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Ecological and socio-political conflicts in the Turga Hydroelectric Project: An examination through the lens of political ecology

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Abstract

The present paper critically examines water-assisted developmental projects and their associated conflicts through the lens of political ecology, with a particular focus on hydroelectric power generation in the Global South. These projects often catalyze localized socio-cultural, political, and ecological tensions, especially in indigenous territories where human–nature relationships have evolved through colonial and postcolonial ecological transformations. Our approach conceptualizes political ecology to explore the multidimensional conflicts tied to such projects, using the Turga Pumped Storage Hydroelectric Project in the Purulia district of West Bengal, India, as a case study. This region exemplifies the socio-ecological conflicts between state-led hydroelectric initiatives and the local indigenous communities, providing critical insights into the broader dynamics of water-based development in the Global South. The five primary areas of inquiry in this paper include (1) the environmental ramifications of the Turga Pumped Storage Hydroelectric Project on Purulia's landscapes, wildlife, and ecosystems; (2) the social consequences that have emerged, including displacement, resource access disparities, and challenges to local livelihoods; (3) the power dynamics

that shape the decision-making processes surrounding the project, shedding light on the role of government policies and corporate interests; (4) comparative analyses with similar hydroelectric projects globally, providing valuable insights into the uniqueness of the Purulia case; and (5) the policy implications and recommendations to ameliorate the conflicts and foster a more sustainable and equitable approach to hydroelectric development. This study highlights the critical role of political ecology in understanding human–nature conflicts and resource management. It emphasizes the need for an integrative approach that considers both technological and socio-political aspects. The Turga Pumped Storage Project in Purulia offers broader insights into the global challenges of sustainable energy and climate change, underscoring the importance of inclusive and environmentally responsible energy production and resource management.

KEYWORDS

aboriginal, human–nature conflict, policy, political ecology, Turga Hydroelectric Project

1 | INTRODUCTION

Hydroelectric power generation allied with water-aided policy is an integral part of ensuring sustainable water security in the 20th century. The contemporary renaissance in renewable energy production through hydroelectric power generation becomes an ideal tool for sustainable energy production, but it is also connected with a set of socio-political and ecological debates and conflicts. Developmental policy-related conflicts often take place in areas where the local commons live closely coordinated with the natural environment, and this relationship deteriorates because of policy-aided construction on the site (Osborne et al., 2021). The use of political ecology (PE) in this context is not only to understand power relations; but to emphasize the tension between human nature, water allocation, land utilization, and deforestation. In the Global South environmental policies are not always passing through in a linear way, rather they connect multiple socio-political and ecological aspects within a territory (Mukherjee et al., 2020). Over the past two decades, the subject matter of PE expanded rapidly and instead of its traditional loose coherent theory, it deals with normative persuasion of resource utilization and sustainable future. More importantly, PE delves into how environmental issues connects with the political economy and a set of socio-cultural attributes (Swyngedouw, 2009).

The basic premise of PE is that environmental issues are not apolitical, rather it connects how different actors act to frame the policy and the response of other users or the people who will receive direct impact (positive/negative) from the policy. In Indian consideration, the hydroelectric power generation projects have a long history of local conflicts. Especially so in the Global South where water-aided policy through hydroelectric generation also brings with it a socio-ecological transformation in certain areas (Underwood et al., 2020). For example, in northern India, the Kuther, Bijolo, Hull, and Jispa hydroelectric projects on the Ravi and Chenab Rivers allied with local protests due to the depletion of natural water sources, deforestation, and risk to sacred and wildlife (Del Bene, 2018). These concerns raised by local inhabitants have been studied in scientific literature and show how the ecology of the western Himalayan region is under threat due to hydroelectric power generation (Asher & Bhandari, 2021; Kaintura et al., 2024). The construction of hydroelectric power is abundant in the hilly and the plateau regions which provides the required geo-lithological structure for the construction of water reservoirs and are sometimes aligned with a particular river basin (Rahaman, 2020; Sahu et al., 2020). In some instances, in India, hydroelectric power generation is an integral part of rural development (Kelly-Richards et al., 2017). Among these hilly parts the northeastern states of India are considered the "Powerhouse of the Country" (Deshamukhya & Choubey, 2023) which undergoes through what has been called the "Hydro Rush" (Huber & Joshi, 2015). For example, Sikkim state has a total number of 47 hydroelectric power plants (Tamang & Mohapatra, 2022) and has been named the Future Powerhouse State in India (Baruah et al., 2021); but at the same time, the region also undergoes with the ecological transformation that arises socio-political conflicts. In this regard, the "Narmada Bachao Andolan" was the first "grassroots ecological movement" (Gutierrez et al., 2019) standing for the foundation of political economy through hydro-social aspects (Palomino-Schalscha et al., 2016). The concept of "Water for Energy" (Espinosa et al., 2021) is an integral part of development projects in the Indian geopolitical context, where the natural system for water consumption and energy production is an avenue for national growth. Although in a reverse angle, the notion of water for energy also brings a critical appraisal of "large-dams-as-usual" (Huber & Joshi, 2015) which stands for the immoral social and wobbly ecological aspects of hydroelectric power generation. In some instances, the megawatts production from the project is lesser than the adverse socio-environmental impacts associated with the hydroelectric power project (Bakken et al., 2014; Kelly-Richards et al., 2017).

The present paper theorizes the concept of PE through microlevel assessment, for which we have considered the Turga Pump Storage Project (TPSP) in the Bagmundi block of Purulia district, West Bengal state, India, as a case study. The TPSP, situated in the hilly landscapes of the Purulia district, marks a significant investment by the authorities and it forms an important part of their water-aided development policies. Initiated against the backdrop of ecological stress, prolonged droughts, and water scarcity, the project is placed in the Bagmundi block which is a hilly portion of Purulia district, in the westernmost part of West Bengal. Physiographically, the region falls under the Chotonagpur plateau region, characterized by dry sub-humid climatic characteristics with frequent drought and water scarcity (Kar et al., 2023). The hydroelectric power project is one of the water-aided development projects in the Bagmundi region (Paul & Das, 2022), which employs dam structures in the hilly expanse of Bagmundi block (Das et al., 2020). The focal point of this article lies in unraveling the complexities of the Turga Hydroelectric Project, where the pursuit of sustainable energy generation collides with the concerns of local indigenous communities. The Purulia district's socioeconomic and ecological intricacies, coupled with the geophysical allure of the Bagmundi block, set the stage for a nuanced analysis. The conflict between governmental initiatives for hydroelectric

power and the indigenous communities' resistance unfolds against the backdrop of deforestation, affecting not only human societies but also triggering human–animal conflicts due to shrinking territorial areas for wildlife (Hazari & Bhui, 2021). The different issues are allied with TPSP generate a set of questions, applicable to a range of water-aided development policies in the Global South.

To understand the complexities of water-aided policies, the theoretical foundation of PE is crucial, as it illuminates the multifaceted landscape of development policies (Bryant et al., 2011; Dallman et al., 2013). PE emphasizes identifying winners and losers (Robbins, 2019; Watts, 2017), understanding the roles of various actors (Sovacool, 2021), and uncovering the fundamental conflicts that arise within such policies (González-Hidalgo & Zografos, 2020). The hydropower development and associated local aboriginal conflicts in the Bagmundi block of Purulia district are examined through a microlevel case study, utilizing PE to explore how socio-political dynamics interact with technical development efforts. The novelty of the present paper lies in its advancement of the discourse on development projects, specifically by conceptualizing the application of PE at a microlevel, particularly within the Global South. Thus, this study not only examines the meaning of development projects and who benefits from them but also questions the long-term trajectory of these projects by delving into critical socio-political aspects such as power imbalances, local resistance, and governance frameworks. This nuanced focus enriches the current understanding of water-driven policy conflicts, adding a layer of depth to the global PE framework.

2 | LITERATURE REVIEW

2.1 | How political ecology works

The interdisciplinary approach of PE explains the complex interconnectedness of human–environment relations. The application of PE in the research field is primarily made by Western academics to highlight the analytical approach that integrates ecological issues with political understanding (Nichols & Del Casino Jr, 2021; Robbins, 2019). The multidimensional approach of PE endorses a set of distinct but interconnected issues while addressing ecological changes and issues from the standpoint of political economy (Fernando, 2020); this includes a series of questions, that is, how the development policies work (Haggard & Kaufman, 2018), who are the primary decision-makers (Ralston et al., 2021), who are the winners and losers (Nuetah & Xin, 2017), what are the different type of conflicts related to environment policy (Le Billon, 2015), and how far the policies are sustainable for the overall ecology (Lederer et al., 2018). Although the subject matter of PE is dynamic (Watts, 2015) and interconnected with multiple discipline (Turner, 2015); the utilization of its full potential is yet to achieve in academia. Earlier, it was used in disciplines like economics, environmental history, and social science (Watts, 2015), which limited the scope of PE to understand environmental issues (Gillespie & Perry, 2019). Though the term "Political Ecology" dates to 1934, it gained recognition as a distinct field of study in the 1980s. Originating from the collaborative efforts of social scientists from disciplines such as sociology, environmental history, and forestry (Sultana, 2021). However, in contemporary world, PE creates a more correct understanding of the environmental issues in the Global South (Watts, 2017).

The theoretical foundation of PE for the Global South was integrated from the colonial era, where uncontrolled resource utilization was meant to enhance the wealth of Europe. Which

shows unequal power relations in national and international domains (Prieto et al., 2023; Watts, 2017). Before the colonial period, if we consider Indian civilization, then human livelihood was developed more in synchronization with their surrounding natural environment, where the finite and renewal resources were used through the well-structured social model, causing few environmental issues. However, during the colonial era, large-scale resource utilization manifested through environmental degradation, which was the carried out for the wealth creation for Western Europe (Nayar, 2014). For example, the Industrial Revolution in Britain drove the forced cultivation of indigo in Bengal and cotton in Gujrat and the Decan Plateau (Roy & Roy, 2019). In this way, the political power game generated two separate parties, Indians as losers and Western European societies as gainers (Cohen, 2023; Sahoo, 2014). During the colonial era, the implementation of British political and economic systems affected different localities in India differently, resulting in diverse regional responses across the Indian subcontinent. For example, apart from the agricultural expansion, regions like Bangla–Bihar–Jharkhand faced drastic deforestation for expanding railway tracks and using wood for railway sleepers (Damodaran, 2002; Gupta, 2020). The destruction of natural resources led to anti-colonial local movements like "Santal Bidroho," which merged with the national struggle for independence (Guha, 2011). However, the collapse of the British Raj did not modify the resource management strategy in the postcolonial phase, as this system and strategy continued after the independence from Britain (Jakob and Steckel, 2022). The nature of developmental projects is typified by resource-exhaustive industrial activity, where schemes like hydroelectric projects and the construction of big dams becomes an integral part of development significant (Boelens et al., 2019). These development projects are a continuation of the colonial policy, where a specific group of people and natural resources within a nation are exhausted by another group, which leads to postindependence ecological protests especially from the marginal and powerless community. Among the post-independence ecological movements, the Chipko movement, the Appiko movement, and the Silent Valley movement show socio-political and ecological hustle connected with development projects (Shiva & Bandyopadhyay, 2019).

2.2 | Political ecology and environmental issues

In the first phase of any policy analysis, PE produces grounded material historical argument to explain the current state of things or simply it sets out the narrative explanations or "why explanations" (Robbins, 2022). In the second phase, the multidisciplinary nature of PE complicates explanations by offering diverse perspectives and narratives. This is the reason why PE has its own crucial lens for examining complex environmental challenges (Görg et al., 2017).

PE provides a conceptual foundation to dissect the interconnected choices made by humans in shaping policies related to the environment (Robbins, 2019). PE emerged as a discipline aimed at unraveling the intricate relationship between environment, resources, and humanity (Kenney-Lazar et al., 2023) that connects the diverse array of socio-political and ecological issues allied with developmental policy. More importantly, PE reveals the "Westernized" way of water policy (Durnik, 2008) which underlies rural development, particularly in the Global South. Any sort of resource developmental project, that is, hydroelectric power generation, has two successive stages, one is the input, and the other is the output stage. The input stage includes construction and estimation of how much the ecology is going to be at risk, while at the output stage, one group of people gets the benefits while another group of people, often those who are close to nature, experience ecological damage. In both stages, a group of actors

act in a certain way with the association of power relation. Incorporating the stages of PE and a wide range of social, political, and environmental aspects is crucial when studying one of the most important pillars of water security: water management. The application of PE in water-aided developmental policy especially in Global South is required, due to its interdisciplinary approach, shedding light on the overall ecological crisis by bridging the realms of social and physical sciences (Kull & Rangan, 2016; Lave, 2014). This inclusive perspective allows PE to interpret a diverse array of environmental issues, ranging from land grabs and water insecurity to man–animal conflicts and policy assessments. The last two decades have seen a significant increase in the use of PE approaches to understand the dynamics of human–environment relationships globally, particularly in the Global South (Bruun & Kalland, 2014).

2.3 | Human–nature conflicts in the context of hydroelectric power projects

Micro-politics within the context of human–environment relations has become a focal point in PE to evaluate environmental challenges (Spencer, 2021; Brown, 2017). Although the literature in the domain of PE is not neatly confined, examining the broader spectrum of resource-related power dynamics reveals the prevalence of environmental degradation (Van Assche et al., 2017). Studies within this framework have delved into discerning winners and losers in the realm of resource redevelopment policies (Blake & Barney, 2018). In the Indian context, water-driven land reclamation policy in Tamil Nadu state shows that the political economy of the state is set up by grabbing land from local farmers (Baka, 2013, 2017). The same parallel scenario unfolded in West Bengal with the "Tata Nano Singur Controversy," where land acquisition for a Tata Motors factory faced protests by local farmers, bringing to light issues of displacement and livelihood concerns (Das, 2016). Another poignant illustration of environmental degradation is seen in Indonesia's palm oil production and deforestation, causing tensions between indigenous communities due to forced land grabbing (Li, 2018).

Water-aided development strategies, especially hydroelectric projects, have consistently sparked debates in academic circles (Koirala et al., 2017). These debates stem from misconceptions surrounding development projects, emphasizing that sustainable development involves more than the exploitation of water or land resources. It needs a harmonious integration of diverse resources, communities, and organizations. Studies in India have highlighted the adverse ecological impacts of hydroelectric projects on rivers, disproportionately affecting marginalized communities (Hill, 2017). Among these communities, indigenous populations often endure most of the negative consequences due to their closer connection to nature than mainstream society (Maher, 2019). For instance, the Bajoli-Holi hydroelectric power project in Himachal Pradesh caused extensive deforestation, leading to protests by the local Gaddi tribe, who depend on the region's natural resources for their livelihoods (Asher & Negi, 2023). A similar narrative unfolds in Kerala, where the Anakkayam small hydroelectric project raises ecological concerns in a region prone to landslides (Kuriakose & KylasamIyer, 2016). The economic, socio-cultural, and environmental crisis faced by the Kadar tribal communities in the wake of forest loss has created a microcosm of intricate challenges posed by hydroelectric developments (Xavier, 2018). In some instances, dam development projects for hydroelectric power generation exaggerate environmental conservation and sustainable energy production benefits. For instance, the Ranganadi hydroelectric project aimed to mitigate floods in North Lakhimpur town of Assam state, which was proven wrong in the 2008 flash flood that affected the downstream local commons

(Sharma, 2018). Despite the unstable geology of the northeastern part of India, the region has the highest concentration of dams for hydroelectric power in the country. The region is also home to many aboriginal communities, who are often exposed to natural calamities. However, these communities show remarkable resilience, relying on survival strategies that are intricately connected to their ecological knowledge and practices (Sankar Bandyopadhyay, 2019). This is the reason water-aided developmental projects; especially hydroelectric power generation are always met with mass protests from the aboriginal communities, as many proposed and operational dam sites are concentrated in varied ecological and culturally rich regions (Huber & Joshi, 2015). The struggle between capitalized and traditional modes of economy through water-aided policies is still unresolved in academic debates. One group of scholars advocates for adopting a Westernized mode of production (Lee, 2017; Rist, 2014), while another group sees traditional economic systems as the solution for achieving long-term sustainable development (Fischer et al., 2012; Tödtling & Trippl, 2021). In these academic debates and environmental conflicts, the application of PE to environmental issues and the exploration of human–nature conflicts (González-Hidalgo & Zografos, 2020) highlights the need for a mix of these approaches. Additionally, the critical analysis of water-aided development underscores the necessity of interdisciplinary approaches to understand the complex web of interactions shaping environmental challenges (Tvedt, 2021). The literature reviewed provides a comprehensive foundation for delving into the nuances of the Turga Pumped Storage Hydroelectric Project and its implications on the environment, communities, and policies that seek to show the benefit of making use of PE approaches. Here said the PE approach allows us to understand the interplay between human response with developmental policy, alongside the fabrication of water-aided schemes where different actors act is certain way.

3 | METHODOLOGY

In trying to understand the pre-implementation impacts of the TPSP, we applied qualitative research methods in combination with an interpretive analytical approach to analyze the primary data collected during the field visit. This primary data included interviews, observations, and surveys conducted on-site. Additionally, we analyzed secondary data, such as existing policies, regulations, historical records, and relevant literature, to provide a comprehensive understanding of the context and potential impacts of the TPSP before its implementation. We have considered a particular case study method to allow in-depth methodical exploration of the experiences and impacts of the project for the residents in the area studied. To understand the perspective of people residing in different parts of the project area, we used focus group discussions (FGDs), to understand the cumulative effects arising from TPSP (Foley et al., 2017; Halseth et al., 2016), we classified the outcomes from the focused group interviews into thematic segments: displacement issue, issues on water resource, deforestation, human–animal conflict, hazard and socio-cultural impacts. These themes were identified by using thematic data analysis methods (Chopra et al., 2022; Joffe, 2011; Terry et al., 2017).

3.1 | Study area

Purulia district is situated in the western part of West Bengal state, India considered often as the dry drought-prone and backward (underdeveloped) section of the state (Kar et al., 2020,

2023). Despite the tagline as backwards, the district is enriched in its cultural artifacts and long colonial history (Kar et al., 2023). Geologically, the region is situated in one of the oldest ancient crystalline rock strata. Despite receiving enough rainfall yearly (1400 mm on average), the undulating topography, hard rock surface, and non-perennial riverine system make the region one of the most water-scarce district in the state (Kar et al., 2020). Among the 20 blocks in the district, Bagmundi is distinct for its cultural integrity of the aboriginal community and scenic beauty with rich flora and fauna, which makes this part of the state one of the most popular tourist destinations in the state (Malladeb et al., 2023). The block is situated in the south-western part of the district (23°12′ N 86°03′ E), which is the segment of the Ranchi plateau (Roy & Jana, 2015). This section has the major highland (elevation ranges from 475 to 700 m) in the district after Bandwan block which acts as a drainage divide between the Subarnarekha River basin and Kangsabati River basin (Younis & Ahmed, 2022). The block is about 427 km^2, with 138 total villages and eight Gram Panchayats, which has significant concentration of aboriginal community (Mishra, 2017). Bagmundi is recognized as an area with severe rural poverty and deprivation (Bose, 2016). About 53% of the working-age population has been found to be non-working and among the working-age population about 40% population are from small-scale agricultural labor, categories that have been found to be strongly related to regional marginalization (Census Village Directory, 2011). This is the reason Bagmundi receives a Backward Regions Grant Fund from the Government of India.

The dry subhumid climatic condition often witnessed a series of drought years (1976, 1979, 1980, 1982, 1983, 1985, 2001, 2003, and 2010) (Government of West Bengal [GoWB], 2012; Palchaudhuri & Biswas, 2013). For this reason, the state authorities have put in significant effort to overcome this situation through water-aided projects. That is, "Jol Dhoro Jol Bhoro," "Ushar Mukti," and "Jalatirtha" have focused on enhancing dry land crop production through irrigational development (Kar et al., 2023). On the other hand, a project like Marble Lake water reservoir seeks to address household-level drinking water supply, particularly at the village level of Bagmundi block (Kar et al., 2023). Among the different water-aided projects Purulia Pumped Storage Project (PPSP) and TPSP (see Figure 1) aims to generate hydro-electric power from human-made water reservoirs. Both the projects are associated with several conflicts voiced by village commons, environmental activists, and social scientists (Chakrabarty & Chatterjee, 2010). Although the proposed aim of the projects is to generate sustainable local livelihood the past and present ecological destruction and ignorance of local job opportunities the operational TPSP and Proposed PPSP allied with mass protest by village commons, especially by the aboriginal communities in the region.

Considering it, the present article aims to provide a clear picture of the association of water-aided projects and its socio-political and ecological dimensions in the Indian context. We have considered the Bagmundi region in the Purulia district as a case study as it enables us to critically analyze this and therefore answer the main aim of the article.

3.1.1 | Water resource and the political economy in the district: A brief history

A number of academic literatures from environmental history focuses on ecological transformation and different land use policies in the district during the colonial period (Damodaran, 2006; Mahato, 2021). However, none of the studies has analyzed the ecological transformation related to water-aided policies in the Purulia district. Table 1 represents a series of distinct phases

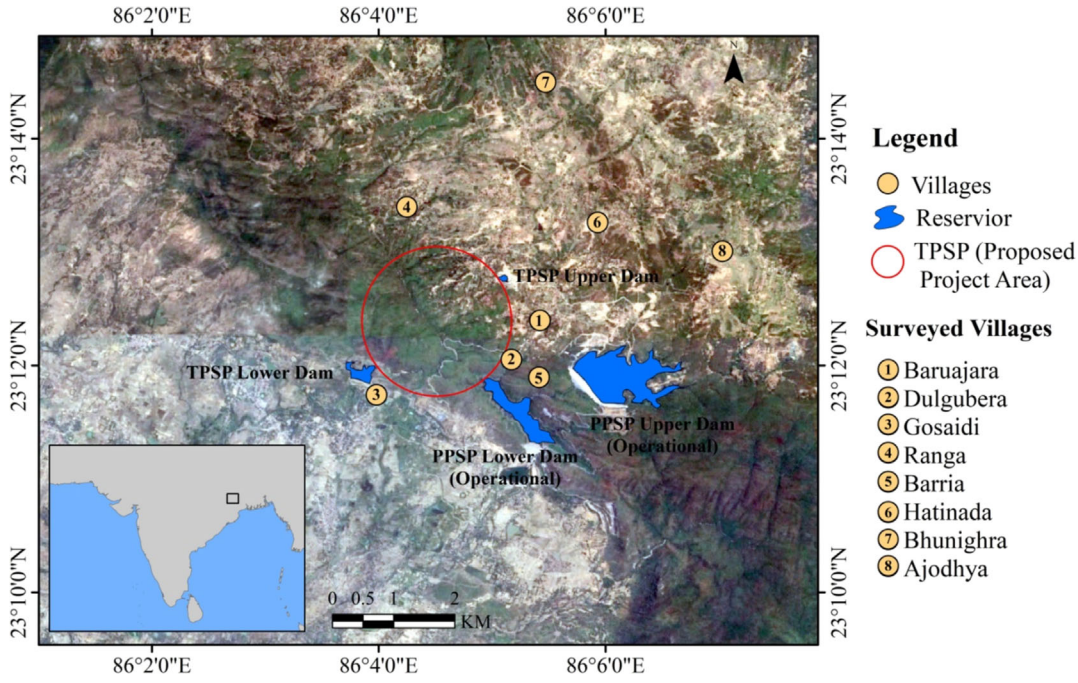

FIGURE 1 Location map of the study area.

TABLE 1 Distinct phases of political economy and water resource in Purulia district.

Chronology of the phases	Nature of the phase	Association of resource development and PE
First phase (1870–1910)	The colonial land use policy and ecological transformation leads to successive drought years	Uncontrolled deforestation for colonial agriculture invasion leads to soil erosion, high bed load in regional river, increasing temperature with high evapotranspiration
Second phase (1973–present)	Drought development program	Past drought incidents in the district made it as a literal drought-prone area, which becomes prominent through enlisting the district in Drought Prone Area Programme (DPAP) onwards 1973
Third phase (2000–present)	Contemporary hydroelectric power development	Although the third phase primarily focused on hydropower generation, various other water-aided projects persisted in the region. During this phase, in addition to a series of irrigation development projects, hydroelectric power schemes like TPSP and PPSP, which were associated with local aboriginal protests, were implemented

moving from the colonial to the modern era showing the resource development policies and tensions arising with particular attention given to socio-political and ecological issues.

The *first phase* of ecological transformation in the district began in the early 1870s when the colonial administration aimed to support agricultural development in the deep forest regions of

the Chotonagpur plateau, including Purulia district (known as Manbhum during British rule). This agricultural intervention resulted in extensive deforestation in the region. Concurrently, there was a high demand for wood to construct railway sleepers, which further accelerated deforestation in the untamed aboriginal forest areas to enhance regional connectivity.

The ecological fragility in the region intensified due to this rapid deforestation over several decades. This led to increased evapotranspiration with rising temperatures, reduced soil moisture content, and extensive land degradation through rapid soil erosion. During this phase, local-scale irrigation heavily relied on ponds (small human-made waterbody) (Mahato, 2010), which were also impacted by siltation caused by eroded materials due to severe soil erosion. All these factors became more sadistic with the late onset of monsoon in 1985–1986 ending up with severe drought situation in 1897. A study by Vinita Damodaran reveals that the regional ecological destruction put the region in a vulnerable situation where trivial oscillation in monsoonal rainfall caused successive droughts in 1896–97, 1899–1900, and 1907 (Damodaran, 2002, 2006). The historical document of H. H. Haines reveals, "The forest flora of Chotonagpur region was totally transformed from dense forest cover to a state of scrub" (Haines, 1910).

The *second phase* did not see events that had direct political effects, but successive drought years tagged the district as one of the drought-prone portions in the state and country. This narrative putting the district under the Drought Prone Area Programme (DPAP) schemes from 1973 onwards. However, debates are still ongoing about how and why the district is categorized as one of the dry arid or semiarid regions, as the average annual rainfall is about 1400 mm. On the other hand, after the postcolonial period, there were a series of drought years; 1976, 1979, 1980, 1982, 1983, 1985, 2001, 2003, and 2010 (GoWB, 2012; Palchaudhuri & Biswas, 2013), marking the district as a literal drought region. The narrative of the district as drought prone and sometimes considered as dry arid or semiarid without applying comprehensive scientific assessment provides a barricade on the vision among the planners. This might be the reason some of the government official documents considered the district as an arid region in the state. However, the exceptional regional development of the surrounding regions of Purulia districts, that is, Ranchi, Bokaro, and Giridih, which have the same geographical and climatic characteristics, makes us question the effectiveness of the ongoing developmental policies in Purulia.

The *third phase* or the second stage of the postcolonial phase was marked by serious political tensions including tribal rebellion movements (between the years 2000 and 2008) against government authority, especially in Bagmundi and Bandwan block. This is due to the long-term deprivation of indigenous communities in the region (Banerjee, 2010; Mukherjee, 2016). However, after this politically unstable situation, the district experienced a series of development projects from year 2010 to the present. Among the development projects, the prime aim was to strengthen the primary economic base of the district through the advancement of irrigational projects, that is, "Ushar Mukti" (drought alleviation) and "MatirSristi" (Barren Land Rejuvenation) contribute to the commendable reduction of wasteland areas. Simultaneously, initiatives like "Jal Dhoro Jal Bhoro" (Preserve Water, Reserve Water) and "Jalatirtha" (Water Conservation) actively fostered the augmentation of water infrastructures (Kar et al., 2023). Within the set of developmental strategies, aboriginal conflict was initiated due to ecological destruction caused by the construction of the PPSP hydroelectric power project that was started in 2002 and concluded in 2007. The aboriginal protest abounded in the portion of Bagmundi hill region, against the ecological destruction of initiating the water reservoirs, that is, upper dam and lower dam. Hence, Turga protest is not a sudden ecological movement, rather the fuel of the protest was inbuilt since the inception of PPSP. The above-mentioned third phase through

hydroelectric power generation and allied ecological conflict has been put forward in the upcoming sections of the article.

3.2 | Data collection methods

The qualitative data collection was carried out in two steps; firstly, a literature review of scholarly articles and secondly through FGD and individual qualitative interviews (IQIs). These methods are particularly suitable to help create an in-depth understanding of lived local community experiences (Adedoyin, 2020). Here, they help us to understand the grounded reality and experiences of the events as well as people's attitudes and experiences (Buckley & Waring, 2013). Here, it allows us to uncover the underlying reasons for people's behavior and attitudes that are directly and indirectly associated with hydroelectric power generation in the study area.

The initial motivation of this research was created as the researcher observed the ongoing protests of the village commoners in the Bagmundi hill area against TPSP, protests that have moved from local to state-level attention (Hazari & Bhui, 2021). Therefore, the background of the strengths of qualitative data collection, helps us to understand the in-depth issues experienced by villagers associated with TPSP. The qualitative research method was carried out in two separate interviews, that is, IQIs and FGD. Both types of qualitative methods of data collection primarily allow us to identify the range of narratives and experiences across the villagers as well as to identify shared narratives among the village common (Hennink et al., 2020) and government officials to understand their experiences and outline of TPSP linked with PPSP too (see Table 2). The IQI among the government officials was carried out to understand a small spectrum of notions with deep individual insight against the hydroelectric power project in the

TABLE 2 Overview of the data collection method.

	Data collection		Sample	Aim	Sample size
Qualitative research method	IQI		Government officials	Understanding the project profile	21 respondents from various departments, that is, Purulia Zila Parishad, District Planning Committee, BDOs, and Village Panchayets
	FGD	Mini FGD	Environmental activists	Understanding the key issues allied with the hydroelectric project in the site	3 activists from each of the villages or 3 individuals * 8 villages = 24 activists
		Single FGD	Village respondents	Understanding the perspectives of village commons in multiple aspects, that is, displacements, deforestation, and man–animal conflicts, against the hydroelectric project that is, TPSP	1 village * 12 participants = 12 participants * 8 villages = 96 respondents (between the age group of 20 to 59) *Total respondents (N) = 141*

Bagmundi area, which the FGD was carried out among the local individuals of surrounding villages to TPSP and PPSP to evacuate large range of opinions against the issued associated with above-mentioned hydroelectric power projects in the region.

3.2.1 | On-site visits

Two back-to-back on-site visits were carried out in the first pilot field visit we carried out in-depth interviews with the block development officer (BDO) and environmental activists from Ranga Village in Bagmundi block. The primary field visit was advantageous to design round two data collection, a larger investigation including both IQI and FGD methods. The reason for conducting FGD for the data collection is that this type of data provides an accurate portrayal of the experiences and dynamics between the participants (Nyumba et al., 2018), as the group dynamic allows the participants to build on one another's responses and generates ideas, which might not be possible of individual interviews.

IQI

The IQI was carried out with the government officials including panchayet members to understand their perceptions of the project's details, aim, and events related to the project. The main reason TPSP is not fully accomplished is due to the local protests. This motivated us to obtain the project-related document of the proposed TPSP from the government officials and departments including. Purulia Zila Parishad, district magistrate, members of the district planning committee, BDO of Bagmundi block, and apex members of different village Panchayats for gathering the project profile of TPSP. The IQI also acted as the foundation of Round 2 FGD, and from the village Panchayats, we got to know the names of the villages that protested against TPSP and that have previously been affected by ongoing PPSP.

FGD

The cultural and socioeconomic homogeneity among the adjacent villages of TPSP and PPSP make FGD suitable as a data collection method (Seamon & Gill, 2016; Van Gent et al., 2019). Hence, we first took the consent of the village community for their participation in group discussions seeking to identify different issues associated with hydroelectric power projects in the region (Nyumba et al., 2018). To get access to participants from the village commons, the local activist associated with the TPSP movement, locally known as "Save Environment and Save the Indigenous Society" ("Prakriti Bachao and Adivasi Bachao"), acted as a mediator. In the first stage of FGD, we conducted the FGD (Mini FDG) with a total of 24 local activists (three activists from each village) who are the leading individuals of the above-mentioned movement. We solely targeted the leaders of the local activists who are primarily from the Santal tribal community, due to their small numbers and to get the permit for approaching the village commons. The Mini FDG was meant to utilize the small latent pool to accrue insight into the key issues associated with the hydroelectric power project from individuals with elevated levels of expertise (Cortini et al., 2019; Winlow et al., 2017). The second level of interactive discussion was carried out using the classical form of Single FGD, one group in one place with participants from one place. For that, we carried out focus groups in a total of eight villages which are close to the proposed TPSP and had experienced adverse ecological impact of previous ongoing PPSP. In each of the villages, we carried out one FGD group of 12 participants (including male and female) between the age group of 20 to 59 from each village (8 villages * 12 participants = 96

TABLE 3 Village details and implication of hydroelectric power projects.

Sl No.	Name of the villages	Gram Panchayet (GP)	Characteristics of the village	Linked with hydroelectric power project
1	Baruajara	Ajodhya GP	Small tribal village with population of less than 200 and 27 household. Apart from small-scale marginal farming, the working-age population are reliant on the nearby Balarampur town (about 35 km away).	Baruajara village situated in the northern portion of PPSP project site received the adverse effect due to the conversion of Bandu water channel.
2	Dulgubera	Bagmundi GP	About 80% of the inhabitants of the village is schedule tribe (ST) community. Most of the working-age population are marginal worker (with less than 6 months of work).	The setup of ongoing PPSP directly putting the adverse impact to Dulgubera since it is very close from the project site. The total 150 member of *Baruawajara-Badhghutu-Dulgubera* Gram Sabha was initiated the TPSP boycott movement.
3	Gosaidi	Bagmundi GP	Out of total 39 household in the village 32 households come under ST category which is more than 87% of total population.	Gosaidi is one of the closest villages of TPSP site. This village has a long history of drinking water crisis that becomes more prominent after the diversion of small natural water channels, that is, Turga falls.
4	Ranga	Ajodhya GP	This medium size village constitutes more than 98% of total population as ST.	*Ranga-Barelhor* Gram Sabha is one of the largest Gram Sabha in Bagmundi block with 560 members, initiates the "Save Green Save Dream" movement after the massive deforestation (before receiving forest clearance for PPSP) in village surrounding.
5	Barria	Bagmundi GP	This one of the largest villages in Bagmundi block having small proportion of ST population (<20) compared with other villages in the sampling. About 30% of total working-age population come under main and marginal worker.	Barria has not initiate any such significant movement against the inception of proposed TPSP and Operational PPSP but based on the village survey the location of this large village (between the upper and lower dam of PPSP) arise some geophysical risk factor in long run.

(Continues)

TABLE 3 (Continued)

Sl No.	Name of the villages	Gram Panchayet (GP)	Characteristics of the village	Linked with hydroelectric power project
6	Hatinada	Ajodhya GP	Hatinada is a 100% ST dominated village where more than 70% of the working-age population are engage in agriculture.	The village communities continue their protest the operational PPSP and proposed TPSP due to not securing job opportunities which was promised by the government official long back before the inception of the operational PPSP.
7	Bhunighra	Ajodhya GP	About 99% of the village residents are ST community, where about 37% of working-age population are engage in primary activities mainly.	The residence in Bhunighra village have submitted the petition to the District Magistrate office for stopping the construction of water reservoir for TPSP as it causes serious ecological destruction through deforestation.
8	Ajodhya	Ajodhya GP	Ajodhya is a medium size one of the oldest villages in the region where 79% village inhabitants are ST category.	This village have shown the initial protest the ecological destruction by PPSP. At present the communities carrying their protest against TPSP too.

respondents). In this regard, we formed mixed-gender (male–female) groups to facilitate group dynamics and gather perspectives on issues related to PPSP. Table 2 shows the breakdown of the methodology followed in conducting the field survey, while Table 3 represents the details of the survey villages. Based on the two levels of FGD we framed the primary issues into six major categories, that is, human displacement, deforestation, hazards (flood and drought), water scarcity through change in river course and dying up of springs, socio-cultural issues, and lastly, encroaching animal habitat that results into human–animal conflict. These above-mentioned issues are further described through the standpoint of PE to understand the holistic perspective of water-aided policy in the region.

4 | FINDINGS

The findings of this study, detailed in the subsequent sections, illuminate the complex ecological and socio-political conflicts surrounding the Turga Pumped Storage Hydroelectric Project in Purulia, India. Through the lens of PE, this examination reveals the intricate interplay between governmental hydroelectric initiatives and the profound environmental and social challenges encountered by the local indigenous communities.

4.1 | Turga Pumped Storage Hydroelectric Project: Context and background

India's pumped storage schemes are mostly situated in plateaus and hilly portions and make use of two storage systems (Elavarasan et al., 2020), an upper system and a lower system that have a vertical difference. Between the two systems, the powerhouse is being located and built to house the turbine producing the energy, (Das et al., 2021; Hunt et al., 2020). This mechanism is quite common in a hydroelectric power system, that is, Lugu Pahar Pumped Storage Project (6×250 MW) in Jharkhand state and Sharavathy Pumped Storage Project (8×250 MW) in Karnataka (Tripathi & Sumana, 2022). Considering the geo-lithological aspect, Bagmundi hill region is the most suitable site to construct a water reservoir for hydroelectric power generation; as a result, projects like PPSP and TPSP are implemented in that part of the district.

The TPSP, nestled in the Ajodhya hill portion under Bagmundi block, has a historical backdrop dating back to the early 1980s. Initiated by the Central Electricity Authority (CEA) in collaboration with the GoWB, the PPSP aimed to harness the hydroelectric potential of the region. Four streams—Kistobazar, Turga, Kathlajal, and Bandu—were initially considered for power generation (Chakrabarty & Chatterjee, 2010).

The project that materialized from this vision was the Kistobazar Nala Pumped Storage Scheme on Bamni River at Ajodhya hill portion in Bagmundi block, which is now known as PPSP, a 900 MW powerhouse completed in 2008 with financial support from JICA in Japan. The PPSP is a closed loop power generating system with two different dam/storage systems, that is, upper dam PPSP (see Figure A1) and lower dam PPSP (see Figure A2). The PPSP received environmental clearance in 2002, with claims of minimal negative impact on the natural environment. The construction area declared out of human habitat was coupled with afforestation plans in non-timber areas. The project promised an erosion prevention dam, afforestation initiatives, and small water bodies catering to the drinking needs of wildlife. The TPSP on Turga River (see Figures A3 and A4) at Ajodhya hill portion in Bagmundi block after the inception of PPSP (see Table 4) sets out with several key advantages. The following are the key advantages of proposed TPSP-

a. eco-friendliness with significant reduction of greenhouse gas emission
b. quick controlling system of turbine
c. improvising grid effectiveness
d. process of restoring the electric power

However, in addition to some inbuilt difficulties with this technology like energy loss during pumping, hurdles to find a proper site, large land acquisition, and high initial costs, a group of academic studies have revealed severe environmental implications associated with such structures through analyzing the impact of TPSP. Examples from these studies include findings showing rapid deforestation within the project site, reducing dense natural vegetation from 93.8 to 85 km^2 between 1999 and 2004, which raised concerns. Approximately 3.5 lakh trees were felled over 8 km of land, incurring a habitat loss cost for forest animals estimated at 10 million rupees annually, with the total cost of deforestation reaching around 48 million rupees. Environmental degradation triggered obligations from the local tribal community (Chakrabarty & Chatterjee, 2010). Despite the environmental drawbacks and unsustainable livelihoods caused by PPSP, the approval of a similar project, the TPSP, carries a similar adverse impact on the ecology of the Ajodhya hill area.

TABLE 4 Salient project features of TPSP.

Sl No.	Project features			Details
1	Purpose			Envisages utilization of hydro potentiality
2	Location	Site		Ajodhya hilly portion of Bagmundi block
		Coordinates		23°12″47″ N and 86°04″20″ E
3	Construction period			63 months
4	Total project cost			4523 lakhs
5	Total land requirement			292.0 ha
3	Type of pump storage			The pumped storage scheme is a close-loop system
4	Number of dams			2 dams are being proposed to construct, that is, upper and lower dam (like previous operational PPSP)
5	Source of river water			Across Turga Nala, a tributary of Subarnarekha River
6	Stabilization			Crushed material, cement, rubble, and so forth
7	Operational pattern			The project is deemed to be operational on daily basis
8	Catchment area			4.37 km^2
9	Geo-climatic and physical features of the site	Climate of the project site		Dry sub-humid
10		Land use and land cover		Mostly natural vegetation (32%), agricultural land (29%), scrub (13%), and barren land (26%)
11		Soil		
12		Water quality	pH level	Ranged from 7.1 to 8.4
			BOD level	Absence of organic pollution loading
			DO level	Ranged from 5.2 to 7.23 mg/l
			TDS level	87.13 to 109.63 mg/L in post monsoon 58.7 to 69.4 mg/L in summer 48 to 54 mg/L in monsoon
13		Air quality		The absence of industries, low vehicular traffic, and low population density can be attributed for good ambient air quality in the project area
14		Vegetation		Dry deciduous forest

Source: Draft report of JICA (2016).

These ecological threats have been met with strong protests, especially from the aboriginal communities, as their traditional livelihood dependent on local resources. As such, their lives are more affected by threats to forests, streams, and ancestral land, which are to be occupied for the sake of the proposed TPSP. The mass protest was led by Santal tribes in the surrounding villages of the proposed site of TPSP. Keeping this aspect under consideration, in 2019, the Kolkata (Calcutta) High Court's judgment questioned the land acquisition for TPSP, citing violations of the 2006 Forest Right Act due to the absence of proper written consent from local communities and Panchayats for forest clearance.

The West Bengal government appealed against the order in 2019, successfully arguing the project's ability to generate regular and temporary employment. However, PPSP and TPSP seemed disconnected from addressing electricity consumption patterns. The peak demand, typically from evening till midnight, experienced only a 0.3% shortfall in 2008, equivalent to 35 MW. The proposed 900–1000 MW from projects like PPSP and TPSP appeared disproportionately large compared to needs, sparking questions about the necessity of constructing such large reservoirs. Contrary to their claimed objectives, these projects seemed impractical for addressing electricity needs. Furthermore, more sustainable sources like solar power or wind energy, which entail less environmental impact, could efficiently manage the shortfall.

The fundamental question arises: Where does the electricity generated by these projects go? The demand from nearby industrial towns, such as Ranchi and Arambag, where a substantial power shortfall does exist, signifies that PPSP and TPSP function as colossal batteries. They store water during periods of low demand and release it downhill through turbines when demand is high, meeting peak requirements. Importantly, it should be clarified that the electricity generated by these projects is not directed towards domestic use but rather industry. In contrast to conventional hydroelectric projects that provide electricity to households, PPSP and TPSP act as strategic reservoirs catering to industrial demands.

This scenario has sparked protests from the 36 villages of Bagmundi block, culminating in the formation of the "Prakriti Banchao Adivasi Bachao Mancha" (*Save Nature and Save the Indigenous People*) (see Appendix: Figures A5 and A6). Environmental activists and local tribal groups, united under this banner, express concerns about human settlement displacement, deforestation, water resource shortages, human–nature conflicts, and cultural and religious issues associated with pumped water storage. The local tribal environmental activists have become vocal advocates highlighting these specific issues and challenging the sustainability of such projects in the Bagmundi hill area. The dichotomy between the intended benefits and actual environmental consequences of the Turga Pumped Storage Hydroelectric Project becomes more apparent when scrutinizing the electricity distribution dynamics. Rather than catering to the essential needs of local communities, the project aligns itself with the demands of industrial towns, revealing a skewed prioritization that intensifies local protests.

This incongruence is underscored by the unique design of the project, deviating from conventional hydroelectric setups. Unlike standard hydroelectric projects with a single dam utilizing the natural course of a river, TPSP involves an upper dam for water storage and a lower dam for water release. Turbines installed in tunnels generate electricity during the water's descent. The water from the lower dam is then pumped back to the upper dam, incurring additional energy expenditure against gravity. The result is a project that consumes more energy—up to 25% more—than it produces, making its claim to contribute positively to the region's power supply dubious. On the other hand, as per the Scheduled Tribes Recognition of Rights Act, 2006, those living in surrounding forest areas have rights over forest land. Keeping this act under consideration, more than 50% consent is required from Gram Sabha's members, for constructing any project in the forest land (Sahu, 2021), which is being violated during the first phase of TPSP. Out of a total of 910 members of three different Gram Sabha (Ranga-Barelhor Gram Sabha, Baruawajara-Badhghutu-Dulgubera Gram Sabha, and Tarpania Gram Sabha), government officials took 20 consents for land acquisition. The land acquisition is not only uprooting the villages from the planned project site but also affects socio-cultural integrity by demolishing traditional sites of worship (rather than), destruction of medicinal plants with annihilation of local flora, and encroaching animal habitat. The movement slurs the observable externalities of development carried out on meticulous economic principles and reveals the

injustice and shaky picture of developmental policies. In the previous section, we discussed the salient features of TPSP and the nature of its electric supply to the surrounding industrial cities.

Furthermore, the projects, namely, PPSP and TPSP, have triggered the formation of "Prakriti Banchao Adivasi Bachao Mancha" (Save Nature and Save the Indigenous People), a collective initiative uniting environmental activists and local tribal communities. This alliance aims to amplify the voices opposing the projects due to concerns related to deforestation, water resource scarcity, conflicts between man and nature, and the erosion of cultural and religious practices integral to the tribal communities.

The judicial discourse surrounding TPSP adds another layer to the complexity. The initial rejection of the project by the Calcutta High Court in 2019, citing violations of the Forest Rights Act, was later overturned in favor of the West Bengal government. This legal saga raises questions about the adequacy of legal frameworks in safeguarding environmental and indigenous rights, exposing potential gaps that need attention. In the backdrop of these intricacies, the TPSP project's approval in 2017 despite protests from Santal tribes underscores the broader challenge of balancing energy development with environmental preservation and social justice. The clash between the purported benefits, such as employment generation, and the tangible adverse effects on local ecosystems and communities epitomizes the complexities inherent in large-scale energy projects. As the discourse surrounding TPSP and its predecessor PPSP unfolds, the need for a comprehensive evaluation encompassing environmental impact, community welfare, and adherence to legal norms becomes increasingly imperative. The trajectory of these hydroelectric projects serves as a microcosm of the broader debate on sustainable development, highlighting the delicate balance required to navigate the intersecting realms of energy, environment, and social equity.

4.2 | Analysis of TPSP through political ecology

Purulia district and the entire Chotonagpur plateau region have a long history of political economic interests linked with different economic inventions. The TPSP provides a strong foundation to analyze the close association of developmental projects and their connection with local livelihood connected to regional ecology, especially for underdeveloped regions. The following sets out key themes identified in the qualitative data. After analyzing a set of issues associated with TPSP in the Ajodhya hill area of Bagmundi block in Purulia district, we set out the arguments associated with the projects which can be relevant for different parts of the Global South experiencing a similar set of issues. These themes include the following.

- Human displacement

The development project-related displacement was argued to fall into two different categories by participants. One is direct displacement, where the construction site leads to human displacement, and the other is indirect displacement, where the construction leads to encroaching on the basic amenities for humans, leading to migration of human settlement to a better location. Both PPSP and TPSP led to several villages' displacement because of road widening. On the other hand, deforestation and the destruction of cattle grazing grounds led to the shifting of Barria villagers from the higher altitude to the lower segment of Ajodhya hill. Earlier, it was situated in the same area where the upper dam of PPSP is situated at present.

> We did not receive proper compensation to construct our houses in the new site and we are also missing our ancestral land which was in the previous site.
>
> (Male respondent at Barria village, 54 years old)

We have seen development projects and human displacement have been interrelated since the inception of the Hirakund dam in 1948 not only in the case of Turga in Bagmundi but also in India more generally (Nayak, 2021). Dams for irrigation and hydroelectric power are the primary causes of forced displacement. About 50 million families in India have been displaced in the last 50 years (Patankar & Phadke, 2020). More specifically, in West Bengal, about 60,000 people were displaced due to the construction of the Farakka Super Thermal Power Plant (Debnath, 2021). If we consider the communities that are the most due to the development project, we are the marginalized asset less indigenous communities, which is approximately 40% of the total displaced population (Negi & Azeez, 2022).

- Deforestation

Deforestation was an apparent environmental damage witnessed during the inception of TPSP, but now, during the Turga project, several forest patches are axed. Based on the Forest Act 2006, tree felling can only be possible for a project after the second phase of forest clearance approval, and at present, due to the indigenous movement, the government still needs clearance for the Turga project. According to the EIA report of TPSP, about 292 ha of forest land and rural forest areas will be destroyed (WBPCB, 2019) (see Figure A7). Apart from the ecological benefits, forest resources are the leading economic support in the entire Ajodhya hill tribal community (Basu, 2020, 2021).

> We used to collect Sal (*Shorea Robusta*) tree leaves and make 10–12-inch Thali (plate), with it, which we used to sell at nearby Bagmundi or sometimes Balarampur market. The selling cost of each of the plates is 1–2 rupees in the market. The massive deforestation during TPSP leads to a decrease of Sal tree too.
>
> (Female respondent, 36 years old)

> We are not against the government policy, but we want our rights to be secured, as we are completely dependent on the nature, especially forest, hills and rivers. We cannot afford those to be destroyed. Even tourists come to Ajodhya hill to enjoy the nature.
>
> (Female respondent, 43 years old)

Apart from the hydroelectric power project, the Global South megaprojects are often unparallel with ecological balance. For example, in Indonesia, the proposed infrastratural development, especially road network causes serious negative implicatios on "Pamali forests", that undergoes through forest protection movement by Arfak community (Keiluhu, 2013). As per the data given by the New York Declaration on Forests (NYDF), about 40% of road networks have increased from 2000 till now in the tropical forest area (Hoang & Kanemoto, 2021),

which includes the Indonesian-Papua and Congo basins because these developing countries are struggling to get back from the fallout of Covid-19.

- Natural hazard/flood

Purulia district does not experience severe flood events when compared with other districts, but the district does experience flash floods (locally known as "Harpa Ban"). The yearly small-scale flash flood is primarily witnessed in the upper catchment of the Darakeshwer river basin (Chakraborty & Chakraborty, 2021). However, considering the human-made flood, the 1992 year is important to note that a serious flood took place due to uncontrolled water discharge in Kangsabati dam during the beginning of the Monsoon session (mid-June month) (Dhar & Mazumdar, 2009). Based on the discussion with the community, the traditional historical knowledge of the local aboriginal community shows their concern against future flood risk in the villages like Barria and Baruajara village due to their closeness to PPSP and TPSP and uncontrolled deforestation.

> The way deforestration is being taking place in the region; in long run we may face soem of the environmental calamities. Low soil compaction may lead to land slide after any heavy rainfall even, which arise risk factor especially for the villages situated along the hill slope i.e., Hatinada village.
>
> (Male respondent, 27 years old)

- Changing the river course

Because the PPSP and TPSP are both close-loop projects, there is a high chance of changing the river course due to deforestation and land use change. For example, the Bamni River in the region is no longer visible below the lower dam of PPSP (Ruj et al., 2022), and the construction of TPSP may act as an integer for the disappearance of the Turga River.

> The main strength of water sources in entire Ajodhya region is its Jhor (spring water), which somehow reducing in number due to the shifting land use.
>
> (Male respondent, 41 years old)

In some instances, the river morphology changes due to the construction of dams, for example, in the Alaknanda River basin, the course of sediment flow changes due to the construction of dams and reservoirs. On the other hand, the construction of the Tehri dam on the upper Gunga basin stopped the sediment flow from upstream and prevented it from reaching downstream (Chauniyal et al., 2018).

- Water crisis

Without human interference, Purulia district has a long history of regional drought and water scarcity. Therefore, local communities depend on mono-crop farming (primarily Paddy), where irrigational water shares about 23% (87,816 ha) of total agricultural land. Even in

Bagmundi block, about 72% of irrigational water comes from Canal Rivers (Government of West Bengal, 2014). Therefore, the disappearance of the river generates low crop yield. Due to the disappearance of the Bamni River, women have been affected the most, as they must travel 5–6 km now for just drinking water, highlighting the severe negative impact on local communities.

> During summer sometimes, we are travelling a long distance to fetch water, in this condition if we lost Turga river, then some of the villages may not get drinking water during summer even as in other session.
>
> (Female respondent, 36 years old)

According to the government document, 27 villages farmed on the banks of the Turga River because Adivasis manually drew water to their field. Hence, they need to be located close to the river.

- Socio-cultural clash

Because the Indigenous communities are close to nature and natural entities for their economy and cultural traits, the destruction of nature leads to the creation of barricades on Indigenous cultural identity. The Marang Buru hill in the region, which is regarded as the goddess of Santal Adivasis (Biswas & Bain, 2022), will completely submerge due to the destruction of the forest land. The same thing is being done through mining activities in East Hazaribagh district of Jharkhand. The mining and stone quarrying directly cleared the sacred grooves of the Santals and Bhumij tribes of the area (Mhaiske et al., 2016). The sacred grooves are the finest example of nature conservation through the traditional practice of going head-to-head.

> The project site of TPSP plan includes destruction of a hillock called Marangburu, which is worshipped by the tribals. The Ajodhya hill too has a "pious" Sutantandi area, which the nearby community considers their social court. Why destroy these social and religion identities of us in the name of development?
>
> (Male respondent, 46 years old)

- Human–nature conflict

During the earlier project on the Bamni River, the forest cleared the most was a vital shelter for elephants, and the habitat of wolves, bears, hyenas, and many animals of Schedule 1 have been displaced because of deforestation. The elephants have now shifted from the Bamni to the Turga forest. However, the dense forest patch of Ajodhya hill serves as an elephant corridor known as the "Dalma Elephant Corridor" (Abhijitha et al., 2021), where elephants migrate from the Dalma range in the Jharkhand state. The ongoing deforestation during the phase of forest clearance in the Turga forest has increased human–elephant conflict, which may increase further from further deforestation. In some instances, human economic activity also leads to human–animal conflict, where the encroachment of natural animal habitat is caused by increasing human cultivation fields through deforestation (Chakraborty & Nabanita, 2021).

This leads to the Bengal Deltic region of "Sundarban," where human–tiger conflicts are common. About 25% of human–tiger conflict events are recorded in this region (Chatterjee, 2023). The Sundarbans region mentioned above is ecologically sensitive, where concentration on human settlement is a threat, but this is how ordinary people sustain themselves. On the other hand, in the case of Bagmundi, the hilly area human–animal conflict does not exist from the past; rather, it is being welcomed through development projects like PPSP and TPSP.

> Due to rapid rate of deforestration by both TPSP and PPSP the natural forest habitat especially for the elephants gets shirked, which causes life threatening man-elephant face off. Village commons from Kurupahar and Dungridi experienced life-threatening situation when a herd of elephant entered to the villages.
>
> (Male respondent, 55 years old)

- Lack of job opportunities and marginalization

Among the 20 blocks in the district, villages in upper Bagmundi are grappling with challenges to sustain their livelihoods. Limited cropland, hilly terrain, and scarce water resources are pushing these communities into uncertainty. Consequently, aboriginal villages in the upper Bagmundi block are increasingly reliant on forest resources. Despite government promises to provide job opportunities in hydroelectric power project sites, which remain unfulfilled to date, deforestation continues unabated. This is occurring without securing the livelihoods of the local communities who depend on ecologically rich regions like Bamni in the upper Bagmundi block.

> We were promised jobs and free electricity when PPSP was started, but the electricity was diverted to the surrounding industrial areas i.e., Arambag and Ranchi. Only temporary jobs were provided to us.
>
> (Male respondent from Hatinada village, age 57 years)

> The ecological rich area i.e., Bamni has already been destroyed due to PPSP and now TPSP acts as the final booster for ecological damage. Our crops are getting affected due to water scarcity.
>
> (Male respondent from Ajodhya village, age 59 years)

4.3 | Policy and governance

The realization and operational outcomes of the Turga Hydroelectric Power Project are profoundly influenced by the overarching government policies and regulatory frameworks that govern energy projects in India. These frameworks serve as the foundation on which the project's decisions, environmental considerations, and community engagements are built, shaping the overall trajectory and consequences of the project. To illustrate the impact of policies and governance, we can draw comparisons with similar cases in India and other countries.

4.3.1 | Legal framework and environmental impact assessment (EIA)

The government's role in establishing a legal framework is pivotal, particularly in policies related to EIA. For instance, in India, the Forest Rights Act aims to protect the rights of indigenous communities, but its implementation often faces challenges. Comparatively, in Brazil, the Forest Code regulates land use and environmental protection. However, controversies around its enforcement highlight global challenges in balancing development and environmental conservation. Considering TPSP, the executive summary for EIA study represents a negligible threat to local ecology, that is, no rare and endangered species are reported from the project area, the construction site has low tree density (3–16 trees/hectare), the area does not fall in the migratory routes of animals (WBPCB, 2019). Considering the draft report of JICA in 2018, the inception of TPSP is not associated with any off-putting socio-cultural and economic consequences on the surrounding villages of the construction site. In this regard out of the total required land, 14.761 ha of private land may be utilized as borrow areas during the construction period if the quantity and quality of soil collected in forest land is not sufficient. Among 14.761 ha of private land, two plots are in Hathinada (total of 5.945 ha), and another two are in Gosaidi (1.82 ha.). The rest 7 ha[1] of private land is planned in Kudna (JICA, 2018). In this instance neglecting the required consent from Gram Sabha members, before implementing the first stage of the project that undergoes with mass deforestrationputting questions on the EIA and social impact assessment (SIA) reports on behalf of the above-mentioned organizations. One of the Gram Sabha members and activists of the "Prakriti Bachao and Adivasi Bachao" movement, Mr. Murmu, stated, "The SIA does not consider the existence of a series of JaherThans (traditional forest sites of worship nature god), which has a deep-rooted connection with our tribal existence." Under the garb of claiming to save nature and hidden behind the slogan of "Save Green Save Dream" is being carried forward by the member of Gram Sabha which is quite like aboriginal local traditional construction from the British raj "Aboha raj etejana, maharani Raj Tundujana" (If you want to know about our governance you have to know Maharani Raj Tundu) (Gupta, 2015). The Forest Rights Act mandates consent from local communities for projects affecting their land. However, cases like the Turga project reveal gaps in implementation, where communities may not have meaningful participation. This is a common scenario in Global South development policies, that is, the Forest Code in Brazil has faced criticism for its impact on indigenous lands (Junior et al., 2020). The clash between development interests and environmental protection is a global issue. The prime flaw of EIA and SIA of such developmental projects that are operational in Indigenous dominated region is the prolonged persisting gap of visualization, where the level of impact assessment is different from aboriginal traditional society to modern civil society.

4.3.2 | Land acquisition policies

Land acquisition policies governing projects like Turga may not adequately address the concerns of displaced communities, leading to challenges in rehabilitation and fair compensation. Comparative cases, such as the controversies around the Dakota Access Pipeline in the United States, underscore the global nature of such issues (Whyte, 2018). Land acquisition for industrial projects like Turga might result in displacement. The Land Acquisition Act attempts to provide compensation but disputes often arise. Another aspect of land acquisition which creates a conflict of interest is in the era of globalization land is always carried out as a symbol of

economic output generation, while the traditional aboriginal society still connects the landscape as a close compaction with cultural integrity. For example, the flood plain or lands close to the river (often known as "Bohal" locally) are positive gestures for aboriginal to civil society due to its high cropping yield, whereas a portion of upland (locally known as "Tnad") can be considered as waste to the civil society due to its low cropping yield; it can be considered as "Jaher Than" (aboriginal sacred place) for the aboriginal community. These different expressions of landscape put dissimilar notions to certain communities where a particular aim of a project may not match the different expectations of different communities too. The Dakota Access Pipeline faced significant opposition due to concerns about indigenous land and water resources (Proulx & Crane, 2020). This mirrors challenges in equitable compensation and addressing community concerns globally.

4.3.3 | Community participation

Regulatory frameworks might lack effective provisions for community participation, particularly among indigenous groups. The case of the Standing Rock protests the Dakota Access Pipeline in the United States is a noteworthy example of the challenges faced by communities seeking a voice in project decisions. Indigenous communities affected by projects like Turga may find limited opportunities for meaningful participation in decision-making processes, hindering their ability to negotiate fair terms. In the United States, the Standing Rock protests highlighted the struggle for Indigenous communities to be heard in decisions affecting their land and resources (Estes & Dhillon, 2019), emphasizing the need for improved community engagement globally. The notion of community participation is considered one of the most selective obvious aspects of regional sustainability that comes with a policy output (Hoppe & Miedema, 2020; Kiss et al., 2022; Pike et al., 2016). However, the in-ground application of this theoretical statement often creates an off-putting impact on the project aim, as in most of the cases the aboriginal communities are far beyond the modern technology which are frequently required for project implementation. As a result, the local aboriginal communities are sometimes engaging in daily labor at the project site which always has a particular tenure. Therefore, community engagement needs to be considered in a serious note, especially for the policies taking place in indigenous provinces.

In summary, while government policies and regulatory frameworks provide the foundational structure for energy projects like the Turga Hydroelectric Power Project, their implementation and efficacy in ensuring environmental protection, equitable benefits, and community participation are often contested. Robust and effective policy implementation, heightened community involvement, and more comprehensive environmental assessments are imperative to navigate these challenges and achieve a more sustainable and socially just outcome for all stakeholders involved in such projects. By examining similar cases globally, we gain insights into shared challenges and potential solutions that can inform policy improvements.

5 | DISCUSSIONS

The objective of this paper was to shed light on the intricate relationship between political conflict, economy, and ecology, by focusing on a hydroelectric power project. Development

initiatives often spark conflicts among communities over natural resource rights. Those safeguarding and relying on nature inherently claim a right to natural resources, and at the same, time the utility and use of natural resources for extensive development is often debated. The discussion about TPSP and PPSP underscores their potential benefits for local communities, particularly indigenous groups who have a strong connection to nature and stand to gain the most. Paradoxically, those reaping the rewards are often distant from the Ajodhya hill ecosystem, while the indigenous communities integrated with it for centuries bear the brunt of environmental destruction associated with these projects.

Beyond individual communities, the Purulia district, labeled as the backward portion of the state, has witnessed insurgencies and protests, primarily led by tribal societies against exclusion, underdevelopment, and power politics. In this context, TPSP and PPSP not only fail to initiate regional sustainable development but also cause resentment towards authorities. A central argument in PE emerges: Who bears the price for the negative consequences of development projects? This article shows that the burden falls on economically and politically less powerful marginal communities, potentially contributing to uneven growth in the developing world.

However, when considering the overall sustainability of the region, the negative consequences of development projects extend beyond the short term and impact every community. The disruption of natural ecology catalyzes climate change, with less affluent marginal communities becoming the soft targets paying the price for natural degradation. This parallels colonial land use, where destroying regional resources in one geophysical setup leads to wealth generation for a specific community elsewhere.

In the context of EIA and SIA for developmental projects, understanding different resource depletions and their indispensability to sustain local livelihood is crucial. Natural inputs not only support local livelihoods but also offer distinct ecosystem services that require valuation from economic and qualitative perspectives, including cultural traits, emotions, feelings, and ethnic identity. Moreover, the assessment of sustainable development projects should embrace a multidimensional, transdisciplinary perspective rather than a narrow, one-dimensional viewpoint. The incorporation of PE in understanding developmental projects enables us to analyze the complexity that is present in development scenarios, offering a set of questions to assess development projects helping us achieve robust, long-term sustainability, particularly in the Global South.

The ongoing debate surrounding the feasibility of simultaneous implementation of developmental projects and environmental protection warrants a concise examination. Delving into the core of this argument, a body of academic literature advocates for the adoption of traditional methods that are environmentally friendly and inherently sustainable. While traditional economic and developmental policies have the advantage of consuming fewer resources and causing less serious environmental damage, they present two significant drawbacks. First, traditional developmental strategies are not always applicable on a large scale. Second, the traditional practices do not consistently yield optimal revenue generation. The applicability of traditional measures for fulfilling the basic needs of specific aboriginal clans is evident, yet their suitability for regional growth remains a matter of debate.

Within the discourse of development policy literature, the role of the state is continually challenged, with a focus on prioritizing community engagement. However, this does not necessarily resolve the broader question of the actual theoretical framework of development. Examining hydroelectricity development projects like Turga introduces a series of unfolding

arguments that hold the potential to reshape the entire development framework. The primary arguments are that we need to critically assess and reconsider how we

a. define what is meant by development,
b. question development for whom, and
c. address the prolonged existence of a particular development project.

All three of these arguments are integral to the subject matter of PE, as one of its prime aspects involves understanding the multiple dimensions of development policy. Further, we have discussed the above-mentioned three arguments from the standpoint of PE by incorporating TPSP and PPSP as case studies:

a. What is meant by developmental policy?

The term "developmental policy" is a multifaceted concept that remains undefined in the discipline of PE (Förster et al., 2021). In the contemporary era, development is primarily carried out through capitalist progress (Wallerstein, 2023), associated with uncontrolled resource utilization (Baccini & Brunner, 2023), environmental degradation (Luo et al., 2023), and, more importantly, class conflicts (Arsel, 2023), particularly in the developing world. PE acknowledges this imbalanced nature of development, termed "Developmentality" (Orchard, 2021), where the exploitation of a specific class, wealth generation for another, and mistreatment of ecology are fundamental components (Swilling et al., 2022). Allocating wealth to a specific class not only creates a biased pathway of development but also depletes the wealth of a particular class of people. Simply put, in the PE domain, development is defined as the persistence of a duality of well-being, where one section of people struggles for basic needs, while another class, having fulfilled basic needs, strives to accrue an expanding list of requirements. The increasing basic needs for those who have already reached the basic needs standard led to more resource utilization, but the negative environmental consequences are not biased and affect all.

In the case of the Turga hydroelectricity power project, industrial areas adjacent to the Ajodhya hill area stand to benefit, while the aboriginal people pay the price through the depletion of forest and water resources. Villages in the Bagmundi block, listed as backward/underdeveloped, further face vulnerability as their wealth shifts through the depletion of the forest. From the perspective of PE, the development concept associated with certain policies in the Global South or especially in the Indian context can be summarized as a process of well-being for a target community through the existence of a struggle to access basic needs for another community.

a. For whom are the developmental policies designed?

Considering the aspect of "for whom the development policies are," based on the previous argument, we transition to the second argument—development for whom? The initial argument implies a distinct part of development where one segment of the population attains the ultimate standard of well-being. However, the outcome of developmental policies is not as straightforward, as it distributes into two segments: those receiving the benefits and those receiving less to nothing from the policy output. This necessitates the integration of associated aspects into how we define a successful policy implementation. These could include the price paid by the beneficiary community for the positive outcome from the development policy,

negotiations, or evacuations due to the development policy and compensation by the authority. In the context of TPSP and PPSP, beneficiaries often do not belong to the adjoining project site or districts, and the Indigenous communities from the project site predominantly bear the costs. This also brings into focus the land rights of the aboriginal community, closely intertwined with natural entities and their socioeconomic life. The evacuation of the local community due to deforestation for constructing the water reservoir is not in a small proportion, involving a total of 13 villages and forest animals directly affected by the ongoing TPSP. Based on the Westphalia Severity, natural resources are meant for the usage of wealth and development (Wenar, 2017), a perspective that is relatable and questionable concerning the "Human Capacity based Approach," which emphasizes the unique human capabilities with skills and intelligence to masquerade over resources (Dirth & Adams, 2019). In the contemporary Global South, not all human societies are equipped with power and privilege. For instance, aboriginal communities, though integral to the state, often keep themselves aloof from civil society and state judiciary, maintaining distinct social, cultural, and institutional traits. In the era of globalization, traditional societies persist in their unique identification. If state policy neglects the socioeconomic-cultural artifacts of traditional society, it mirrors colonial land use policy, where power regulates who will get what.

The major issue arises from why aboriginal communities consistently emerge as losers in hydroelectric development projects in Purulia and other parts of the globe. The prolonged integration of tribal societies in hill forest regions, like Ajodhya in Bagmundi block, establishes a symbiotic relationship with nature, encompassing vegetation and rivers. Aboriginal communities derive basic needs from forest resources. However, relying too heavily on natural substances can have a downside, as it may hinder the ability to effectively engage with modern technology and education. Given these conditions, the geographical and physical characteristics necessary for developing a hydroelectricity project are aligned with the geographical disposition of the Bagmundi hill region. Consequently, constructing a dam for hydroelectric power becomes essential to support the industrial sector within the state and across the country. However, this necessitates the evacuation of nature-dependent tribal people, highlighting the dichotomy between developing a hydropower project and respecting aboriginal land rights. While there are possibilities for the state to compensate aboriginal affected villages through monetary allocation, the viability of compensation remains a question. The cultural and religious coherence of the aboriginal community with the forest and water body is not possible to compensate through money, as these natural substances are closely linked with indigenous ancestors before the development of the project or even the birth of the Purulia district.

a. Are the development projects long term?

Moving on to the question of "to what extent the development projects are long term," the long-term prospects of development project outcomes rely on a set of explicit but interconnected factors like governance, local participation, and geophysical factors. The government sector is an individual entity, but for a comprehensive environmental policy, different departments like the Ministry of Water Resources, Ministry of Tribal Affairs, and Ministry of Forest Affairs could merge with one another to achieve a specific target. Likewise, the association of different ministries within the framework of governance and the association of different local communities with the ministry also affirm the prolonged existence of the policy outcome. The main flaws of developmental policies in the Global South are not considering community engagement in every stage of a development policy (Arocena et al., 2015) but rather considering

only the monitoring phase (Chu et al., 2016). The participation of the local community in every stage of the developmental policy not only provides buy-in and employability but also could reduce the burden of dependability of only the government officials. Moreover, engaging the community from the initial phase of any resource developmental project could create a higher level of community understanding and avoid tensions between local traditions and modern techniques. Therefore, apart from paying emphasis on the traditional knowledge and modern technologies separately, we better call for a hybrid decision-making tool for more sustainable policy outcomes by incorporating government officials and researchers with the traditional society (see Table 5). This hybrid process can be effective with the multiple associations of different players with their different roles, which needs to be undertaken from the beginning to the end of a selective project.

The water centric development projects and associated socio-political conflicts can be summarize through the concept of *hydrocapitalism*, which is the process of transforming water into a commodity subject to market dynamics (Pritchard, 2012). In the case of TPSP, the commodification of water taken place through unequal power dynamics; where the diversion of water resource for urban and industrial power generation reflects a significant shift in control

TABLE 5 Different level of developmental policy with the incorporation of hybrid decision-making tool.

Phases	Factors
Initiation	Sometimes, this is based on the requirement of the region in small scale. Even as, if the project has large scale or national level development, still it needs to the association of local community. As sometimes the choice of the project site may hamper the livelihood of the nearby commmunity.
	Awareness of the authority/ministry about the local and geophysical character of the project site.
	Site visit of the ministry/higher government official who are directly connected with the project and communication of the local community making them aware about the objective of the project.
Framing	Collective think-tank among the government technician and research scientist to understand the climatic variability, geophysical, and geology of the region.
	Combining the local participation to understand the local small-scale land use to verify with the mapping from government planning units.
	Calculating the EIA and SIA.
Implementing	This stage is associated with construction of structures for water reservoirs; therefore, before initiating the construction, the officials need to have Environmental Clearance Permit from the nodal authority, as well as sanction documentation from the village panchayet and Gram Sadans.
	Engagement of the local community for the constructional work will enhance the economic stability which will further mutually support for the monitoring phase.
Monitoring	The monitoring phase is the last stage where the scrutinizing to maintain the flow of the entire system needs to assess.
	Engaging local bodies to monitor the structures is the hustle free way to run the project in effective way.
	This also requires the monthly/quarterly/yearly meeting with the government officials' agents and local monitors.

from local commons to state and corporate actors. Hydrocapitalism aggravates these inequalities by converting communal water into a profit-driven asset, systematically marginalizing indigenous populations whose livelihoods are deeply tied up to such resource (Prieto, 2021). Although hydrocapitalism offers a valuable framework for deepening our insight of water centric socio-political conflicts, it will not be the primary focus of the article. The main objective is to conduct a political ecology analysis of the micro-level impacts on the indigenous communities as a result of TPSP, which necessitates a narrower scope. Nonetheless, acknowledging hydrocapitalism enriches the theoretical underpinnings of this discussion. Still, the socio-ecological and governance dynamics specific to this project- such as indigenous struggle arises through development projects - take precedence over a broader capitalist critique of water commodification.

To expand on the broader socio-political dynamics surrounding water-aided developmental projects, it is also important to briefly consider the concept of hydrocapitalism. Although not the primary focus of this study, this framework provides critical insight into the commodification and exploitation of water resources under neoliberal policies, which reinforce the unequal power structures already discussed in relation to the Turga Pumped Storage Hydroelectric Project (TPSP). Hydrocapitalism, defined as the process of transforming water into a commodity subject to market dynamics (Pritchard, 2012), emerges as an underexplored but essential dimension in the discourse surrounding water-driven development projects like the TPSP. The commodification of water, often facilitated by neoliberal agendas, reshapes local water governance and access, typically privileging urban and industrial users over rural and indigenous communities (Moore, 2021). In the context of the TPSP, the diversion of water resources for industrial power generation reflects a significant shift in control from local commons to state and corporate actors, further exacerbating pre-existing socio-political inequities (Ahlers, 2010). Hydrocapitalism aggravates these inequalities by converting communal water into a profit-driven asset, systematically marginalizing indigenous populations whose livelihoods are deeply tied to such resources (Roberts, 2008; Prieto, 2021).

Pritchard (2012) further argues that hydrocapitalism is closely intertwined with its colonial antecedent—hydroimperialism. This connection emphasizes how water management in 19th- and 20th-century France and its colonies exemplified both "hydropower" forms as fundamental instruments of colonial and neocolonial control. The historical processes shaping French hydro-imperialism illustrate the complex interdependencies between environmental management, science, technology, and political power—dynamics that continue to influence modern water governance globally. While hydrocapitalism offers a valuable framework for deepening our understanding of water-based socio-political conflicts, it will not be the primary focus of this article. The main objective is to conduct a political ecology analysis of the micro-level impacts on indigenous communities as a result of the TPSP, which necessitates a narrower scope. Nonetheless, acknowledging hydrocapitalism enriches the theoretical underpinnings of this discussion. Still, the socio-ecological and governance dynamics specific to this project—such as indigenous displacement and deforestation—take precedence over a broader capitalist critique of water commodification.

6 | CONCLUSIONS AND RECOMMENDATIONS FOR POTENTIAL POLICIES

The perpetual debate on whether developmental projects can coexist with environmental protection can be resolved by advocating for methods that consider traditional communities

perspectives and incorporate environmentally friendly practices. On the other hand, these approaches may not be sufficient to meet the needs of large-scale development. However, our study has also demonstrated that reconciling traditional practices with the requirements of regional growth remains challenging.

Developmentality, as discussed in PE scholarships, epitomizes the imbalanced nature of contemporary development. The Turga hydroelectricity project exemplifies this, where wealth accrues to certain industrial areas at the expense of indigenous communities, raising concerns about land rights and ecological sustainability.

The issue of whom development policies benefit is further dissected, revealing a dichotomy between beneficiaries and those adversely affected. In the case of TPSP and PPSP, the indigenous communities pay the price for the development, emphasizing the need for just compensation and acknowledging the unique socio-cultural connection of these communities with their environment. The long-term positive prospects of a development projects needs to have the direct engagement of the local communities with the project, so that the participatory approach of the community not only makes the policy long life but it also securing the livelihood of the regional community. As the regional sustainability needs to rely on the people response to any sort of development scheme.The interconnected phases of initiation, framing, implementing, and monitoring underscore the need for a holistic approach that integrates community participation, EIAs, and ongoing scrutiny.

Mitigating conflicts between humans and the environment stemming from the Turga Power Project demands a realignment of policies towards enhanced sustainability, equity, and inclusivity. Several potential policy recommendations can effectively address these conflicts:

1. Enhanced community engagement

Develop policies mandating early and meaningful consultations with affected communities. Implement mechanisms for Free, Prior, and Informed Consent (FPIC) to ensure the active participation of indigenous and marginalized groups in decision-making processes. Community engagement should be integrated into every stage, from proposal and planning to execution and monitoring. Agitation arises when policy requirements impose specific actions on local communities without their input.

2. Environmental protection measures

Strengthen EIA procedures, ensuring comprehensive studies covering social and ecological aspects. Enforce strict adherence to mitigation measures and monitoring to minimize environmental harm. This necessitates the creation of a think-tank involving diverse stakeholders and the local community in the project site.

3. Land rights and compensation

Reform land acquisition policies to prioritize the protection of land rights and ensure fair compensation for displaced communities. Establish transparent and accountable mechanisms for rehabilitation and livelihood restoration. The concept of "Indigenous Sovereignty" emphasizes the right to ancestral land for aboriginal communities, including self-determination, self-governance, and cultural practices. Compensation is crucial if any management scheme displaces these communities, aligning with sustainability principles.

4. Inclusive governance structures

Foster inclusive governance structures that involve diverse stakeholders in project oversight and management. Create platforms for dialogue and conflict resolution to address grievances and ensure fair benefit sharing. In the Indian governance context, where resource development is often fragmented across multiple departments, the inclusive approach should extend beyond involving local communities to integrating various departments when needed for specific project implementation.

5. Long-term sustainability plans

Introduce policies mandating the development of long-term sustainability plans. Ensure a balance between energy needs and environmental conservation, promoting renewable energy sources and eco-friendly technologies. Proper site suitability analysis for constructing water reservoirs, without causing serious ecosystem damage, is imperative.

Implementing these policy recommendations necessitates a collaborative effort from government bodies, regulatory agencies, project developers, and civil society. This collective approach aims to foster sustainable and equitable outcomes for all stakeholders involved in the Turga Hydroelectric Power Project. The credibility of PE in this paper is it constantly advancing the explanation of different debates allied with hydropower projects and constantly undermining the ability to explain how things must be happened to sustainable water future. In a simple way, PE accepts ontology or material ontology sometimes that allows us to move forward with knowledge production, while constantly making epistemological movement that makes the explanation harder. Hence, the application of PE in water-aided policy is not only restricted for academic knowledge production, rather it may shape the developmental policy particularly in Global South, as most of the water-aided policies in Global South are equipped with similar attitude.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest to report.

ENDNOTES

[1] Hectare (symbol *ha*) is the metric unit of land-area that equals 10,000 m^2.

REFERENCES

Abhijitha, C. S., Areendran, G., Raj, K., Bhat, P., & Sahana, M. (2021). Habitat linkages for Asian elephants in Central Indian landscape. In *Habitat, ecology and ekistics: Case studies of human-environment interactions in India* (pp. 75–89). Springer. https://doi.org/10.1007/978-3-030-49115-4_4

Adedoyin, O. B. (2020). Qualitative research methods. *Principles of social psychiatry* (pp. 77–87).

Ahlers, R. (2010). Fixing and Nixing: The Politics of Water Privatization. *Review of Radical Political Economics*, *42*, 213–230. https://doi.org/10.1177/0486613410368497

Arocena, R., Göransson, B., & Sutz, J. (2015). Knowledge policies and universities in developing countries: Inclusive development and the "developmental university". *Technology in Society*, *41*, 10–20. https://doi.org/10.1016/j.techsoc.2014.10.004

Arsel, M. (2023). Climate change and class conflict in the Anthropocene: Sink or swim together? *The Journal of Peasant Studies*, *50*(1), 67–95. https://doi.org/10.1080/03066150.2022.2113390

Asher, M., & Bhandari, P. (2021). Mitigation or myth? Impacts of hydropower development and compensatory afforestation on forest ecosystems in the high Himalayas. *Land Use Policy*, *100*, 105041. https://doi.org/10.1016/j.landusepol.2020.105041

Asher, M., & Negi, V. (2023). Tunnels as temples of 'New green India': Dominant narratives of Himalayan dam building. *National law School Journal*, *17*(1), 1. https://doi.org/10.55496/IDHK7166

Baccini, P., & Brunner, P. H. (2023). *Metabolism of the anthroposphere: Analysis, evaluation, design*. MIT Press.

Baka, J. (2013). The political construction of wasteland: Governmentality, land acquisition and social inequality in South India. In *Governing global land deals: The role of the state in the rush for land* (pp. 211–229). https://doi.org/10.1002/9781118688229.ch10

Baka, J. E. (2017). Political-industrial ecologies of energy. In *Handbook on the geographies of energy* (pp. 477–489). Edward Elgar Publishing. https://doi.org/10.4337/9781785365621.00047

Bakken, T. H., Aase, A. G., Hagen, D., Sundt, H., Barton, D. N., & Lujala, P. (2014). Demonstrating a new framework for the comparison of environmental impacts from small- and large-scale hydropower and wind power projects. *Journal of Environmental Management*, *140*, 93–101. https://doi.org/10.1016/j.jenvman.2014.01.050

Banerjee, S. (2010). Radical and violent political movements. In *Routledge handbook of South Asian politics* (pp. 382–398). Routledge.

Baruah, A., Basu, M., & Amuley, D. (2021). Modeling of an autonomous hybrid renewable energy system for electrification of a township: A case study for Sikkim India. *Renewable and Sustainable Energy Reviews*, *135*, 110158. https://doi.org/10.1016/j.rser.2020.110158

Basu, J. P. (2020). Forest dependence, institutions and enforcement: An empirical study in the drought prone district of Purulia West Bengal. *Indian Journal of Ecology*, *47*(4), 1068–1073.

Basu, J. P. (2021). Forest participation of local communities: A study of a tribal dominated region in India. *Journal of Social and Economic Development*, *23*(1), 180–201. https://doi.org/10.1007/s40847-020-00142-w

Biswas, S., & Bain, W. K. (2022). Conservation of biodiversity using ethnic adaptive folk beliefs: A case study in Purulia District, West Bengal India. *Antrocom: Online Journal of Anthropology*, *18*(1), 335–358.

Blake, D. J., & Barney, K. (2018). Structural injustice, slow violence? The political ecology of a "best practice" hydropower dam in Lao PDR. *Journal of Contemporary Asia*, *48*(5), 808–834. https://doi.org/10.1080/00472336.2018.1482560

Boelens, R., Shah, E., & Bruins, B. (2019). Contested knowledges: Large dams and mega-hydraulic development. *Water*, *11*(3), 416. https://doi.org/10.3390/w11030416

Bose, R. (2016). Changing lives of Birhors in Purulia: A socio-economic observation in twenty-first century. *Contemporary Voice of Dalit*, *8*(2), 206–219. https://doi.org/10.1177/2455328X16661085

Brown, J. (2017). Democratizing accounting: Reflections on the politics of "old" and "new" pluralisms. *Critical Perspectives on Accounting*, *43*, 20–46. https://doi.org/10.1016/j.cpa.2016.11.001

Bruun, O., & Kalland, A. (2014). Images of nature: An introduction to the study of man–environment relations in Asia. In *Asian perceptions of nature* (pp. 1–24). Routledge. https://doi.org/10.4324/9781315026138

Bryant, R. L., Paniagua, A., & Kizos, T. (2011). Conceptualising 'shadow landscape' in political ecology and rural studies. *Land Use Policy*, *28*(3), 460–471. https://doi.org/10.1016/j.landusepol.2010.09.005

Buckley, C. A., & Waring, M. J. (2013). Using diagrams to support the research process: Examples from grounded theory. *Qualitative Research*, *13*(2), 148–172. https://doi.org/10.1177/1468794112472280

Chakrabarty, A., & Chatterjee, S. (2010). Geoinformatics in environmental cost assessment of Purulia Pumped Storage Project-West Bengal. *Indian Journal of Geography and Environment*, *10*, 9–18.

Chakraborty, S., & Nabanita, P. A. U. L. (2021). Efficacy of different human-elephant conflict prevention and mitigation techniques practiced in West Bengal India. *Notulae Scientia Biologicae*, *13*(3), 11017. https://doi.org/10.15835/nsb13311017

Chakraborty, S. K., & Chakraborty, S. K. (2021). Geo-hydrological perspectives of riverine flows. *Riverine Ecology. Volume 1: Eco-functionality of the physical environment of Rivers* (pp. 375–476).

Chatterjee, S. (2023). Rising trend of man-tiger conflict at man-nature interface of Indian Sundarbans: Study towards traditional understanding and challenging livelihood of Sundarbans people. *Safety in Extreme Environments*, *5*(1), 35–46. https://doi.org/10.1007/s42797-023-00069-5

Chauniyal, D. D., Dutta, S., & Semwal, S. (2018). Changing pattern of channel morphology of Alaknanda River in Srinagar Valley (Garhwal Himalaya), India. *Journal of the Indian Society of Remote Sensing*, *46*, 1379–1387. https://doi.org/10.1007/s12524-018-0782-2

Chopra, S., Ranjan, P., Malhotra, A., Verma, A., Kumari, A., Sharma, K. A., Sarkar, S., & Vikram, N. K. (2022). Perceived risk factors for weight gain, barriers, and facilitators related to weight loss experienced by perimenopausal women: focus group discussion and thematic analysis. *Menopause*, *29*(2), 219–224. https://doi.org/10.1097/GME.0000000000001909

Chu, E., Anguelovski, I., & Carmin, J. (2016). Inclusive approaches to urban climate adaptation planning and implementation in the Global South. *Climate Policy*, *16*(3), 372–392. https://doi.org/10.1080/14693062.2015.1019822

Cohen, S. (2023). *Environmentally Sustainable Growth: A Pragmatic Approach*. Columbia University Press. https://doi.org/10.7312/cohe20864

Cortini, M., Galanti, T., & Fantinelli, S. (2019). Focus group discussion: How many participants in a group? *Encyclopaideia*, *23*(54), 29–43.

Dallman, S., Ngo, M., Laris, P., & Thien, D. (2013). Political ecology of emotion and sacred space: The Winnemem Wintu struggles with California water policy. *Emotion, Space and Society*, *6*, 33–43. https://doi.org/10.1016/j.emospa.2011.10.006

Damodaran, V. (2002). History, landscape, and indigeneity in Chotanagpur, 1850–1980. *South Asia: Journal of South Asian Studies*, *25*(2), 77–110. https://doi.org/10.1080/00856400208723476

Damodaran, V. (2006). Famine in Bengal: A Comparison of the 1770 Famine in Bengal and the 1897 Famine in Chotanagpur. *The Medieval History Journal*, *10*(1-2), 143–181. https://doi.org/10.1177/097194580701000206

Das, P., Das, B. K., Mustafi, N. N., & Sakir, M. T. (2021). A review on pump-hydro storage for renewable and hybrid energy systems applications. *Energy Storage*, *3*(4), e223. https://doi.org/10.1002/est2.223

Das, R. (2016). The politics of land, consent, and negotiation: Revisiting the development-displacement narratives from Singur in West Bengal. *South Asia Multidisciplinary Academic Journal*, *13*. https://doi.org/10.4000/samaj.4103

Das, S., Ray, A., & De, S. (2020). Optimum combination of renewable resources to meet local power demand in distributed generation: A case study for a remote place of India. *Energy*, *209*, 118473. https://doi.org/10.1016/j.energy.2020.118473

Debnath, D. (2021). Development-induced displacement, resettlement and tribal life—A study in the protected areas of India. *Development, displacement & tribal life* (Vol. 123).

Del Bene, D. (2018). *Hydropower and ecological conflicts: From resistance to transformations*.

Deshamukhya, T., & Choubey, G. (2023). Prospects of micro-hydropower plants in Northeast India: A brief review. *International Journal of Energy and Water Resources*, *7*(2), 297–308. https://doi.org/10.1007/s42108-022-00197-x

Dhar, S., & Mazumdar, A. (2009). Hydrological modelling of the Kangsabati river under changed climate scenario: Case study in India. *Hydrological Processes: an International Journal*, *23*(16), 2394–2406. https://doi.org/10.1002/hyp.7351

Dirth, T. P., & Adams, G. A. (2019). Decolonial theory and disability studies: On the modernity/coloniality of ability. *Journal of Social and Political Psychology*, *7*(1), 260–289. https://doi.org/10.5964/jspp.v7i1.762

District census handbook, Purulia. (2011). Village & town directory, Directorate of census operations, West Bengal, Census of India, 2011. Series-20.

Durnik, M. (2008). Aboriginal participation in Canadian hydroelectric development: Political economy and public policy. *Analihrvatskogpolitološkogdruštva*, *5*, 367–395.

Elavarasan, R. M., Shafiullah, G. M., Padmanaban, S., Kumar, N. M., Annam, A., Vetrichelvan, A. M., Mihet-Popa, L., & Holm-Nielsen, J. B. (2020). A comprehensive review on renewable energy development, challenges, and policies of leading Indian states with an international perspective. *IEEE Access*, *8*, 74432–74457. https://doi.org/10.1109/ACCESS.2020.2988011

Espinosa, V. I., Alonso Neira, M. A., & Soto, J. H. D. (2021). Principles of sustainable economic growth and development: A call to action in a post-COVID-19 world. *Sustainability*, *13*(23), 13126. https://doi.org/10.3390/su132313126

Estes, N., & Dhillon, J. (Eds.). (2019). *Standing with standing rock: Voices from the# NoDAPL movement*. University of Minnesota Press. https://doi.org/10.5749/j.ctvr695pq

Fernando, J. (2020). From the Virocene to the Lovecene epoch: Multispecies justice as critical praxis for Virocene disruptions and vulnerabilities. *Journal of Political Ecology*, *27*(1), 685. https://doi.org/10.2458/v27i1.23816

Fischer, J., Hartel, T., & Kuemmerle, T. (2012). Conservation policy in traditional farming landscapes. *Conservation Letters*, *5*(3), 167–175. https://doi.org/10.1111/j.1755-263X.2012.00227.x

Förster, J. J., Downsborough, L., Biber-Freudenberger, L., KelboroMensuro, G., & Börner, J. (2021). Exploring criteria for transformative policy capacity in the context of South Africa's biodiversity economy. *Policy Sciences*, *54*, 209–237. https://doi.org/10.1007/s11077-020-09385-0

Foley, T., Boyle, S., Jennings, A., & Smithson, W. H. (2017). "We're certainly not in our comfort zone": a qualitative study of GPs' dementia-care educational needs. *BMC Family Practice*, *18*, 1–10.

Gillespie, J., & Perry, N. (2019). Feminist political ecology and legal geography: A case study of the Tonle Sap protected wetlands of Cambodia. *Environment and Planning a: Economy and Space*, *51*(5), 1089–1105. https://doi.org/10.1177/0308518X18809094

González-Hidalgo, M., & Zografos, C. (2020). Emotions, power, and environmental conflict: Expanding the 'emotional turn' in political ecology. *Progress in Human Geography*, *44*(2), 235–255. https://doi.org/10.1177/0309132518824644

Görg, C., Brand, U., Haberl, H., Hummel, D., Jahn, T., & Liehr, S. (2017). Challenges for social-ecological transformations: Contributions from social and political ecology. *Sustainability*, *9*(7), 1045. https://doi.org/10.3390/su9071045

Government of West Bengal. (2012). *West Bengal State Action Plan on Climate Change (WB SAPCC)*. Government of West Bengal.

Government of West Bengal. (2014). District statistical hand book, Purulia. Bureau of Applied Economics and Statistics, Department of Statistics and Programme Implementation.

Guha, A. (2011). Using the past to win the present: Peasant revolt, political parties and the print media in leftist West Bengal. In *The politics of belonging in India* (pp. 199–216). Routledge.

Gupta, B. (2020). Power knowledge and environmental resources: A study of the marginalisation of the tribal communities of Chota Nagpur. *Webology*, *17*(1), 512–532.

Gupta, S. S. (2015). *A flag, a song and a pinch of salt: Freedom fighters of India*. Penguin Books India.

Gutierrez, G. M., Kelly, S., Cousins, J. J., & Sneddon, C. (2019). What makes a megaproject?: A review of global hydropower assemblages. *Environment and Society*, *10*(1), 101–121. https://doi.org/10.3167/ares.2019.100107

Haines, H. H. (1910). *A Forest flora of Chotanagpurincluding Gangpur and the Santal Parganahs -A description of all the indigenous trees, shrubsand climbers, the principal economic herbs, andmost common cultivated trees and shrubs (withintroduction and glossary)*. Superintendent Govt. https://doi.org/10.5962/bhl.title.10943

Haggard, S., & Kaufman, R. R. (Eds.). (2018). *The politics of economic adjustment: International constraints, distributive conflicts and the state*. Princeton University Press. https://doi.org/10.2307/j.ctv39x8b8

Halseth, G., Markey, S., Ryser, L., & Manson, D. (2016). *Doing community-based research: Perspectives from the field*. McGill-Queen's Press-MQUP.

Hazari, T. M., & Bhui, S. (2021). Are the developmental projects is equal to improve the lifestyle of tribal people of Ajodhya Hill, Purulia? A case study. *Annals of Anthropological Research and Reviews*, *1*(1).

Hennink, M., Hutter, I., & Bailey, A. (2020). *Qualitative research methods*. Sage.

Hill, D. P. (2017). The discursive politics of water management in India: Desecuritising Himalayan river basins. *South Asia: Journal of South Asian Studies*, *40*(4), 827–843. https://doi.org/10.1080/00856401.2017.1380576

Hoang, N. T., & Kanemoto, K. (2021). Mapping the deforestation footprint of nations reveals growing threat to tropical forests. *Nature Ecology & Evolution*, *5*(6), 845–853. https://doi.org/10.1038/s41559-021-01417-z

Hoppe, T., & Miedema, M. (2020). A governance approach to regional energy transition: Meaning, conceptualization and practice. *Sustainability*, *12*(3), 915. https://doi.org/10.3390/su12030915

Huber, A., & Joshi, D. (2015). Hydropower, anti-politics, and the opening of new political spaces in the Eastern Himalayas. *World Development*, *76*, 13–25. https://doi.org/10.1016/j.worlddev.2015.06.006

Hunt, J. D., Zakeri, B., Lopes, R., Barbosa, P. S. F., Nascimento, A., de Castro, N. J., Brandão, R., Schneider, P. S., & Wada, Y. (2020). Existing and new arrangements of pumped-hydro storage plants. *Renewable and Sustainable Energy Reviews*, *129*, 109914. https://doi.org/10.1016/j.rser.2020.109914

Jakob, M., & Steckel, J. C. (2022). *The political economy of coal: obstacles to clean energy transitions* (p. 364). Taylor & Francis.

Japan International Cooperation Agency (JICA). (2018). Abbreviated Resettlement Action Plan for Turga Pumped Storage Project. West Bengal State Electricity Distribution Company Limited, Government of West Bengal. portalq.wbsedcl.in (Accessed on 18.10.2024).

JICA. (2016). *EMP report on Turga Pump Storage Project* (Vol. 3). Government of West Bengal, State Electricity Company Limited. https://www.jica.go.jp (Accessed on 18.06.2024)

Joffe, H. (2011). *Thematic analysis. Qualitative research methods in mental health and psychotherapy: A guide for students and practitioners* (pp. 209–223). https://doi.org/10.1002/9781119973249.ch15

Junior, C. H. S., Celentano, D., Rousseau, G. X., de Moura, E. G., van DeursenVarga, I., Martinez, C., & Martins, M. B. (2020). Amazon forest on the edge of collapse in the Maranhão State Brazil. *Land Use Policy*, *97*, 104806. https://doi.org/10.1016/j.landusepol.2020.104806

Kaintura, D., Dasgupta, S., & Chauhan, D. S. (2024). Impacts of hydropower-induced flow alterations on composition and diversity of riparian vegetation in the Western Himalayas: A case study in Uttarakhand India. *Journal of Mountain Science*, *21*(4), 1272–1286. https://doi.org/10.1007/s11629-024-8606-z

Kar, S., JibanbandhuGayak, K., Satpati, K. R. L., & Mukherjee, S. (2023). Achieving rural water security through traditional knowledge: a comprehensive appraisal of traditional water harvesting techniques used in dry lands of Purulia District, West Bengal, India. In *Indigenous Knowledge and Disaster Risk Reduction: Insight Towards Perception, Response, Adaptation and Sustainability* (pp. 343–384). Springer International Publishing.

Kar, S., Sen, E., & Mukherjee, S. (2020). A geospatial technique-based site suitability analysis for construction of water reservoirs in Arsha and Balarampur Blocks, Purulia. *World Water Policy*, *6*(1), 52–88.

Keiluhu, H. J. (2013). *The impact of hunting on Victoria crowned pigeon (Gouravictoria: Columbidae) in the rainforests of Northern Papua*. Cuvillier Verlag.

Kelly-Richards, S., Silber-Coats, N., Crootof, A., Tecklin, D., & Bauer, C. (2017). Governing the transition to renewable energy: A review of impacts and policy issues in the small hydropower boom. *Energy Policy*, *101*, 251–264. https://doi.org/10.1016/j.enpol.2016.11.035

Kenney-Lazar, M., Johnson, A., Sultana, F., Himley, M., Bebbington, A., Havice, E., Rice, J., & Osborne, T. (2023). Relational environmental governance: A critical framework for praxis with the material world. *Journal of Political Ecology*, *30*, 678. https://doi.org/10.2458/jpe.5542

Kiss, B., Sekulova, F., Hörschelmann, K., Salk, C. F., Takahashi, W., & Wamsler, C. (2022). Citizen participation in the governance of nature-based solutions. *Environmental Policy and Governance*, *32*(3), 247–272. https://doi.org/10.1002/eet.1987

Koirala, S., Hill, D., & Morgan, R. (2017). Impacts of the delay in construction of a large scale hydropower project on potential displacees. *Impact Assessment and Project Appraisal*, *35*(1), 106–116. https://doi.org/10.1080/14615517.2016.1271540

Kull, C. A., & Rangan, H. (2016). Political ecology and resilience: Competing interdisciplinarities? In *Interdisciplinarités entre Natures et Sociétés: Colloque de Cerisy* (pp. 71–87). PIE Peter Lang.

Kuriakose, F., & KylasamIyer, D. (2016). Documenting democratic decentralisation in Kerala with special reference to services to children under six: Case study of Malappuram District, Kerala, India.

Lave, R. (2014). Engaging within the academy: A call for critical physical geography. *ACME: An International Journal for Critical Geographies*, *13*(4), 508–515.

Le Billon, P. (2015). Environmental conflict. In *The Routledge handbook of political ecology* (pp. 598–608). Routledge.

Lederer, M., Wallbott, L., & Bauer, S. (2018). Tracing sustainability transformations and drivers of Green Economy approaches in the Global South. *The Journal of Environment & Development*, *27*(1), 3–25. https://doi.org/10.1177/1070496517747661

Lee, S. (2017). WHO and the developing world: The contest for ideology. In *Western medicine as contested knowledge* (pp. 24–45). Manchester University Press. https://doi.org/10.7765/9781526123572.00007

Li, T. M. (2018). After the land grab: Infrastructural violence and the "Mafia System" in Indonesia's oil palm plantation zones. *Geoforum*, *96*, 328–337. https://doi.org/10.1016/j.geoforum.2017.10.012

Luo, J., Ali, S. A., Aziz, B., Aljarba, A., Akeel, H., & Hanif, I. (2023). Impact of natural resource rents and economic growth on environmental degradation in the context of COP-26: Evidence from low-income, middle-income, and high-income Asian countries. *Resources Policy*, *80*, 103269. https://doi.org/10.1016/j.resourpol.2022.103269

Mahato, N. K. (2010). Environment and Migration, Purulia, West Bengal. *Policies and Practices*, *32*.

Mahato, N. K. (2021). Deforestation, ecological deterioration and scientific forestry in Purulia, 1890s–1960s. In *History of science, technology, environment, and medicine in India* (pp. 214–232). Routledge India.

Maher, R. (2019). Pragmatic community resistance within new indigenous ruralities: Lessons from a failed hydropower dam in Chile. *Journal of Rural Studies*, *68*, 63–74. https://doi.org/10.1016/j.jrurstud.2019.03.009

Malladeb, V., Mishra, S., & Sahoo, P. (2023). Understanding the integration of agriculture and tourism in Jungalmahal region of West Bengal and it's contribution to farmer's income from small-scale and commercial farms. *Journal of Survey in Fisheries Sciences*, *10*(1), 4384–4394. https://doi.org/10.53555/sfs.v10i1.2010

Mhaiske, V. M., Patil, V. K., & Narkhede, S. S. (2016). *Forest tribology and anthropology*. Scientific Publishers.

Mishra, M. (2017). An assessment of economic inequality in the district of Purulia, West Bengal India. *Economic Affairs*, *62*(3), 459–469. https://doi.org/10.5958/0976-4666.2017.00058.4

Moore, M. (2021). Liquid gold or the source of life? Understanding water commodification as a contradictory and contested political project. *Globalizations*, *19*, 797–813. https://doi.org/10.1080/14747731.2021.2011586

Mukherjee, S., Sundberg, T., & Schütt, B. (2020). Assessment of water security in socially excluded areas in Kolkata, India: An approach focusing on water, sanitation, and hygiene. *Water*, *12*(3), 746. https://doi.org/10.3390/w12030746

Mukherjee, U. (2016). Revolution and the Maoists. *Liberal Studies*, *1*, 39.

Nayak, A. K. (2021). Involuntary displacement and rehabilitation: A comparative study of Hirakud and Kaptai dams of India and Bangladesh. *Indian Journal of Public Administration*, *67*(2), 237–255. https://doi.org/10.1177/00195561211026629

Nayar, P. K. (2014). Indigenous cultures and the ecology of protest: Moral economy and "knowing subalternity" in Dalit and tribal writing from India. *Journal of Postcolonial Writing*, *50*(3), 291–303. https://doi.org/10.1080/17449855.2013.815127

Negi, D. P., & Azeez, E. P. (2022). Impacts of development induced displacement on the tribal communities of India: An integrative review. *Asia-Pacific Social Science Review*, *22*(2), 5. https://doi.org/10.59588/2350-8329.1420

Nichols, C. E., & Del Casino, V. J. Jr. (2021). Towards an integrated political ecology of health and bodies. *Progress in Human Geography*, *45*(4), 776–795. https://doi.org/10.1177/0309132520946489

Nuetah, J. A., & Xin, X. (2017). Global agricultural trade liberalization: Is Sub-Saharan Africa a gainer or loser? *The Journal of International Trade & Economic Development*, *26*(1), 65–88. https://doi.org/10.1080/09638199.2016.1205120

Nyumba, T., Wilson, K., Derrick, C. J., & Mukherjee, N. (2018). The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and Evolution*, *9*(1), 20–32. https://doi.org/10.1111/2041-210X.12860

Orchard, S. (2021). Sustainable developmentality: Interrogating the sustainability gaze and the cultivation of mountain subjectivities in the central Indian Himalayas. *Geoforum*, *127*, 209–221. https://doi.org/10.1016/j.geoforum.2021.11.004

Osborne, T., Brock, S., Chazdon, R., Chomba, S., Garen, E., Gutierrez, V., Lave, R., Lefevre, M., & Sundberg, J. (2021). The political ecology playbook for ecosystem restoration: Principles for effective, equitable, and transformative landscapes. *Global Environmental Change*, *70*, 102320. https://doi.org/10.1016/j.gloenvcha.2021.102320

Palchaudhuri, M., & Biswas, S. (2013). Analysis of meteorological drought using standardized precipitation index—A case study of Puruliya district, West Bengal, India. *International Journal of Environmental, Ecological, Geological and Mining Engineering*, *7*(3), 119–126.

Palomino-Schalscha, M., Leaman-Constanzo, C., & Bond, S. (2016). Contested water, contested development: Unpacking the hydro-social cycle of the Ñuble River Chile. *Third World Quarterly*, *37*(5), 883–901. https://doi.org/10.1080/01436597.2015.1109436

Patankar, B., & Phadke, A. (2020). Dams and displacement: A review. In *Water conflicts in India* (pp. 307–311). Routledge India. https://doi.org/10.4324/9780367817671-58

Paul, S., & Das, C. S. (2022). Environmental degradation and erosion susceptibility mapping at Ajodhya hill, Purulia, India—A GIS based analysis. *Safety in Extreme Environments*, *4*(3), 257–275. https://doi.org/10.1007/s42797-022-00065-1

Pike, A., Rodríguez-Pose, A., & Tomaney, J. (2016). *Local and regional development*. Routledge. https://doi.org/10.4324/9781315767673

Prieto, M. (2021). Indigenous resurgence, identity politics, and the anticommodification of nature: The Chilean water market and the Atacameño people. *Annals of the American Association of Geographers*, *112*, 487–504. https://doi.org/10.1080/24694452.2021.1937036

Prieto, M., Valdivia, G., & Perreault, T. (2023). Aporias of North/South political ecologies. *Progress in Environmental Geography*, *2*(3), 166–178. https://doi.org/10.1177/27539687231184901

Pritchard, S. B. (2012). From hydroimperialism to hydrocapitalism: 'French' hydraulics in France, North Africa, and beyond. *Social Studies of Science*, *42*(4), 591–615. https://doi.org/10.1177/0306312712443018

Proulx, G., & Crane, N. J. (2020). "To see things in an objective light": The Dakota Access Pipeline and the ongoing construction of settler colonial landscapes. *Journal of Cultural Geography*, *37*(1), 46–66. https://doi.org/10.1080/08873631.2019.1665856

Rahaman, M. M. (2020). Hydropower development along Teesta river basin: Opportunities for cooperation. *Water Policy*, *22*(4), 641–657. https://doi.org/10.2166/wp.2020.136

Ralston, R., Hill, S. E., da Silva Gomes, F., & Collin, J. (2021). Towards preventing and managing conflict of interest in nutrition policy? An analysis of submissions to a consultation on a draft WHO tool. *International Journal of Health Policy and Management*, *10*(5), 255–265. https://doi.org/10.34172/ijhpm.2020.52

Rist, G. (2014). *The history of development: From western origins to global faith*. Bloomsbury Publishing.

Robbins, P. (2019). *Political ecology: A critical introduction*. John Wiley & Sons.

Robbins, P. (2022). *POLITICAL ECOLOGY OF WATER IN THE AMERICAS: JUSTICE, POWER, FLOWS: Luttes pour l'eau dans les Amériques: Mésusages, arrangements et changements sociaux* (Vol. 59).

Roberts, A. (2008). Privatizing Social Reproduction: The Primitive Accumulation of Water in an Era of Neoliberalism. *Antipode*, *40*, 535–560. https://doi.org/10.1111/J.1467-8330.2008.00623.X

Roy, S. S., & Jana, N. C. (2015). Impact of geomorphic attributes on rural settlement distribution: A case study of Baghmundi block in Purulia District, West Bengal. *International Journal of Innovative Research and Development*, *4*, 121–132.

Roy, T., & Roy, T. (2019). The making of British India. In *How British rule changed India's economy: The paradox of the Raj* (pp. 25–53). Palgrave Pivot. https://doi.org/10.1007/978-3-030-17708-9_2

Ruj, C., Majumdar, A., & Ghosal, S. (2022). Political ecology and hydrosocial relation: A study on drought and associated migration in a semi-arid district of West Bengal, India. *Letters in Spatial and Resource Sciences*, *15*(3), 709–734. https://doi.org/10.1007/s12076-022-00321-9

Sahoo, S. (2014). Globalization and Politics of the Poor in India. *Journal of Asian and African Studies*, *49*(1), 3–15. https://doi.org/10.1177/0021909612471785

Sahu, G. (2021). Implementation of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Rights) Act 2006 in Jharkhand: Problems and challenges. *Journal of Land and Rural Studies*, *9*(1), 158–177. https://doi.org/10.1177/2321024920968334

Sahu, N., Sayama, T., Saini, A., Panda, A., & Takara, K. (2020). Understanding the hydropower and potential climate change impact on the Himalayan river regimes—A study of local perceptions and responses from Himachalpradesh, India. *Water*, *12*(10), 2739. https://doi.org/10.3390/w12102739

Sankar Bandyopadhyay, G. (2019). Climate Change, Endangered Environment and Vulnerable Aboriginals of India–A Critical Study. In RAIS Conference Proceedings-The 14th International RAIS Conference on Social Sciences and Humanities.

Seamon, D., & Gill, H. K. (2016). Qualitative approaches to environment–behavior research: Understanding environmental and place experiences, meanings, and actions. *Research methods for environmental psychology* (pp. 115–135). https://doi.org/10.1002/9781119162124.ch7

Sharma, C. K. (2018). Dam, 'development' and popular resistance in Northeast India. *Sociological Bulletin*, *67*(3), 317–333. https://doi.org/10.1177/0038022918796942

Shiva, V., & Bandyopadhyay, J. (2019). The Chipko Movement. In *Deforestation* (pp. 224–241). Routledge. https://doi.org/10.4324/9780429330094-8

Sovacool, B. K. (2021). Who are the victims of low-carbon transitions? Towards a political ecology of climate change mitigation. *Energy Research & Social Science*, *73*, 101916. https://doi.org/10.1016/j.erss.2021.101916

Spencer, D. (2021). *Critique of architecture: Essays on theory, autonomy, and political economy* (Vol. 168). Birkhäuser.

Sultana, F. (2021). Political ecology 1: From margins to center. *Progress in Human Geography*, *45*(1), 156–165. https://doi.org/10.1177/0309132520936751

Swilling, M., Nygaard, I., Kruger, W., Wlokas, H., Jhetam, T., Davies, M., Jacob, M., Morris, M., Robbins, G., Funder, M., Hansen, U. E., Olsen, K. H., Davy, E., Kitzing, L., Khan, B. S., & Cronin, T. (2022). Linking the energy transition and economic development: A framework for analysis of energy transitions in the Global South. *Energy Research & Social Science*, *90*, 102567. https://doi.org/10.1016/j.erss.2022.102567

Swyngedouw, E. (2009). The political economy and political ecology of the hydro-social cycle. *Journal of Contemporary Water Research & Education*, *142*(1), 56–60. https://doi.org/10.1111/j.1936-704X.2009.00054.x

Tamang, K. L., & Mohapatra, S. (2022). Teesta hydro-electricity projects and livelihood security in the Sikkim Himalaya: Issues and challenges. *Integrated Journal for Research in Arts and Humanities*, *2*(3), 48–54. https://doi.org/10.55544/ijrah.2.3.32

Terry, G., Hayfield, N., Clarke, V., & Braun, V. (2017). *Thematic analysis. The SAGE handbook of qualitative research in psychology* (Vol. 2, 17-37) (p. 25).

Tripathi, A., & Sumana, P. (2022). Pumped Storage Development EmergingChallenges and Available Options – CaseStudies. International Conference on Hydropower and Dams Development for Water and Energy Security – Under Changing Climate,7-9 April, 2022, Rishikesh, India.

Tödtling, F., & Trippl, M. (2021). Regional innovation policies for new path development—Beyond neo-liberal and traditional systemic views. In *Dislocation: Awkward spatial transitions* (pp. 79–95). Routledge. https://doi.org/10.4324/9781003133551-6

Turner, M. D. (2015). Integrating politics and ecology through mixed methods. *The international handbook of political ecology* (Vol. 530).

Tvedt, T. (2021). *Water and society: Changing perceptions of societal and historical development* (Vol. 304). Bloomsbury Academic. https://doi.org/10.5040/9780755606511

Underwood, G., Hill, D., & Lamichhane, S. (2020). Earthquakes, blockades and energy crises: A conceptual framework for energy systems resilience applied to Nepal. *Energy Research & Social Science*, *69*, 101609. https://doi.org/10.1016/j.erss.2020.101609

Van Assche, K., Beunen, R., Duineveld, M., & Gruezmacher, M. (2017). Power/knowledge and natural resource management: Foucaultian foundations in the analysis of adaptive governance. *Journal of Environmental Policy & Planning*, *19*(3), 308–322. https://doi.org/10.1080/1523908X.2017.1338560

Van Gent, W., Das, M., & Musterd, S. (2019). Sociocultural, economic and ethnic homogeneity in residential mobility and spatial sorting among couples. *Environment and Planning A: Economy and Space*, *51*(4), 891–912. https://doi.org/10.1177/0308518X18823754

Wallerstein, I. (2023). The rise and future demise of the world capitalist system: Concepts for comparative analysis. In *Imperialism* (pp. 141–169). Routledge.

Watts, M. (2017). Political ecology. In*A companion to economic geography* (pp. 257–274). https://doi.org/10.1002/9781405166430.ch16

Watts, M. J. (2015). The origins of political ecology and the rebirth of adaptation as a form of thought. In *The Routledge handbook of political ecology* (pp. 19–50). Routledge.

Wenar, L. (2017). Property rights and the resource curse. In *Global justice* (pp. 457–487). Routledge. https://doi.org/10.4324/9781315254210-20

West Bengal Pollution Control Board (WBPCB). (2019). *Executive summery for EIA study for Turga Pump Storage Project*. Government of West Bengal.

Whyte, K. (2018). Settler colonialism, ecology, and environmental injustice. *Environment and Society*, *9*(1), 125–144. https://doi.org/10.3167/ares.2018.090109

Winlow, H., Simm, D., Marvell, A., & Schaaf, R. (2017). Using focus group research to support teaching and learning. In *Pedagogic research in geography higher education* (pp. 112–123). Routledge.

Xavier, S. (2018). The problems and challenges of the Kadar tribe of Kerala. *Contemporary Voice of Dalit*, *10*(2), 204–215. https://doi.org/10.1177/2455328X18785454

Younis, J., & Ahmed, C. I. (2022). Application of remote sensing and GIS to mapping groundwater potential zones of Khazir River Basin, Northern Iraq. *Iraqi National Journal of Earth Science*, *22*(2), 209–230. https://doi.org/10.33899/earth.2022.176650

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APPENDIX A

FIGURE A1 PPSP upper dam.

FIGURE A2 PPSP lower dam.

FIGURE A3 Turga falls at Ajyodhya.

FIGURE A4 Nearby site of Turga dam (proposed).

FIGURE A5 Protest against TPSP by indigenous women at Baruajara Village at Ajodhya GP.

FIGURE A6 Mass protest against TPSP at Barria village at Bagmundi GP.

FIGURE A7 Deforestation at Ranga village in Ajodhya GP during the first phase of TPSP.