁵⁸

Further, comprehensive policy reforms are needed to address regulatory fragmentation by fostering integrated environmental governance that harmonizes mining, forest, and land-use policies. Strengthening inter-agency coordination and adopting a landscape-based approach will ensure ecological balance while supporting economic development.⁵⁹

8. Conclusion

The foregoing analysis demonstrates that mining activities in the Aravalli Hills have persistently undermined environmental integrity despite the existence of a comprehensive legal and constitutional framework. While statutes such as the Environment (Protection) Act, 1986 and the Forest (Conservation) Act, 1980, coupled with judicial doctrines like sustainable development, the precautionary principle, and intergenerational equity, provide a robust normative foundation, their practical enforcement remains inadequate. Judicial interventions—ranging from *M.C. Mehta v. Union of India* to *T.N. Godavarman Thirumulpad v. Union of India*—have played a transformative role in recognizing and protecting the ecological significance of the Aravalli range. However, these interventions have largely been reactive, stepping in to remedy administrative and regulatory failures rather than preventing them.

The recent order dated 20 November 2025 in *In Re: Protection of Aravalli Hills*, Suo Motu Writ Petition (Civil) No. 10 of 2025, marks a critical turning point in this trajectory. It underscores the continued prevalence of illegal mining and the systemic inability of enforcement agencies to ensure compliance with environmental norms. By mandating technological monitoring mechanisms and emphasizing administrative accountability, the Supreme Court has once again reinforced the centrality of environmental protection within the constitutional framework. At the same time, the necessity of such suo motu intervention reveals

a deeper structural malaise—namely, the persistent gap between environmental law in theory and its implementation in practice.

A sustainable balance between developmental imperatives and ecological preservation in the Aravalli region can no longer rely solely on judicial oversight. Instead, it requires a paradigm shift toward proactive governance, where regulatory authorities function efficiently, transparently, and in coordination with one another. Strengthening environmental impact assessment processes, integrating advanced technological tools such as GIS-based monitoring, and ensuring meaningful community participation are essential to bridging existing enforcement gaps. Moreover, policy coherence across mining, forest, and land-use regulations must be prioritized to prevent fragmentation and overlap in governance.

Ultimately, the conservation of the Aravalli Hills is not merely an environmental concern but a constitutional and intergenerational imperative. Continued degradation of this fragile ecosystem threatens biodiversity, accelerates desertification, and undermines the environmental security of large parts of north-western India. The 2025 Supreme Court intervention serves both as a warning and an opportunity—highlighting the urgency of reform while providing a framework for more effective environmental governance. The future of sustainable development in the Aravallis will depend on the State's ability to transition from reactive enforcement to preventive and participatory environmental stewardship, ensuring that economic development does not come at the irreversible cost of ecological destruction.

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