

Constrained Climate Justice: Development, Cost-Benefit Rationality, and Ecological Governance in Uttarakhand, India

Hammad Qamrul Hasan¹, Dr. Ritam Dutta²

¹Research scholar, School of Liberal Studies and Humanities, UPES, Kandoli Campus, Dehradun-248007, Uttarakhand, India

²Assistant Professor, School of Liberal Studies and Humanities, UPES, Kandoli Campus, Dehradun-248007, Uttarakhand, India

Email: ¹ hammadqamaralhasan@gmail.com , ² Ritam.dutta@ddn.upes.ac.in

Abstract

This conceptual paper interrogates the tension between infrastructure-led development and climate justice in Uttarakhand, a Himalayan state of India that serves simultaneously as an ecological common of national importance and a frontier for mega-project expansion. Drawing on political ecology, development economics, and post-development theory, the paper establishes that contemporary development in Uttarakhand is operationalised through a tripartite logic of growth-oriented Cost-Benefit Analysis (CBA), national security imperatives, and political-electoral optics. This logic systematically constrains the scope of climate justice by rendering the costs of ecological destruction, community displacement, and intergenerational risk as externalities that fall outside the calculus of project approval. The paper introduces the concept of 'constrained climate justice' to capture how justice claims are not absent from policy discourse but are actively reshaped, diluted, and subordinated within dominant development frameworks. Using the Rishikesh-Karnaprayag Railway project as its principal illustrative case, the paper demonstrates how technocratic governance privileges economic valuation over social and ecological considerations. The study contributes to theoretical debates by reconceptualising climate justice not as an aspirational absence requiring insertion into development frameworks, but as a structurally constrained presence whose emancipatory potential is continuously curtailed by institutional architecture. The paper concludes by proposing alternative evaluation frameworks that could recalibrate the relationship between development velocity and justice claims in ecologically fragile regions.

Keywords: Climate justice, Cost-benefit analysis, Uttarakhand, Infrastructure development, Political ecology, Development Economics, Himalayan governance, Environmental impact assessment

1. Introduction

Across the Global South, infrastructure-led development has emerged as the centrepiece of state-led modernisation. In India, this impulse finds its most concentrated and contested expression in the Himalayan state of Uttarakhand, where the past two decades have witnessed an unprecedented cascade of mega-projects: the Rs 12,000 crore Char Dham highway expansion, the Rs 16,200 crore Rishikesh-Karnaprayag Railway, dozens of run-of-the-river hydroelectric schemes, and an expanding network of border roads mandated by the strategic imperatives of the India-China frontier. These projects share a common grammar: they are presented as instruments of connectivity, security, pilgrimage facilitation, and economic upliftment, while their ecological and social costs are

systematically narrated as manageable externalities or acceptable trade-offs in the national interest.

What makes Uttarakhand an exceptional site for examining this dynamic is the density of contradiction it embodies. The state carries 71 per cent forest cover and stands among India's most ecologically significant territories, serving as the primary source of glacial headwaters for the Ganga and Yamuna river systems that sustain hundreds of millions of people across the Indo-Gangetic Plain (Sati, 2023; Forest Survey of India, 2019). Its forests provide ecosystem services estimated at Rs 95,000 crore per year by a government-commissioned valuation (Indian Institute of Forest Management, 2018). As documented by environmental researchers, reckless construction has sacrificed over 50,000 hectares of forest over two decades, with mining accounting for 17.5 per cent of this loss

and road construction another 15.1 per cent (Risk Avoider Forum, 2025). The Joshimath land subsidence crisis of January 2023, which produced cracks in over 868 civil structures and displaced hundreds of families, brought this contradiction to global attention (Awasthi and Jain, 2024; Bera et al., 2023). The crisis demonstrated that geological risk warnings documented by the Geological Survey of India and the Comptroller and Auditor General of India as far back as 2009 were consistently overridden by development imperatives (Singh and Pandey, 2024).

The central question this paper addresses is: How is climate justice reinterpreted and structurally constrained within development regimes in ecologically sensitive regions like Uttarakhand? The question is deliberately not framed as whether climate justice exists in these regimes, because such framing would imply that its absence is the problem. This paper argues for a more precise diagnosis: climate justice is present in policy discourse, in the Uttarakhand Action Plan on Climate Change (UAPCC), in judicial pronouncements, and in international commitments. It is, however, structurally constrained by institutional mechanisms that ensure its operational subordination to economic and security rationalities.

To develop this argument, the paper proceeds as follows. Section 2 examines development as economic rationality, focusing on how Cost-Benefit Analysis structures the valuation of Himalayan infrastructure projects. Section 3 outlines the three-dimensional framework of climate justice, comprising distributive, procedural, and recognition justice, as it applies to ecologically fragile mountain contexts. Section 4 identifies the theoretical tension between development rationality and climate justice claims. Section 5 introduces the paper's central conceptual contribution: the notion of 'constrained climate justice.' Section 6 applies this framework to the Rishikesh-Karnaprayag Railway project as a case illustration. Section 7 draws out policy implications, and Section 8 concludes with directions for future research.

Methodologically, the paper is a conceptual and theoretical inquiry informed by secondary literature, policy documents, judicial records, investigative journalism, and academic studies in political ecology and development studies. It does not claim ethnographic depth but rather theoretical systematisation of a well-documented empirical pattern studied extensively by scholars working in the tradition of Himalayan political ecology.

2. Development as Economic Rationality: CBA and the Himalayan Project

Development economics, as both academic discipline and governmental practice, centres on three interrelated imperatives: growth, efficiency, and welfare maximisation (Sen, 1999; Todaro and Smith, 2015). The translation of these imperatives into project-level decision-making is institutionalised through the tool of Cost-Benefit Analysis. CBA operates by converting all relevant project impacts into monetised present-value equivalents, discounting future effects at a chosen social discount rate, and approving projects where the net present value of benefits exceeds costs. This framework is not merely technical. It is deeply ideological, encoding specific assumptions about what counts as value, whose preferences count, and over what temporal horizon effects are relevant.

In the context of Uttarakhand, development is routinely framed within three overlapping rationalities that together constitute what this paper terms the Growth-Security-Optics (GSO) nexus. The growth rationality emphasises tourism revenues, employment generation, regional GDP multipliers, and energy generation from hydropower (Singh and Pandey, 2024). The security rationality, amplified since the Galwan Valley confrontation of 2020, invokes the imperative of border infrastructure to project strategic depth toward the India-China Line of Actual Control. The optics rationality connects infrastructure investment to Hindu pilgrimage symbolism at the Char Dham shrines of Badrinath, Kedarnath, Yamunotri, and Gangotri in ways that render opposition to projects politically and socially costly. Figure 1 below maps this nexus and its outputs.

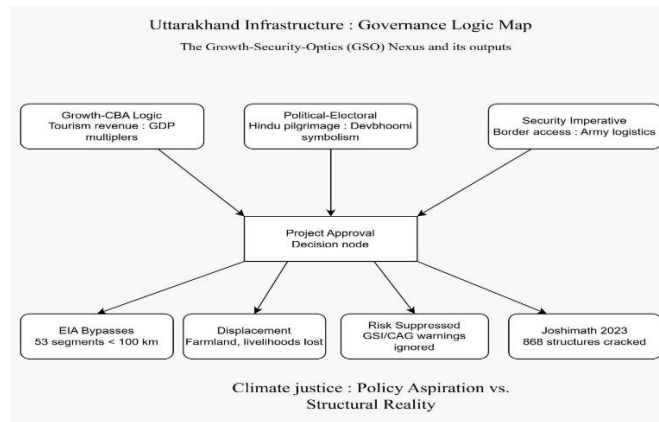


Figure 1: The Growth-Security-Optics (GSO) Nexus and the structural outputs it produces in Uttarakhand's infrastructure governance.

Each of these rationalities deforms CBA in characteristic ways. The growth rationality inflates benefit estimates by including induced tourism growth and multiplier effects while treating environmental degradation as a zero-cost baseline. The security rationality activates exemptions from environmental review, as enacted in the Forest Conservation Amendment of 2023 and the Ministry of Environment notification of July 2022, which exempted highway projects within 100 km of international borders from Environmental Impact Assessment requirements. These exemptions remove the regulatory moment at which environmental costs would enter any calculus. The optics rationality creates political atmospheres in which civil society opposition to projects is depicted as anti-national or anti-religion sentiment, foreclosing the democratic deliberation through which non-market values might otherwise be expressed.

2.1 The Structural Biases of CBA in Mountain Contexts

Three structural biases of CBA are particularly consequential in Himalayan development contexts. First, CBA systematically discounts future costs relative to present benefits. A social discount rate of 10 to 12 per cent, which characterises Indian infrastructure appraisals (Government of India, Planning Commission, 2009), renders costs occurring 30 years hence at approximately 6 per cent of their nominal value. The long-term consequences of deforestation for glacier stability, groundwater

recharge, and landslide frequency are thereby rendered economically negligible compared to the immediate revenues of a tourism boom. This is not merely a technical parameter choice. It encodes an intergenerational injustice whereby present generations extract the benefits while future Himalayan communities inherit compounded ecological debt.

Second, CBA cannot incorporate non-market values without generating arbitrary and contestable monetary estimates through techniques such as contingent valuation or hedonic pricing (Hanemann, 1994; Pearce et al., 2006). The cultural, spiritual, and subsistence significance of a glacial spring to a village community, the kind documented in Panai Pokhari, Chamoli district, where tunnelling for the Rishikesh-Karnaprayag Railway destroyed the settlement's sole natural water source, does not register in project accounts. The RVNL's response to affected residents illustrates this failure with precision. The claim of no connection between the tunnel and the spring loss was not merely administrative denial. It reflected a sincere institutional incapacity to process claims that do not carry a monetary price tag (101 Reporters, 2023).

Third, CBA aggregates costs and benefits across affected populations without accounting for their distribution. Even when total benefits exceed total costs, making a project apparently efficient, the beneficiaries and cost-bearers are entirely different populations. In Uttarakhand's development model, the beneficiaries of railway connectivity are overwhelmingly urban pilgrims from the plains,

national defence establishments, and the tourism economy. The costs of tunnelling, deforestation, water source destruction, and induced geological

instability fall on mountain communities who derive little of the tourism revenue that supposedly justifies their dispossession.

Table 1: Structural biases of CBA as applied to Himalayan infrastructure appraisal

CBA Element	Standard Application	Himalayan Distortion	Justice Implication
Discount rate	10-12% in Indian appraisals	Long-term ecological costs rendered negligible	Intergeneration injustice
Non-market values	Contingent Valuation applied	Spiritual, subsistence values excluded	Recognition injustice
Distribution	Aggregate net benefit	Costs and benefits fall on different groups	Distributive injustice
Risk assessment	Expected value framework	Geological tail risks underweighted	Procedural failure
Cumulative effects	Project-level analysis	Valley-wide cumulative impacts ignored	Systemic blind spot

3. Climate Justice: A Tripartite Framework for Fragile Ecologies

Climate justice, as a theoretical and political project, emerged from the intersection of environmental justice scholarship and climate policy debates in the late 1990s and early 2000s. The foundational insight is that the burdens of climate change, and of the development trajectories that produce it, are not distributed in proportion to who has benefited from those trajectories. The Global South bears a disproportionate share of climate impacts while having contributed least to atmospheric concentrations of greenhouse gases. Within nations, marginalised communities, including indigenous peoples, subsistence farmers, pastoralists, women, and low-income households, face the sharpest exposures (Kashwan, 2021).

Building on the justice philosophy of David Schlosberg (2007), the climate ethics of Simon Caney (2010), and the framework elaborated for the Indian context by Prakash Kashwan (2022), this paper adopts a tripartite framework of climate justice comprising distributive, procedural, and recognition dimensions. Each dimension illuminates a distinct aspect of the injustice produced by constrained development regimes.

3.1 Distributive Justice

Distributive justice concerns the equitable allocation of benefits and burdens across individuals, communities, and generations. In the context of Himalayan infrastructure development, it raises a

precise question: who receives the economic gains of connectivity, energy, and tourism, and who bears the ecological and social costs? The answer, documented across the literature, is starkly asymmetric. Energy generated by run-of-the-river hydropower in Uttarakhand is consumed primarily in the power-hungry plains states, while the river communities whose water commons are appropriated receive negligible compensation and face the loss of fisheries, agricultural irrigation, and cultural practices connected to riverine life (Sati, 2023; Singh and Pandey, 2024). Similarly, the pilgrimage and adventure tourism economy benefits hotel and transport operators concentrated in towns like Haridwar and Dehradun, while the environmental costs of road expansion, including landslides, deforestation, and debris pollution, fall on mountain villages along the construction corridors.

The distributional inversion becomes particularly acute in its temporal dimension. Present-generation urban Indians benefit from faster pilgrimage travel, while future-generation Himalayan communities inherit destabilised slopes, depleted aquifers, and reduced biodiversity. This temporal dimension connects climate justice directly to intergenerational ethics, a connection that standard CBA is structurally incapable of capturing honestly.

3.2 Procedural Justice

Procedural justice concerns the fairness of decision-making processes: who participates, whose voices count, and how disputes are resolved. In Indian

environmental law, the Environmental Impact Assessment (EIA) process is the primary institutional locus of procedural justice, the moment when affected communities receive information, raise objections, and shape project outcomes.

The systematic evasion of EIA requirements in Uttarakhand constitutes a fundamental failure of procedural justice. The Char Dham highway project's division into 53 sub-segments of below 100 km each, specifically to circumvent the EIA threshold, was identified by Kanchi Kohli of the Centre for Policy Research-Namati Environmental Justice Program as an action that undermined the objective of environmental regulation, which was to ensure ecologically sound and socially just decisions (Kohli, 2023). The Forest Conservation Amendment 2023 went further, permitting private entities to acquire forest land for developmental projects without gram sabha (village assembly) consent, thereby removing the only formal procedural mechanism through which tribal and forest-dependent communities could exercise veto power over displacement (Ministry of Environment, Forest and Climate Change, 2023).

Procedural justice is also undermined by what the political ecology literature terms 'green grabbing,' the appropriation of environmental discourse to legitimise dispossession (Fairhead et al., 2012). When project proponents claim that Tunnel Boring Machines minimise ecological disturbance, or that railway connectivity reduces carbon emissions relative to road travel, they deploy green language to foreclose more fundamental questions about whether the project should proceed at all, and under what conditions of community agreement.

3.3 Recognition Justice

Recognition justice, drawing on Iris Marion Young's (1990) work on social difference, concerns whether diverse forms of knowledge, identity, and experience are acknowledged as legitimate inputs into governance. In Himalayan contexts, this dimension is particularly significant because local communities possess bodies of ecological knowledge about groundwater behaviour, slope stability, seasonal flood patterns, and traditional land management practices that are systematically excluded from technocratic project planning.

The testimony of Dr Hemant Dhyani, a member of the Supreme Court's High-Powered Committee on the Char Dham project, establishes this point precisely. He observed that wherever tunnels are built in the hilly areas of Uttarakhand, water sources dry up, a fact irrespective of whether the constructions are for hydroelectric projects or rail connectivity (101 Reporters, 2023). This is indigenous experiential knowledge, validated by scientific hydrology, that project EIAs consistently failed to incorporate. The affected communities of Panai Pokhari possessed this knowledge. The construction authorities denied it. The denial constitutes a recognition injustice, a refusal to treat local knowledge as epistemically authoritative.

4. The Theoretical Tension: Epistemological Conflict at the Heart of Development

The tension between development rationality and climate justice is not merely practical, a matter of insufficient political will or technical capacity. It is epistemological, reflecting fundamentally incompatible ways of understanding value, progress, and well-being. This section develops this theoretical argument through two bodies of critical theory: post-development thought and political ecology.

4.1 Post-Development Theory and the Development Discourse

Post-development theorists, most notably Arturo Escobar (1995), Wolfgang Sachs (1992), and Gustavo Esteva (1992), have established that 'development' is not a neutral or universal goal but a culturally constructed and politically enforced discourse that emerged from specific Western historical conditions and was imposed as a global normative framework since the Truman era. Central to this critique is the argument that development discourse creates and reproduces hierarchies: between 'developed' and 'underdeveloped' nations, between modern and traditional forms of life, and between economic and non-economic ways of inhabiting the world.

Applied to Uttarakhand, this post-development lens reveals how mountain communities are positioned as pre-modern subjects in need of the connectivity, energy, and market integration that infrastructure projects promise. Their ecological knowledge,

subsistence practices, and community governance institutions are thereby rendered as obstacles to development rather than as alternative rationalities deserving recognition. The Chipko movement of the 1970s, the Tehri Dam opposition of the 1990s, and the current resistance to Char Dham highway widening all represent moments in which Himalayan communities have rejected this positioning and asserted alternative values, only to be overridden by state authority (Guha, 1989; Baviskar, 1995).

Ramachandra Guha's foundational account of the Chipko movement (1989) established that Himalayan peasant resistance to forest commercialisation was not mere conservationism but a defence of a distinct mode of ecological production, one in which forests were livelihoods rather than resources. Contemporary resistance to mega-infrastructure in Uttarakhand operates in this same tradition, but confronts a more sophisticated ideological apparatus: projects are legitimised not only by economic growth but by environmental language such as clean energy and reduced road emissions, religious significance through Char Dham pilgrimage, and security imperatives that leave little political space for alternative framings.

4.2 Political Ecology and the Power Relations of Environmental Governance

Political ecology provides a second theoretical lens, directing attention to how power relations shape environmental governance. Drawing on Blaikie and Brookfield (1987) and Bryant and Bailey (1997), and on the extensive literature on Himalayan political ecology, this paper identifies three axes of power that structure the production of what may be termed 'development facts' in Uttarakhand.

First, the power to define the problem: which risks are made legible, and which are rendered invisible. The state's problem definition in Uttarakhand centres consistently on connectivity deficits, tourism revenue foregone, and strategic vulnerability, while geological instability, water source depletion, and community displacement are defined as manageable side effects rather than constitutive features of the development model. The Geological Survey of India's warnings about Joshimath, documented since at least 2009, exemplify risks that were technically legible but politically invisible until the crisis became impossible to deny (Singh and Pandey, 2024). Second, the power to shape regulatory frameworks. The modification of EIA thresholds, the Forest Conservation Amendment, and the border-area exemption from environmental clearance represent exercises of legislative and executive power to reshape the regulatory environment in ways that systematically advantage development interests over ecological and community ones. This is not regulatory capture in the classical sense. It is regulatory dismantlement by the state itself. Third, the power to narrate outcomes. When 41 workers were trapped in the Silkyara tunnel collapse of November 2023 for 17 days, an event directly connected to the absence of rigorous EIA and disaster management planning that Ravi Chopra had warned about after resigning from the Supreme Court's committee in January 2022 (Mongabay, 2024; Down to Earth, 2022), the official narrative emphasised the heroism of the rescue operation rather than the institutional failures that produced the emergency. The capacity to set the terms of public discourse about development outcomes is itself an exercise of political power that constrains the articulation of justice claims.

Table 2: Power axes shaping environmental governance in Uttarakhand infrastructure development

Power axis	Mechanism	Effect on Justice
Problem definition	State controls which risks are officially recognized	Ecological risks rendered sub-political
Regulatory frameworks	Exemptions, threshold manipulation, law amendment	Environmental review bypassed or weakened
Outcome narration	Official discourse emphasises growth benefits and rescue heroism	Systemic failures reframed as technical incidents
Knowledge hierarchies	Technocratic EIA overrides local ecological knowledge	Recognition justice denied
Legal geography	Broader-area exemptions, national security override	Spatial injustice institutionalised

5. Constrained Climate Justice: A Conceptual Contribution

Having established the structural biases of CBA, the tripartite dimensions of climate justice, and the theoretical tensions between development rationality and justice claims, this paper introduces its central conceptual contribution: the notion of 'constrained climate justice.' This concept is offered as a theoretical tool for understanding the specific mechanism through which climate justice is present but rendered operationally inert in development regimes governing ecologically fragile regions.

5.1 Defining Constrained Climate Justice

Constrained climate justice refers to a condition in which the normative language, institutional acknowledgment, and policy commitments of climate justice co-exist with governance architectures that systematically prevent those commitments from influencing material decisions about who bears ecological costs and who accesses development benefits. It differs from a condition of 'absent climate justice,' where justice claims are not articulated at all, by demonstrating that in contemporary Uttarakhand, as in many Global South development frontiers, the problem is not the absence of justice language but its structural subordination.

The Uttarakhand Action Plan on Climate Change (2010) explicitly recognises that climate change impacts are likely to be inequitable, disproportionately affecting the poor, women, the aged, and the very young, and commits to reorienting developmental strategies in an environmentally caring manner. The NAPCC's eight national missions, to which UAPCC is aligned, include missions on Himalayan ecosystems and sustainable agriculture. Supreme Court jurisprudence, culminating in the April 2024 ruling that extended the constitutional right to life to encompass protection from climate harm, provides additional institutional acknowledgment. These constitute a genuine, if incomplete, architecture of justice recognition.

Yet they remain constrained. The UAPCC carries no binding grievance mechanism through which affected communities can hold project authorities

accountable. The climate right established by the Supreme Court requires affected individuals to mount expensive and time-consuming legal challenges, a procedural burden that systematically disadvantages the mountain communities who most need protection. The NAPCC missions are advisory frameworks rather than regulatory requirements that must be satisfied before infrastructure projects receive clearance. The legislative trajectory since 2022 moves in the direction of further weakening even the existing weak regulatory mechanisms.

5.2 Three Mechanisms of Constraint

This paper identifies three interlocking mechanisms through which climate justice is constrained within development regimes in contexts such as Uttarakhand:

Economic Valuation as Epistemic Filter. The monetisation requirement of CBA functions as an epistemic filter that determines which costs and benefits enter the decision calculus. Only impacts convertible to rupee values at a defensible exchange rate are considered. The spiritual significance of the Ganges as a living entity (recognised explicitly in the Uttarakhand High Court's 2017 ruling, later stayed by the Supreme Court), the subsistence value of a mountain spring to a community without access to piped water, and the cultural cohesion of a pastoralist community whose migration routes are severed, none of these pass through the monetisation filter cleanly. The result is systematic undervaluation of what Amartya Sen (1999) terms the capabilities of the worst-off, and systematic overvaluation of the marketable outputs of development.

Technocratic Governance as Participation Barrier. Decision-making for mega-infrastructure in Uttarakhand is dominated by a constellation of technical agencies, including RVNL, NTPC, NHAI, the Border Roads Organisation, and the state Irrigation Department, each with its own mandate, technical vocabulary, and institutional incentives aligned with project execution rather than community protection. The EIA process, even when conducted, is notoriously opaque to non-specialist communities. Technical reports run to hundreds of pages, public hearings are scheduled with minimal notice in district headquarters that may be days of

travel from affected villages, and the scope of what can be objected to is legally constrained. This technocratic governance structure is not merely administratively convenient. It is a participation barrier that systematically excludes the most affected communities from the decisions that most affect them (Kashwan, 2022).

State Priority Override as Emergency Legitimation. The invocation of state priority interests, including national security, disaster reconstruction, and religious sentiment, as grounds for overriding regular procedural requirements constitutes the third and most politically powerful mechanism. This is not merely about individual project exemptions. It has been institutionalised through law: the 2022 EIA exemption for border highways, the 2023 Forest Conservation Amendment, and successive provisions of the National Highways Act create a permanent legal architecture in which state priority declarations override community consent, environmental review, and judicial monitoring. Climate justice claims, which are inherently community-based and long-term, are structurally unable to compete with state priority declarations, which are inherently collective and immediate.

5.3 The Justice Gap

The result of these three mechanisms operating simultaneously is what this paper terms the justice gap: the distance between the climate justice commitments expressed in policy documents and judicial pronouncements, and the material conditions experienced by mountain communities affected by infrastructure development. This gap is not incidental or correctable by marginal reforms. It is structurally reproduced by the institutional architecture of development governance in Uttarakhand and in India's approach to Himalayan development more broadly.

The justice gap carries three characteristic dimensions corresponding to the three pillars of climate justice: a distributive gap (benefits accrue to plains-based populations while costs fall on mountain communities), a procedural gap (participation mechanisms are systematically circumvented or weakened), and a recognition gap (local ecological knowledge is excluded from project planning while technocratic expertise is

granted epistemic authority). Together, these gaps constitute the terrain of constrained climate justice, a terrain where justice is acknowledged in principle and denied in practice. Figure 5 in Section 7 maps current policy instruments according to their position on these two axes.

6. Case Illustration: The Rishikesh-Karnaprayag Railway and the Architecture of Constraint

The Rishikesh-Karnaprayag Railway project provides the base for an ideal case study to illustrate the dynamics of constrained climate justice. It combines extraordinary ambition, a 126-km alignment through one of the world's most geologically complex mountain zones, with 84 per cent of its route running underground through 17 main tunnels totalling 105 km (RVNL,2023), with documented patterns of ecological impact, community harm, and procedural evasion that make it emblematic of the broader governance dynamics this paper theorises.

6.1 Project Overview and Strategic Rationale

The Rishikesh-Karnaprayag Railway, executed by Rail Vikas Nigam Limited (RVNL) at an estimated cost of Rs 16,200 crore (approximately USD 1.9 billion), connects Yog Nagari Rishikesh in the Himalayan foothills to Karnaprayag in the Garhwal region of the Lower Himalayan Range. It is explicitly framed as the primary feeder route to the larger Char Dham Railway project, which aims to connect all four major Hindu pilgrimage sites of the Garhwal Himalayas. The project passes through five districts, namely Dehradun, Tehri Garhwal, Pauri Garhwal, Rudraprayag, and Chamoli, and includes 12 new railway stations (RVNL, 2023).

The official justification for the project, as articulated by the Ministry of Railways, is tripartite: it will reduce travel time from Rishikesh to Karnaprayag from 6 to 8 hours to approximately 2.5 hours, serving pilgrims and local residents; it will boost the economy and tourism in the state; and it will play a vital role in national security by enabling the rapid movement of troops to the India-China border. These three justifications map precisely onto the Growth-Security-Optics nexus described in Section 2 of this paper. The Swedish Export Credit Agency (EKN), which provided guarantees for equipment procurement for the project, classified it

as Category A under OECD standards, meaning it carries large risks to the environment and people, a classification that places it among the most environmentally significant infrastructure investments worldwide (EKN, 2020).

6.2 Ecological Dimensions and the EIA Question

The railway alignment passes through some of the most ecologically significant terrain in the Indian Himalayas. It runs parallel to the Ganga river system through zones of active geological compression, crosses areas identified as seismically sensitive by the Wadia Institute of Himalayan Geology, and tunnels through mountain massifs whose hydrology is poorly understood and which support numerous natural springs that provide water to hillside communities.

Despite these characteristics, the environmental review of the project has been inadequate. The project received environmental clearance through a process not made publicly available in full detail, a concern noted by EKN, which stated that due to the circumstances of equipment supply to different contractors, it was not in a position to disclose the project's Environmental and Social Impact Assessment (EKN, 2020). This opacity is itself a procedural justice failure: affected communities and independent researchers cannot scrutinise the assessment's methodology, assumptions, or omissions.

The inadequacy of environmental review is demonstrated most concretely by documented community impacts. In Panai Pokhari village, Chamoli district, tunnelling for the railway project destroyed the community's sole natural water source, a spring that 50 families had depended on for subsistence and agriculture. As Dr Hemant Dhyani documented in testimony reported in 2023, this is a predictable consequence of tunnel construction in Himalayan geology: tunnels intercept and divert the fracture networks through which groundwater flows, drying up springs and wells above (101 Reporters, 2023). The residents of Panai Pokhari petitioned RVNL, the district administration, and contractor Dilip Buildcon Limited, and received no effective response, with RVNL's deputy general manager claiming the project had nothing to do with their spring loss. This sequence, of predictable harm

followed by community petition and institutional denial, is the signature of the constrained justice dynamic at the case level.

Beyond the Panai Pokhari case, the project generates ecological pressures characteristic of large-scale Himalayan tunnelling: vibration-induced slope destabilisation, disposal of excavated debris into river channels and on agricultural land, disruption of drainage patterns during construction, and the long-term hydrological effects of a 105-km tunnel network on regional groundwater. For every kilometre of new road or tunnel in Uttarakhand, an estimated 50 mature trees are felled and 18,000 cubic metres of debris produced (Risk Avoider Forum, 2025). Scaled to the railway project's scope, this implies ecological disturbance of extraordinary magnitude, a cumulative impact that project-level EIA, focused on individual construction packages, is structurally unable to capture.

6.3 The GSO Nexus in Practice: How Constraints Are Applied

The Rishikesh-Karnaprayag case illustrates with particular clarity how the three mechanisms of constrained climate justice operate in practice. Figure 4 documents the distribution of costs and benefits across social groups, making visible the spatial and social injustice that the GSO nexus produces.

The economic valuation mechanism is evident in the project's cost-benefit framing. Official justifications emphasise the tourism revenue multiplier effect of improved pilgrimage connectivity and the strategic value of troop-movement capability. The costs borne by communities such as Panai Pokhari, including water source destruction, agricultural disruption, and blast vibration damage, do not appear in project accounts because they were not captured in an EIA conducted before, rather than after, local impacts became apparent.

The technocratic governance mechanism is evident in the project's institutional structure. RVNL, as a public sector undertaking of Indian Railways, operates under a mandate focused on project delivery timelines and cost management. Its deputy general manager's denial of the Panai Pokhari spring destruction reflects institutional incentives that reward delivery speed and penalise delays that

would result from acknowledging community impacts and negotiating remediation. The technical complexity of the project, including Tunnel Boring Machines and international engineering consultants, further reinforces the technocratic frame in which affected community voices appear as emotionally understandable but technically irrelevant.

The state priority override mechanism is visible in the explicitly dual mandate of the railway: pilgrimage facilitation and troop movement capability. The security dimension places the project

within the category of infrastructure where normal regulatory procedures can be shortened. The broader legal architecture of border-area exemptions from EIA requirements, established in 2022, creates a presumption in favour of project approval that reverses the burden of proof: rather than proponents demonstrating that projects are safe, communities must demonstrate that projects are harmful, a near-impossible standard to meet without access to geological data and hydrological modelling that only the project's own consultants possess.

Table 3: Climate justice gaps in the Rishikesh-Karnaprayag Railway project

Dimension	What climate justice requires	What the project delivers	Gap characterisation
Distributive	Benefits and costs fall on same populations	Benefits flow to pilgrims/state; costs borne by mountain villages	Spatial-Social injustice
Procedural	Full EIA with public participation before clearance	EIA opacity; community petitions dismissed; no prior consent	Participation exclusion
Recognition	Local ecological knowledge shapes design and monitoring	Community testimony on spring destruction dismissed by RVNL	Epistemic marginalisation
Intergenerational	Future ecological integrity protected	Long-term hydrological and geological effects unassessed	Temporal injustice
Cumulative	All project effects assessed together	Project-level assessment ignores systemic effects across valley	Analytical fragmentation

6.4 Comparison with Alternative Approaches

Contrasting the governance approach of the Rishikesh-Karnaprayag Railway with alternative frameworks applied to infrastructure in comparable ecological contexts clarifies the role of institutional architecture. The Asian Development Bank's Uttarakhand Integrated and Resilient Urban Development Project, which includes Category B environmental safeguards, a mandatory Climate Resilience Modelling component, and gender-sensitive social impact requirements, demonstrates that multilateral financing conditionalities can operationalise climate justice criteria in ways that domestic procurement frameworks do not. The difference in outcomes is not a function of project type or technical complexity. It is a function of institutional architecture and the binding force of justice requirements.

India's own Supreme Court High Powered Committee process on the Char Dham highway project demonstrates that judicial oversight partially constrains the GSO nexus. The committee's recommendations did lead to a reduction in approved road width along some sections. However, the committee's authority was overridden by Ministry of Defence arguments about strategic road requirements, and the Supreme Court approved three border-adjacent stretches despite committee findings of significant ecological risk (Mongabay, 2024). Ravi Chopra resigned as committee chairperson in January 2022, stating that his belief that the panel could protect the fragile ecology of the Himalayas had been shattered (Down to Earth, 2022). The partial nature of this judicial constraint illustrates precisely what constrained climate justice means in practice: justice claims are heard but not determinative; they slow and modulate development

decisions rather than reshaping their fundamental orientation.

7. Implications: Toward an Architecture of Unconstrained Justice

The analysis developed in this paper carries implications at three levels: theoretical, policy-institutional, and methodological. This section addresses each in turn, while acknowledging that the structural nature of constrained climate justice means that technical fixes and incremental reforms, however necessary, are insufficient without deeper transformations in the political economy of Himalayan development.

7.1 Theoretical Implications

The concept of constrained climate justice contributes to the growing literature on 'governance traps' in environmental management, situations where institutional arrangements systematically prevent the adoption of more sustainable and equitable alternatives even when their superiority is recognised (Pahl-Wostl et al., 2012). It extends this literature by theorising the specific mechanisms through which justice claims are not merely blocked but actively reshaped by development governance: monetisation filters, technocratic exclusion, and priority overrides that together constitute a distinctive institutional technology of justice constraint.

The concept also advances the political ecology of mountains, adding to the analytical tradition established by Guha (1989), Baviskar (1995), and others by identifying the contemporary governance architecture that has replaced the colonial forest administration that earlier political ecologists critiqued. The new architecture is more sophisticated. It speaks the language of sustainability, deploys environmental rhetoric, and acknowledges community concerns even as it structurally overrides them. This sophistication makes it more difficult to critique and more resilient to reform than simpler forms of state extraction.

Finally, the concept opens a productive conversation with the capabilities approach of Amartya Sen (1999) and Martha Nussbaum, suggesting that the evaluation of development projects in ecologically fragile regions should centre on how they affect the

substantive freedoms of the worst-off members of affected communities, rather than aggregate net present values. A railway that destroys a community's water source, even if its overall net present value is positive, is a development failure on a capabilities account. Constrained climate justice theory provides the analytical vocabulary for making this argument within development economics itself.

7.2 Policy and Institutional Implications

The policy implications of constrained climate justice theory are demanding but specific. Three reform directions are most pressing for Uttarakhand and comparable Himalayan development contexts.

First, cumulative impact assessment must replace project-level EIA as the primary regulatory mechanism. A comprehensive river-basin or valley-level assessment, updated before each new major project receives clearance, would compel planners to confront the aggregate ecological footprint of development in a given watershed rather than treating each project as if it were operating in an otherwise undisturbed environment. Several jurisdictions, including British Columbia, Canada, and Norway, have developed basin-level assessment frameworks for hydropower that provide viable institutional models.

Second, community veto rights must be restored and strengthened. The Forest Rights Act's original gram sabha consent requirement, weakened by the Forest Conservation Rules of 2022, should be reinstated and extended to include all major infrastructure projects with significant ecological footprint. Community veto does not mean the permanent blocking of all development. It means that communities must be genuinely persuaded of a project's benefit-cost balance, rather than simply overridden by state priority declaration.

Third, non-market value accounting must be institutionalised in project appraisal. Multi-Criteria Analysis (MCA), which evaluates projects across multiple dimensions, including economic, ecological, social, cultural, and intergenerational, without requiring all dimensions to be reduced to a common monetary unit, provides a more epistemologically honest framework for project evaluation in contexts of genuine value pluralism.

Table 4: Reform directions for moving from constrained to substantive climate justice

Reform area	Current failure	Proposed alternative	Justice dimension addressed
Impact assessment	Project-level EIA, evaded or weakened	Mandatory cumulative basin-level assessment	Procedural+ Distributive
Community consent	Gram sabha rights weakened by 2022 rules	Restore and extend binding consent requirement	Procedural+ Recognition
Value accounting	CBA with non-market values excluded	Multi-criteria analysis with capability indicators	Distributive Recognition
Monitoring	No independent post-project monitoring	Community-led monitoring with legal standing	Procedural
Temporal accounting	Social discount rate renders future costs trivial	Long-term cost bonds held by project proponents	Intergenerational

7.3 Methodological Implications

For researchers, the concept of constrained climate justice points to the value of methods that can trace the journey of justice claims through governance systems, following specific justice arguments from their articulation in community spaces or civil society organisations, through their processing by regulatory bodies and courts, to their ultimate expression or suppression in project decisions. This 'claims-tracing' methodology, analogous to process tracing in political science, would make visible the institutional mechanisms through which constraints are applied, a visibility that is currently lacking in both the development economics and the political ecology literatures.

The comparative dimension also warrants greater attention. Systematic comparison of infrastructure governance in Uttarakhand with Himachal Pradesh, a state with a stronger tradition of participatory forest governance through van panchayats, or with Nepal and Bhutan, whose constitutional provisions for gross national happiness and ecological rights create different institutional environments, would allow the specific institutional variables that produce constrained climate justice to be identified with greater precision.

8. Conclusion

This paper has established that climate justice in Uttarakhand's infrastructure development context is not absent but constrained. It is present in the normative commitments of policy frameworks,

judicial pronouncements, and international agreements, but structurally subordinated by three interlocking mechanisms: economic valuation as an epistemic filter, technocratic governance as a participation barrier, and state priority override as emergency legitimation. The resulting justice gap, between acknowledged commitments and material realities, is not a correctable administrative failure but a constitutive feature of the development governance architecture that currently prevails.

The Rishikesh-Karnaprayag Railway case illustrates these dynamics with painful specificity: a project of genuine strategic and connectivity significance, executed at extraordinary engineering scale through one of the world's most ecologically sensitive mountain systems, under a governance framework that was unable to anticipate, acknowledge, or remediate the destruction of a village's water source by its own tunnelling operations. This is constrained climate justice in its most concrete form. The problem is not the denial that the spring existed, but the institutional incapacity to treat its destruction as a cost that should have been avoided or compensated. The concept of constrained climate justice is intended as a contribution to both theoretical and practical debates. Theoretically, it advances the political ecology of mountains by providing a precise vocabulary for the governance dynamics that Ravi Chopra, Kanchi Kohli, and numerous Himalayan scholars have documented empirically without a unified conceptual framework. It connects the justice literature's three-

dimensional framework to the specific institutional mechanisms through which each dimension is constrained. And it situates Uttarakhand's experience within the broader global pattern of aspirational sustainability: the proliferation of sustainability and justice language in development governance alongside the structural preservation of growth imperatives (Kashwan, 2021).

Substantive climate justice in Himalayan development requires binding community consent mechanisms that cannot be overridden by security declarations, mandatory cumulative impact assessment frameworks that replace project-level analysis, and evaluation methodologies that take seriously the capabilities of the worst-off rather than the aggregated net present values of the average.

The urgency of this reorientation is not merely normative. The Joshimath crisis, the Silkyara tunnel collapse, the proliferating landslides along the Char Dham highway, and the drying springs along the railway corridor are predictable outputs of a development model that consistently prioritises speed and scale over caution and equity. In a changing Himalayan climate, where glacial retreat is accelerating, extreme precipitation events are intensifying, and the geological stability of mountain slopes is increasingly precarious (Singh and Pandey, 2024; Wadia Institute of Himalayan Geology, 2022), the costs of constrained climate justice will be borne not only by the communities currently dispossessed but by the hundreds of millions whose water security depends on the ecological integrity of the Himalayan system. The question of climate justice in Uttarakhand is, in this sense, not a regional or marginal concern. It is a question about the long-term habitability of the Indian subcontinent.

Future research should pursue four directions: empirical applications of the constrained climate justice framework to other Indian development frontiers including the Western Ghats, the Northeast, and the Andaman and Nicobar archipelago; comparative institutional analysis of the governance conditions under which Himalayan states have achieved greater or lesser justice integration; normative philosophical work on the appropriate scope and institutional form of community veto rights in contexts where

development benefits extend beyond affected communities; and participatory action research that supports affected communities in exercising whatever justice claims the existing institutional architecture does permit.

The author(s) declare no conflict of interest. The research was conducted in the absence of any commercial relationships that could be construed as a potential conflict of interest. Although the financial assistantship was provided by UPES (University of Petroleum and Energy Studies) in the form of stipend.

References

- 101 Reporters. (2023). Char Dham rail tunnel leaves Uttarakhand village high and dry. 101 Reporters. <https://101reporters.com>
- Awasthi, S., & Jain, K. (2024). Analyzing Joshimath's sinking: Causes, consequences, and future prospects with remote sensing techniques. *Scientific Reports*, 14, 10876. <https://doi.org/10.1038/s41598-024-60276-3>
- Baviskar, A. (1995). *In the belly of the river: Tribal conflicts over development in the Narmada Valley*. Oxford University Press.
- Bera, B., Saha, S., & Bhattacharjee, S. (2023). Sinking and sleeping of Himalayan city Joshimath. *Quaternary Science Advances*, 12, 100100. <https://doi.org/10.1016/j.qsa.2023.100100>
- Blaikie, P., & Brookfield, H. (1987). *Land degradation and society*. Methuen.
- Bryant, R. L., & Bailey, S. (1997). *Third world political ecology*. Routledge.
- Caney, S. (2010). Climate change, human rights and moral thresholds. In S. Humphreys (Ed.), *Human rights and climate change* (pp. 69-90). Cambridge University Press.
- Down to Earth. (2022, February 11). 'Assault on the Himalayas': Chairman of Char Dham committee resigns. Down to Earth. <https://www.downtoearth.org.in/environment/-assault-on-the-himalayas-chairman-of-char-dham-committee-resigns-81533>
- EKN. (2020). Rishikesh-Karnaprayag railway project, India. Swedish Export Credit Agency project disclosure, September 2020. <https://www.ekn.se/en/about-ekn/sustainability/ekns-sustainability-agenda/environmental-and-human-rights-classification-of-transactions/archive-transactions-for-category-a-projects/rishikesh-karnaprayag-railway-project-india/>

10. Escobar, A. (1995). *Encountering development: The making and unmaking of the Third World*. Princeton University Press.
11. Fairhead, J., Leach, M., & Scoones, I. (2012). Green grabbing: A new appropriation of nature? *Journal of Peasant Studies*, 39(2), 237-261. <https://doi.org/10.1080/03066150.2012.671770>
12. Forest Survey of India. (2019). *India state of forest report 2019 (Vol. 2)*. Ministry of Environment, Forest and Climate Change. <https://fsi.nic.in>
13. Guha, R. (1989). *The unquiet woods: Ecological change and peasant resistance in the Himalaya*. University of California Press.
14. Hanemann, W. M. (1994). Valuing the environment through contingent valuation. *Journal of Economic Perspectives*, 8(4), 19-43. <https://doi.org/10.1257/jep.8.4.19>
15. Indian Institute of Forest Management. (2018). *Valuation of ecosystem services in Uttarakhand*. Government of India commissioned study.
16. Kashwan, P. (2021). Climate justice in the Global North: An introduction. *Case Studies in the Environment*, 5(1), 1125003. <https://doi.org/10.1525/cse.2021.1125003>
17. Kashwan, P. (Ed.). (2022). *Climate justice in India*. Cambridge University Press. <https://doi.org/10.1017/9781009171908>
18. Fatma, N. (2022, January 15). *Concerns over the environment in the Char Dham project have prompted the Supreme Court to appoint*. *Aequitas* Victoria. <https://www.aequivic.in/post/concerns-over-the-environment-in-the-char-dham-project-have-prompted-the-supreme-court-to-appoint>
19. Ministry of Environment, Forest and Climate Change. (2023). *The Forest (Conservation) Amendment Act, 2023*. Government of India. [https://prsindia.org/files/bills_acts/bills_parliament/2023/Forest%20\(Conservation\)%20Amendment%20Bill,%202023.pdf](https://prsindia.org/files/bills_acts/bills_parliament/2023/Forest%20(Conservation)%20Amendment%20Bill,%202023.pdf)
20. Mongabay. (2024, February). *Risky development in Uttarakhand: Interview with environmentalist Ravi Chopra*. Mongabay India. <https://news.mongabay.com/2024/02/risky-development-in-uttarakhand-interview-with-environmentalist-ravi-chopra/>
21. Pahl-Wostl, C., Backer, H., Bomba, P., Gupta, J., Hare, M., Huntjens, P., Moltgen, J., Petry, D., Riske, G., Taber, D., & Borowski, I. (2012). Analyzing complex water governance regimes: The management and transition framework. *Environmental Science and Policy*, 23, 571-580. <https://doi.org/10.1016/j.envsci.2012.02.006>
22. Pearce, D., Atkinson, G., & Mourato, S. (2006). *Cost-benefit analysis and the environment: Recent developments*. OECD Publishing. <https://doi.org/10.1787/9789264010055-en>
23. Risk Avoider Forum. (2025). *Climate change and Uttarakhand's environment*. Risk Prevention Mitigation and Management Forum. <https://riskavoider.com/climate-change-and-uttarakhands-environment/>
24. RVNL. (2023). *Rishikesh-Karnaprayag railway project: Project overview*. Rail Vikas Nigam Limited, Ministry of Railways. <https://railanalysis.in/rail-news/rvnl-achieves-200-km-tunnel-excavation-for-rishikesh-karnaprayag-rail-project/>
25. Petersen, W., & Sachs, W. (1992). The Development Dictionary: A Guide to Knowledge as Power. *Population and Development Review*, 18(1), 194. <https://doi.org/10.2307/1971880>
26. Sati, V. P. (2023). Ecosystem services valuation and payment for livelihood sustainability in the Indian Central Himalayan Region. *Journal of Resources and Ecology*, 14(3), 470-482. <https://doi.org/10.5814/j.issn.1674-764X.2023.03.005>
27. Schlosberg, D. (2007). *Defining environmental justice: Theories, movements, and nature*. Oxford University Press. <https://doi.org/10.1111/j.1747-7093.2008.00164.x>
28. Sen, A. (1999). *Development as freedom*. Oxford University Press.
29. Singh, G., & Pandey, A. (2024). Climate change induced disasters and highly vulnerable infrastructure in Uttarakhand, India: Current status and way forward towards resilience and long-term sustainability. *Sustainable and Resilient Infrastructure*, 9(2), 145-167. <https://doi.org/10.1080/23789689.2023.2253409>
30. Supreme Court of India. (2024). *M.K. Ranjitsinh and Ors. v. Union of India and Ors. Writ Petition (Civil) No. 838 of 2019*. April 2024.
31. Smith, Stephen & Todaro, MP. (2003). *Economic Development*, 12th Edition (The Pearson Series In Economics).
32. Uttarakhand Government. (2014). *Uttarakhand action plan on climate change (UAPCC)*. Government of Uttarakhand. <https://moef.gov.in/uploads/2017/08/Uttarakhand-SAPCC.pdf>

-
33. Wadia Institute of Himalayan Geology. (2022). Glacial retreat in the Indian Himalayas: A scientific review. Wadia Institute of Himalayan Geology, Dehradun.
 34. Young, I. M. (1990). Justice and the politics of difference. Princeton University Press.
<https://doi.org/10.2307/j.ctvcn4g4q>