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BEYOND CARTOGRAPHY: MINING IN THE ARAVALLI LANDSCAPE AND THE LIMITS OF DEFINITION-BASED ENVIRONMENTAL GOVERNANCE IN INDIA

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ABSTRACT: The recent renewed judicial controversy over mining in the Aravalli area reflects a basic weakness in environmental governance in India: relying on legal definitions to control ecologically linked ecosystems. Several interventions made by the Supreme Court of India relating to the Aravalli Hills and Ranges, such as adopting an elevation-based definition and the Court's decision to put those directions into abeyance, changed what was perceived to be a strictly technical debate into a larger governance issue [8]. This paper argues that difficulties in regulating mining activities in the Aravalli area stem not simply from failures in implementing regulations, but from the nature of creating definitions as a means of environmental governance. Using doctrinal analysis, the article will examine how legal definitions create regulatory visibility, jurisdiction, and ecological sensitivity in the Aravalli area. Finally, the article proposes moving away from object-focused regulation toward landscape-level regulation to address cumulative and spatially diffuse environmental damage, and notes that this approach's principles can be applied to governing extractive activities in other ecologically sensitive areas outside India.

Keywords: Aravalli Landscape, Mining Regulation, Environmental Constitutionalism, Definition-Based Regulation, Judicial Governance, Cumulative Impact Assessment.

I. INTRODUCTION

For more than twenty years, mining activities in the Aravalli area have been under judicial and regulatory scrutiny.[15] Over this period, court orders, expert committee reports, executive notifications, and numerous public interest litigation cases have attempted to mitigate the environmental impact of extraction in an area generally recognized as ecologically sensitive.[14] Yet despite this accumulation of legal intervention, both authorized and unauthorized mining continue in ways that appear to comply formally with the law, yet remain harmful to the environment.[5]

Ongoing extraction in a legally saturated area demonstrates a problem that cannot be solved entirely by reference to either poor enforcement or illegal activity. The Aravalli area certainly shows elements of both. Still, they do not explain why, when environmental standards are clear, the judiciary provides ongoing oversight, and the government acknowledges the environmental harm caused by extraction, governance still fails. The Aravalli experience suggests a greater structural difficulty in how environmental regulation has been conceptualized and implemented.

In recent years, regulation of the Aravalli area has increasingly relied on legal definitions as a key regulatory mechanism. Legal definitions of elevation boundaries, cartographic boundaries, and categorizations, for example, of hills, forest land, and non-forest land have become increasingly

determinative of the extent of environmental protections afforded.[7] Legal definitions provide regulatory certainty and facilitate enforcement, especially within a federal system characterized by varying degrees of regulatory capacity. At the same time, they create a regulatory focus that is not ecologically neutral.

Ecological processes in the Aravalli area are not localized within separate, identifiable areas. Ecological importance arises from many interconnected aspects of an ecosystem, such as water recharge areas, habitats or corridors, and geological formations that may need surrounding land to remain stable.[23] When regulatory requirements are tied to defined spatial boundaries of environmental protection, this can create unequal visibility (or lack thereof) for regulatory agencies to protect the environment. Some areas receive high scrutiny, while others of similar ecological value receive little to no protection.[2] Therefore, environmental harm often stems from regulatory frameworks failing to recognize and protect ecological interdependencies rather than from actual violations of law. Recent judicial activity involving the Aravalli area exemplifies this. The Supreme Court has previously accepted a single elevation-based definition of the "Aravalli Hills and Ranges" but has now suspended its own direction on this matter.[7] Both judicial decisions reflect a lack of understanding of how legally defined mechanisms can regulate ecosystems with continuity.[8]

The article argues that legal definitions are not simply descriptive tools. Rather, in environmental governance, they constitute operational instruments that determine the scope of regulatory authority, the relative priority of enforcement and the visibility of ecological degradation. As such, the article uses the Aravalli mining controversy to argue that continuing failures of environmental governance in the Aravalli area are not simply due to failures of implementation, but also to the fact that the regulatory model used in the area relies upon definition-based strategies to govern landscapes that do not lend themselves to being compartmentalized.

II. REVIEW OF LITERATURE

1. EXISTING APPROACHES TO MINING REGULATION AND ENVIRONMENTAL ADJUDICATION

Several bodies of scholarship examine the relationship between mining regulation, environmental governance, and the judiciary in India [8]. One large body of scholarship seeks to identify the causes of enforcement failures and the prevalence of illegal mining, focusing on weaknesses in administrative capacity, political economy pressures, and regulatory capture.[6] Another body of literature critiques the procedural structure of Environmental Impact Assessment regimes, arguing that they are project-focused and therefore insufficiently concerned with cumulative and spatially diffuse environmental harm.[17] A third body of literature explores judicial environmentalism, analyzing the judiciary's growing role in enforcing constitutional environmental rights amid executive inaction.[12] Together, these perspectives have significantly influenced discussions about environmental governance. They highlight institutional shortcomings, procedural inadequacies, and the judiciary's growing role in environmental governance [21]. Nevertheless, they tend to frame governance failure primarily as an implementation or institutional problem.

2. THE NEGLECTED ROLE OF LEGAL DEFINITION IN ENVIRONMENTAL GOVERNANCE

The literature has examined the regulatory impacts of creating legal definitions and, relatively little, how definition options establish what is visible, juridical, and ecologically vulnerable.[1] Specifically, in regions such as the Aravalli, where ecological functioning does not fit into well-defined legal categories, defining legal boundaries may do more than organize regulation.[23] Defining legal boundaries can dictate which ecosystems receive consistent, long-term regulatory attention and which remain outside regulatory awareness. As a result, legal definitions of regulatory boundaries have created non-neutral distributions of environmental risk and benefit.

3. THE ARAVALLI CONTROVERSY AS A GOVERNANCE PROBLEM

A contemporary example of this problem has arisen in relation to the elevation-based definition of the "Aravalli Hills and Ranges". This issue did not arise simply from poor enforcement or a lack of adequate substantive regulations. Instead, the controversy arose out of efforts to govern a continuous ecological system

using separate legal categories established for administrative purposes. Elevation and cartographic boundary definitions were expected to fulfill governance roles that typically require coordinated administration, scientific surveillance, and adaptable oversight.[9] This framework produced regulatory clarity in some areas while creating regulatory obscurity in others, allowing environmentally destructive activities to occur in conformity with existing laws.[6] The challenge in this context was not regulatory absence but regulatory form.

4. CONTRIBUTION OF THE PRESENT STUDY

This paper addresses this gap by establishing legal definition-making as a form of environmental governance. The authors argue that the methods used to define legal boundaries perform substantial regulatory work, including allocating authority, determining regulatory priorities, and establishing which forms of environmental damage are recognized as having occurred.[20] Furthermore, in continuous ecological systems, definition-based regulatory frameworks can promote cumulative environmental degradation even with continued judicial and administrative review.

The authors make three additional contributions.

First, the authors conceptualize definition-making as a governance practice with distributive effects rather than a neutral process of clarification.

Second, the authors frame judicial intervention in the Aravalli context as a response to the fragmented regulatory regime and view courts as de facto managers of the Aravalli landscape working within institutional constraints.

Lastly, the authors use the Aravalli experience to illustrate the limits of object-centric environmental regulation and to advocate for environmental governance approaches that engage ecological continuity at the landscape scale.

III. JUDICIAL GOVERNANCE, DEFINITION-MAKING, AND THE ARAVALLI LANDSCAPE

1. EARLY JUDICIAL INTERVENTION AND THE LIMITS OF PROHIBITION

Initially, judicial intervention in the Aravalli region responded to visible ecological degradation caused by mining. Early litigation before the Supreme Court raised concerns about groundwater depletion, deforestation, and unregulated extraction, particularly in areas adjacent to the National Capital Region. At this stage, the Supreme Court addressed mining primarily as an environmental and public health concern protected under Article 21 of the Indian Constitution.[24]

Judicial intervention primarily enforced protection reactively at the individual-site level. Orders from the Court to cease or limit mining on sites shown to harm the environment reinforced constitutional environmental protections; however, they did not provide a comprehensive regulatory structure to govern the Aravalli region as a whole.[14] Additionally, although the various regulatory divisions (land, forest, mining, and environmental) remain fragmented and uncoordinated, the limitations of judicial restraint in addressing ongoing mining pressures on a case-by-case basis are becoming increasingly apparent.

2. FROM ADJUDICATION TO MANAGEMENT: COURTS AS REGULATORY SUBSTITUTES

Over time, judicial strategy transitioned from prohibiting mining to managing mining through regulated activity. The courts began to explore whether mining could be permitted in a controlled manner, provided expert assessments and administrative safeguards were in place.[17] Environmental clearance documents, technical reports, and committee recommendations began to gain greater prominence in the judicial rationale of the courts.

This shift in judicial strategy represented an effort to balance economic development with environmental protection. Additionally, the judiciary's role shifted from determining legality to overseeing regulatory processes. Thus, the courts could compensate for deficiencies in executive coordination and enforcement. [22]

In this context, judicial intervention functioned less as episodic corrective action and more as governance substitution. Although this shift was necessary because of institutional shortcomings, it also placed courts in a structural environment in which they were not suited to manage complex ecological systems on an ongoing basis.

3. THE TURN TO DEFINITION-MAKING: ELEVATION AS GOVERNANCE TOOL

Establishing elevation thresholds is an important part of developing court strategies for environmental regulation in the Aravalli. The Court sought to create stability in the regulatory environment by establishing definitions that would clarify practices and ensure consistency across states in environmental regulation and enforcement. Elevation thresholds were seen as one way to define where environmental restrictions applied. [9]

Using definitions to identify and restrict environmental degradation offers administrative advantages. These include uniformity, easier enforcement, and less discretion in enforcement and regulation, all of which can matter when considering the difficulties of coordinating and enforcing disparate federal regulatory policies. The ability to define where environmental restrictions exist also gives the judiciary a mechanism to promote coherence in its decision-making without relying on long-term cooperation from the states. [19] However, the Court's reliance on elevation as the exclusive means of defining environmental restrictions highlights the limits of definition-based regulation.

4. ABEYANCE AND INSTITUTIONAL CONSTRAINT IN JUDICIAL GOVERNANCE

The controversy over endorsing an elevation-based definition of "hills" reflected those concerns. Many experts and civil society representatives questioned the science behind the thresholds used to define hills, as well as the legal implications of excluding certain lands from regulated activities. The focus of concern shifted from the definition's clarity to the ecological spaces it left unprotected.

The Supreme Court's decision to delay implementing its guidelines on the definition of "hills" marked a moment of judicial re-evaluation. Rather than moving forward with a controversial framework for defining hills, the Court delayed action on operationalizing the definition while continuing to implement interim restrictions on mining in the area. [8] The Court's dual approach to governance appears to reflect an understanding of institutional limitations. Defining what constitutes a hill through judicial action could create ecological blind spots that are difficult to remove from administrative processes once established.

IV. IMPLICATIONS FOR ENVIRONMENTAL GOVERNANCE

1. DEFINITION-BASED REGULATION AND THE PROBLEM OF REGULATORY VISIBILITY

The Aravalli example highlights a fundamental contradiction in environmental litigation: Courts have the responsibility of addressing environmental issues largely due to the fragmentation of regulatory authority, but the tools, i.e., definitions, thresholds, and procedural supervision, available to courts to govern ecologically connected environments are inappropriate for the task. As a consequence, judicial governance is both necessary and ineffective: it can stop direct harm in the short term but cannot provide long-term regulatory solutions.

The Aravalli case illustrates a major challenge to modern environmental governance: reliance on legal definitions as a surrogate for developing regulatory capacity. Definitions identify which ecological spaces are legally recognizable, thereby defining the boundaries of regulatory visibility and determining where environmental scrutiny is focused and where it is diminished.[1] The effects of structuring the regulatory environment in response to definitions of ecological space are significant when the ecological space is contiguous. Mining damage is rarely limited to specific locations; instead, mining can damage ecosystems throughout hydrologic systems, habitats, and geologic formations that extend far beyond the boundaries of identified areas.[6] In addition, government organizational structures tied to discrete legal objects (e.g., "notified hills", "forest parcels") can limit the ability to address cumulative and spatially diffuse mining impacts.

As a result, environmental degradation can continue even with regulatory compliance. Activities outside narrowly defined environmentally protected areas may meet regulatory requirements while contributing to larger-scale environmental degradation [13]. Therefore, in such cases, environmental harm occurs not because of a lack of regulation, but because of the selectivity of regulatory attention: Law functions as intended within its own categories of regulation, while ecological integrity is degraded across those same categories.

2. JUDICIAL GOVERNANCE AND INSTITUTIONAL OVER-EXTENSION:

Definition-based regulation has significant implications for the judicial branch. Courts are becoming central actors in environmental regulation primarily because fragmented statutory frameworks and variable administrative capacity create persistent governance gaps. [22]

Courts are institutionally structured to resolve disputes, not to monitor environmental conditions continuously or to regulate them adaptively. When judicial governance expands to address the failures of administrative governance, it may

result in institutional overextension and regulatory dependency [13]. The elevation-definition episode described above illustrates this tension. Although judicial intervention was necessary to address the immediate environmental degradation occurring in the Aravalli Hills, it was insufficient to establish sustainable governance for the complex ecological system existing there.

Placing the definition of "hills" in abeyance indicates that the Court recognized the limits of judicial governance. [2]

The Court implied that once a definition of "hills" is incorporated into administrative practice via leases and clearances, it will create ecological blind spots that will be difficult to rectify in future court proceedings. Thus, judicial restraint here is not a retreat from the issue, but recognition of the judiciary's institutional limits.

3. TOWARD LANDSCAPE-LEVEL GOVERNANCE

To move past episodic judicial management of environmental governance in the Aravalli Hills, regulatory philosophy must change. Rather than organizing environmental protection around discrete legal objects, regulatory philosophy needs to consider the ecosystem as a whole. This does not imply abandoning legal definition altogether, but rather reconceptualizing it in a broader regulatory context. [11] A regulatory philosophy that considers ecosystems as wholes would require spatially identifying ecological systems based on ecological function, rather than administrative convenience, with legal consequences that apply beyond narrow core areas of protection. [18]

Additionally, a regulatory philosophy that considers ecosystems as wholes would require enforceable limits on cumulative extraction and land-use conversion. [17] Such a regulatory philosophy would ensure that environmental assessments constrain environmental degradation substantively, rather than procedurally. [16] Finally, a regulatory philosophy that considers ecosystems as wholes requires continuous monitoring capabilities, including those that enable regulatory responses to gradual and diffused environmental harm. Hence, the regulatory response is anticipatory rather than reactive.[10] While a regulatory philosophy that considers ecosystems as wholes would reduce the need for judicial intervention in environmental protection, judicial oversight would still be necessary to ensure that government entities meet their constitutional obligations and to address administrative failure.[4] By integrating ecological continuity into regulatory design, however, a regulatory philosophy that considers ecosystems as wholes would reduce dependence on judicial intervention and restore a clearer distinction between the roles of courts and administrative agencies.

V. CONCLUSION

The current mining controversy in the Aravalli landscape highlights the structure of today's environmental laws regarding mining in the Aravalli landscape. This case study demonstrates that environmental degradation can occur not only because of a lack of environmental regulations, but also because of how environmental regulations are structured. A key component of the problem is the focus on definition-based governance, which, when applied to ecosystems that are naturally connected ecological continua, creates areas of environmental degradation with varying levels of environmental legal visibility or invisibility that do not reflect on-the-ground environmental realities.

This article argues that the definition-threshold debate between the Indian government and the judiciary, and the Supreme Court's subsequent direction to keep its directions in abeyance, should be viewed in the context of definition-based governance and its ability to provide a framework for managing complex landscapes. The apparent technical disagreement over thresholds reflected a deeper question about whether legal forms can govern complex, large-scale ecological systems. Therefore, judicial reconsideration in this context is not a withdrawal of power, but rather an acknowledgment by the judiciary of its own limitations.

While courts will continue to enforce the constitutional rights to a healthy environment and correct administrative failures, continued use of judicial action to manage ecological systems at the landscape level is neither sustainable for institutions nor adequate for addressing environmental issues. Long-term effective management of large-scale ecological systems will require regulatory frameworks that can manage ecological continuity through mechanisms such as binding spatial planning, limits on cumulative impacts, and long-term monitoring and evaluation.

The lessons learned from the Aravalli experience have relevance beyond India. As pressures from extractive industries increase in regions with high environmental sensitivity, the limitations of object-focused, definition-driven regulation will continue to be exposed. For environmental law, the challenges go well beyond refining definitions of what constitutes environmental degradation; they include developing environmental governance mechanisms that can respond to the environmental systems they attempt to govern.

Author Contributions

The author conducted the conceptualization, methodology, data analysis, investigation, writing, review, editing, and final approval of the manuscript.

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Data Availability

The dataset will be available from the author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest.

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