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People's Perceptions regarding Environmental Conflict in the Context of Hydropower Development: A Case Study of Chamera Stage II in Himachal Pradesh

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Abstract

The sustainable development of hilly regions, such as those in Himachal Pradesh, faces significant challenges due to environmental degradation. Over time, disputes have arisen over forests, water sources, and other natural resources. This analysis focuses on the environmental conflicts surrounding the Chamera Stage-II hydroelectric project in the Chamba region of Himachal Pradesh. Based on perception surveys conducted within local communities and field studies examining ecological and environmental parameters, the analysis highlights several key issues. These include the loss of green cover, a decline in biodiversity, depletion of natural resources, disruption of access to common property, disturbances in the ecological cycle, alterations in microclimate, changes in land use patterns, and the loss of ethnobotanical and wild edible fruit plants. Local communities overwhelmingly assert that these conflicts have arisen due to the construction of the dam. They firmly hold the view that higher authorities disregard the environmental and ecological impact as a crucial consideration in any project. Consequently, as communities grapple with survival challenges, conflicts with authorities emerge over environmental issues. To address these challenges; the analysis suggests several measures to mitigate the adverse impacts of hydropower development. These include implementing more stringent environmental impact assessments, enhancing community involvement in project planning and decision-making, and adopting sustainable development practices that prioritize environmental conservation. By fostering better collaboration between authorities and local communities, it is possible to manage such projects more effectively and reduce conflicts

Keywords: *Environmental Conflict, Hydropower, Chamera-II, Chamba, HimachalPradesh*

Introduction

The Himalayas, often called "Asia's Water Towers," are the highest mountain range in the world and the main location for ice accumulation outside the poles. These majestic peaks are crucial as they are the principal source of Asia's major rivers. Over 1.5 billion people in the Himalayan region and downstream countries, including China, India, Pakistan, Nepal, Bangladesh, Vietnam, Burma, Thailand, and Laos, rely heavily on these rivers for their livelihoods, economies, and water supplies (Immerzeel *et al.*, 2010; Xu *et al*., 2009). However, the rapid pace of population growth and technological and infrastructure advancements, such as the construction of large cities, highways, bridges, and dams, have disrupted the delicate

ecological balance. This imbalance threatens the environment and impacts the region's sustainability. As environmental awareness increases, conflicts between environmental officials and engineers become more common. It is well known that constructing engineering projects, particularly dams, poses significant environmental risks (Gadgil and Guha, 1994).

Dams are typically designed based on the characteristics of rivers and the surrounding land. Environmental changes can significantly impact how these dams function and are managed. Unfortunately, project offices often overlook this, making it difficult for communities and disaster management authorities to predict and prepare for threats like flash floods. Experts believe that current knowledge about the water systems, ecology, biology, and geography of the Himalayan region is insufficient to fully protect its rivers. Raising dams has been suggested to slow global environmental changes and support sustainable development in North India. However, this idea faces criticism due to its significant ecological and social impacts, the release of methane from dam reservoirs, and reduced hydroelectric power production caused by decreased water flow in rivers and streams due to climate change (Giles, 2006; Vicuna *et al*., 2008)

Over time, it has become clear that river valley projects, like other planned developments, have significant negative impacts on the environment, society, and the economy. Most hydropower projects are located in river valleys that are crucial for plant and animal diversity. Despite their benefits, building dams usually changes land use and affects local water systems (Dixon *et al*., 1989). Social impacts of dams include displacing communities, disrupting social structures and lifestyles, and unevenly distributing costs and benefits. Dams harm upstream areas and alter both the quantity and quality of water due to sediment build-up. Other negative effects on ecosystems include loss of forests, wild areas, and biodiversity, and the release of pollutants that damage the ozone layer(Dixon *et al.*, 1989; De Wet, 1999; WCD, 2000., Terry, 1995). Water system dams can also cause problems like reduced soil fertility due to waterlogging, salinization, hardpan development, and the spread of diseases due to increased vectors. Some studies argue that the significant social conflicts and destruction of marine life caused by hydropower dams often outweigh their financial benefits (Bratrich *et al*., 2004).

Current pressures are causing increased social and environmental conflicts, as observed by Schlosberg (2004). Environmentalists point out issues such as displacement of people and changes in biodiversity resulting from dam construction. Conversely, hydroelectric project owners emphasize that dams provide renewable energy (Basson, 2004). These conflicts are closely linked to water movement in the landscape and are influenced by hydrological and biological processes, which can significantly impact the sediment load in rivers.

It's understandable that citizens are expressing genuine concern about any developments linked to deforestation, given the alarming pace at which the planet's forest cover is declining. For example, the creation of reservoirs behind dams can inundate vast areas, necessitating the removal of contiguous trees to make way for roads and settlements. However, environmentalists are also deeply concerned about issues such as land degradation due to waterlogging and

increased soil salinity, which contribute to what are known as "ecological distribution conflicts." This term was first coined in the late 1990s by Martínez-Alier and O'Connor and refers to conflicts arising from the scarcity of natural resources or from the overloading of an ecosystem's capacity to absorb impacts.

In the context of environmental conflicts, the definition often revolves around disputes arising from the uneven distribution of costs and benefits associated with resource utilization. For instance, in the case of hydroelectric projects, costs include the loss of human livelihoods and environmental degradation, in addition to financial burdens on the hydro company and the state. Conversely, benefits accrue to the country and the company through the utilization of extensive reservoirs and canal systems.

These conflicts highlight the complex trade-offs involved in development projects that impact natural resources and ecosystems, reflecting broader concerns about sustainability and equitable resource management Libiszewski (1992). Controversies surrounding the hydropower development in the region deal with a wide range of concerns: displacement, loss of livelihoods; ecological impacts including seismic activity and downstream effect on the delicate Himalayan ecosystem flooding or submergence, preservation.

Originating from Bara Banghal, a branch of Dhauladhar, the Ravi River is formed by the glacier-fed Badal and Tant Gari.The The Ravi River embodies an entire ecosystem, encompassing human settlements, forests, flora, and fauna within the region. Chamba town is strategically positioned on the river's right bank. Noteworthy right bank tributaries include Budhil, Tundah Beljedi, Saho, and Siul, while the significant left bank tributary is Chirchind Nala. As the Ravi River meanders through the Dalhousie hill's base, it gracefully traverses the renowned Chamba valley. Given the region's distinctive features and the planned scale of intervention, it is crucial to meticulously assess social and environmental impacts before determining the feasibility of large Dams. The Ravi basin region is home to diverse indigenous communities, with a significant portion of the population relying on livelihoods based on natural resources. Stretching approximately 158 km in Himachal Pradesh, the river boasts a catchment area spanning about 5,451 km². This diversity brings unique socio-cultural, agro-ecological, and landholding systems, including various forms of community control over forests.

While hydropower development is a contemporary focus, it may not always align with the preferences of residents, particularly those in rural areas, as it can significantly alter occupational and production systems. Environmental conflicts extend beyond acquiring land and compensation; they involve the challenge of restoring displaced communities' access to rich environmental and ecological resources. The study aims to explore the environmental conflict over hydropower development, assessing the environmental loss. This selection is based on significant reasons related to environmental conflicts arising from hydro-electric power projects and their impacts on socio-ecological dynamics. The area for study is the Chamera Dam -II area in the Ravi basin of Chamba district. The environmental toll is considerable, encompassing forest depletion, soil erosion, loss of pasture lands, and harm to water resources.

About the Project

Chamera Hydroelectric Project Stage-II is situated in the Chamba district of Himachal Pradesh and operates as a run-of-the-river scheme. The Chamera Stage-II (300 MW) hydropower stations are located across Ravi river which is a mountainous river of western Himalaya. The river Ravi originates at an elevation of about 6000m from Bara Bhangal glaciated area and is formed by the confluence of two streams. The major tributaries joining the River are Kalihan Nala, Budhil Nala and Tundah Nala, before the Chamera Stage-II Dam at Bagga. The Catchment area of Chamera-II power station is bounded between latitude 32°10' N to 32°40' N and longitude 76°11' E to 77°04' E. Chamera -II power station is located on main Ravi River near Chamba town and the catchment area is 2596 sq km. With an installed capacity of 300 MW (3X100 MW), the Chamera Project -II has been operational since its commissioning in 2004. Residents in and around the project vicinity were required to be relocated due to the inundation of land resulting from the project's construction. Of the total 145 affected families due to the land acquisition for project development, 45 families found themselves without homes or land and were in need of resettlement. 32 families due to land submerged in Dam. The remaining families experienced partial impacts, such as the loss of a portion of their land. Additionally, various environmental repercussions, including submergence, deforestation, the depletion of flora and fauna, and soil erosion, were identified. However, all of these impacts were mitigated comprehensively through appropriate measures.

Methodology

The study undertaken here is a comprehensive exploration that integrates primary and secondary data sources to investigate the impact of Chamera Stage II on surrounding villages named as Karian ,Kuranh, Taggi ,Gurad and Rajera. By employing a direct interview approach with meticulously designed questionnaires, the study collected primary data from the field. Using a Systematic Random Sampling method, one hundred households within the affected area were selected for in-depth analysis. The survey, conducted between October 2021 and November 2022, involved interviewing family heads or their counterparts from each household, covering various aspects related to the impact of Chamera Stage II. The study's strength lies in its direct engagement with the community, enabling a detailed understanding of the challenges, concerns, and implications faced by these villages. By combining rigorous methodology with on-the-ground investigation, this research aims to provide valuable insights into the repercussions of the Chamera Stage II project on the local populace.

Result and Discussion

In contemporary times, a significant concern revolves around the surging demand for electricity, driving the exploitation of Himalayan Rivers. This issue is particularly acute in areas where multiple consecutive projects, termed bumper-to-bumper projects, are proposed, severely limiting free-flowing river segments. The relentless pursuit of hydroelectric potential through numerous dams poses a grave threat to the region's water security, social dynamics, and ecological balance. The construction of extensive hydropower infrastructures necessitates large-

scale interventions that lead to deforestation, disrupting forest ecosystems and triggering a concerning decline in biodiversity. The cumulative impact of these projects not only alters the natural flow of rivers but also endangers the delicate ecological fabric of the Himalayas. The need for electricity must be balanced with preserving the integrity of these vital ecosystems to ensure a sustainable future for both the environment and the communities reliant on these resources.

Change in land use pattern

Land use change is a fundamental process driven by human activity, altering natural landscapes to serve economic functions. In a recent study, 89% of respondents acknowledged land use pattern alterations due to the construction of a large dam and power house. There is total loss of agricultural land where paddy fields were present before the construction. Karian village has most of the change in land use pattern due to Project colony construction. Although hydropower is an essential energy source, it comes with environmental implications, particularly concerning the transformation of land use and river flow patterns. The construction of reservoirs for hydropower projects leads to significant ecological shifts, transitioning ecosystems from aquatic and terrestrial to lentic environments. This transition often involves relocating communities and engaging in different production activities. However, it also competes for land with agriculture and forestry, potentially leading to pollution and increased food insecurity, especially in areas reliant on imported agricultural goods. While hydropower plants require considerable land for construction and operation, the inundation of land behind dams disrupts ecosystems both upstream and downstream. Even though land-use intensity might decrease with larger systems, the alterations in land use have significant climatic implications due to greenhouse gas emissions and changes in local microclimates, affecting evapotranspiration. The impacts on biodiversity are profound, leading to habitat degradation, reduced connectivity, and alterations in terrestrial and marine habitats due to changes in land use. Balancing the benefits of hydropower with its ecological impacts remains a crucial challenge in sustaining both energy needs and environmental conservation. Efforts to minimize adverse land-use changes while harnessing hydropower's potential are imperative for a sustainable future.

Loss of Green Cover

The construction of a dam significantly impacts the environment within its vicinity, necessitating land usage, as exemplified in the Chamera Stage-II construction illustrated in Figure 1. In a survey involving 100 households, 79% of respondents expressed concerns about the reduction of green cover due to the dam's construction. Conversely, 15% did not perceive any loss of green cover, while 6% remained uncertain about the impact. The presence of green cover offers diverse advantages, such as diminishing air pollution, enhancing soil quality, ameliorating the effects of climate change, and providing habitats for wildlife. It reluted in reduction of livestock rearing .Additionally, green spaces play a vital role in promoting human health and well-being. Access to these areas has been proven to

alleviate stress and enhance mental health. Preserving green cover amidst large-scale construction projects, like dams, is crucial not only for environmental conservation but also for the welfare of local ecosystems and the communities relying on them.

Biodiversity Loss (Flora and Fauna)

Rivers serve as vital components within diverse landscapes, acting as natural conduits for energy, matter, and various species, crucial in regulating and preserving landscape biodiversity (Nilsson and Jansson, 1995). However, the construction of dams profoundly alters the established patterns of disturbances that river flora and fauna have adapted to over time. These ecosystems have evolved to withstand the specific rhythms of their rivers—navigating floods, droughts, and varying current speeds. The impact of dam construction on biodiversity loss has sparked notable concern, with 78% of affected individuals expressing heightened worries about the consequences. The loss of biodiversity presents a critical issue due to its adverse effects on ecosystem functionality and the provision of essential services for human well-being, including clean air, water, food, and medicinal resources. Moreover, such losses can significantly impact various economic sectors like agriculture, forestry, and tourism. Interestingly, a minority, 21% of the local populace, did not express apprehension towards the observed biodiversity decline resulting from the dam's construction.

Access to common Property

In the Chamera-II region, approximately 91% of respondents express a belief that the loss of their shared communal property around the project areas was primarily due to the requisition of land by the project or its submergence. Hydropower project authorities obtained land from various villages to cater to the development and infrastructure requirements of the project, such as the powerhouse site, head race tunnel, link road, and residential colony, among other purposes. These lands encompassed common resources, including barren land, traditional water sources, forests, and pasture lands, serving the collective non-agricultural needs and household activities of the villagers. The usage of these communal properties, accessible to all villagers in the past, has now been restricted, depriving the local community of their once-shared resources. Importantly, no monetary compensation has been provided to the affected individuals in return for this loss. Consequently, the villagers find themselves excluded from utilizing lands and resources integral to their non-agricultural activities, without receiving any financial recompense for the acquired property. Few respondents from Rajera claimed that due to construction they have been restricted to collect firewood from the forest which leads to no traditional Chula fire in such rural areas. This situation has left a significant impact on the community's traditional practices and daily livelihoods, creating a sense of loss and deprivation among the affected populace without appropriate recourse.

Loss of Natural resources

88% of survey respondents concur that the construction of a hydropower project has caused the depletion of natural resources due to various prevalent activities linked with the project. These encompass infrastructural development, road construction, tunnel boring, muck

dumping, powerhouse-related operations, and siltation in riverbeds and downstream reservoirs, primarily stemming from muck dumping. Local villagers assert that the indiscriminate dumping of muck occurred without the necessary approval from relevant authorities, adversely affecting land patches, leading to desiccation and closure of water sources. Consequently, this has had a detrimental impact on the growth and yield of wild plants and crops in terraced hill farming. The loss of natural resources, including forests, freshwater, minerals, and wildlife, has significantly impacted the environment and social fabric. People claimed that there is disappearance of natural springs. Villagers are concerned about the decline in available resources, which poses various environmental and social challenges. Overall, the depletion of natural resources through these activities has wide-ranging implications, signaling the need for sustainable resource management to ensure the long-term availability of resources and maintain the planet's health and the well-being of its inhabitants. It is imperative to address these issues for the preservation of the environment and the communities reliant on these resources.

Ethnobotanical Species

These species represent a diverse array of plants deeply intertwined with different human cultures, historically utilized for medicinal, ceremonial, nutritional, and various other purposes. This relationship denotes the intrinsic connection between people and plants, underscoring how communities have harnessed plants for their well-being across time. Concerns arise regarding the impact of Dam or Hydropower projects on local ethnobotanical plant use. A substantial 75% of respondents perceive a decline in the utilization of these plants post-construction, attributing this shift to the presumed destruction or submersion of a significant number of species due to the dam's presence. The listed plant species—*Achyranthes bidentata* (Puthknda), *Bauhinia variegate* (Kachnar), *Berberis lycium* (Kasmal), *Cannabis sativa* (Bhang), and others—have historically held cultural and utilitarian significance among local populations for their ethnobotanical applications. Local reliance on these plants for their various uses reflects a rich tapestry of traditional knowledge and practices. However, the perceived impact of large-scale infrastructure projects, like dam construction, raises concerns about the potential loss or disruption of these valuable botanical resources. Preserving and understanding the ethnobotanical heritage is crucial for sustaining this intricate relationship between communities and their plant resources.

Wild edible fruits

Wild edible fruits refer to fruits that naturally grow in the wild and are safe for human consumption. These fruits are not cultivated and thrive in various ecosystems like forests, fields, deserts, and wetlands. However, there's concern among 64% of respondents in the surrounding area regarding the disappearance of various wild edible fruit species after the construction of a Hydropower project. This disappearance could be attributed to the construction process or the submerging of land due to the dam. The disappearance of these fruits, which have been a staple for local communities for a long time, includes species such

as *Berberis lyceum* (Kashmal), *Carissa spinarum* (Garna), *Celtis australis* (Khadak), *Ficus auriculata* (Trimbal), *Ficus palmata* (Fegda), *Fragaria nubicola* (Wild Strawberry), *Grewia optiva (Dhaman)*, *Morus alba* (Shehtoot), *Prinsepia utilis* (Bhekhad), *Prunus persica* (Jangli Aadu), *Prunus armaniaca* (Chir), *Punica granatum* (Dadu), *Pyrus pashia* (Kainth), *Rubus ellipticus* (Aakhre), *Zizyphus mauritiana* (Ber), and more. The conflict arises as local people accuse the authorities of not considering the ecological and environmental impact in their compensation and long-term planning following the construction. This oversight has led to distress and concern among the community due to the loss of these vital resources and the lack of foresight in preserving the local ecosystem.

Ecological cycle disturbances

Ecological cycle disturbances encompass disruptions to the intricate balance of natural processes vital for the functioning of ecosystems. These disturbances manifest in various ways, from natural disasters such as hurricanes, floods, and fires to those induced by human activities like deforestation, pollution, and overfishing. Healthy ecosystems depend on a delicate equilibrium among diverse ecological cycles that support life. Large dam construction can significantly impact ecological cycles. Dams alter the natural flow of rivers, disrupting the water cycle and the habitats of various species. These structures impede the movement of sediments and nutrients downstream, affecting the soil fertility and the survival of organisms that rely on these resources. Additionally, dam construction can influence the life cycles of aquatic species, blocking fish migration routes and altering their breeding and feeding patterns. The modifications in water levels and flows can also impact the local climate and vegetation, affecting the habitats and food sources of numerous terrestrial species. The responses you mentioned, indicating a strong agreement (67%), suggest a widespread concern among respondents regarding the ecological disturbances caused by large dam constructions. This aligns with the understanding that such developments can significantly disrupt the delicate balance of ecological cycles within affected ecosystems.

Loss of water mills

The disappearance of water mills, locally known as 'Gharats,' reflects a loss of a traditional practice deeply rooted in the region. These mills, fashioned from readily available natural resources, utilized the force of water from streams and rivulets, serving as an eco-friendly means of livelihood for the 'Gharatis,' their owners. For generations, these mills stood as a hallmark of tradition, fostering social cohesion within communities. The flour produced by the Gharats was renowned for its superior taste and health benefits. With their construction and maintenance relying on easily accessible bioresources, these water mills were not only economically feasible but also sustainable and reliable, especially in areas lacking proper electricity supply. Particularly suitable for hilly terrains with ample water sources, they served as a significant income source. However, 92% local respondents' stark reality is that these traditional water mills have all but disappeared from the landscape. The construction of hydroelectric projects altered water courses, leading to a decline in the number of operational

water mills. Consequently, Gharatis now struggle to operate their mills due to the changed water dynamics. While higher authorities offer compensation to the mill owners, these gestures result in the removal of these cultural symbols without any plan for their revival, depriving local communities of an integral part of their heritage.

Microclimate change (rainfall, temperature)

A significant majority, comprising 83% of respondents living near a hydropower project, attribute local climate changes to the construction of large dams. Their belief is rooted in the speculation that the dryness resulting from multiple dam projects along river lengths might trigger alterations in the microclimate. Specifically, concerns are raised about potential temperature increases within the river valley due to this transformation. Microclimates, delicate and localized climatic conditions, are subject to a variety of influences. These encompass topography, vegetation cover, human activities, and local weather patterns. In the context of dam construction, the potential impact on the microclimate arises from the extensive drying of river segments. This drying is linked to changes in the immediate weather patterns and conditions, which, in turn, can lead to alterations in the local climate of the river valley. The prevalent perception among the nearby population reflects a deep-seated connection between large-scale construction projects and consequential alterations in the microclimate, emphasizing the intricate interplay of various environmental factors in shaping local weather conditions.

Discussion

Development and environment are two sides of the same coin and it is recognized that sustainable development is not possible without adequate environmental protection measures. Because water is held behind the dam and often released from some depth, the temperature of the water below the dam is usually lower than it would be prior to dam emplacement. The loss of natural flows also affects anthropocentric values of rivers, i.e., social, economic, cultural, aesthetic and recreational values. Rivers are central elements in many landscapes. They are important natural corridors for the flows of energy, matter and species, and are often key elements in the regulation and maintenance of landscape biodiversity (Nilsson and Jansson, 1995).

Population growth and development in technology and constructions such as building large cities and building roads, bridges and dams have led to an imbalance in the ecosystem and a loss of the ecological balance (Huesemann and Huesemann, 2011). When planning the construction of any project, we should pay attention to the environmental problems and how this project will affect the community and the organisms, it is not necessary to pay attention only to the economic value (Richter et al., 2010).

Among the development projects, large dams are of great interest to the agencies and the World Bank (Ledec and Quintero, 2003). Dams produce many negative impacts on the environment and society, including during construction, and these end after the completion of construction, but the most serious impacts are in the operational phase, which

lasts for thousands of years. It may also result from civil works, such as building roads, drilling, power transmission lines, and others.

In a survey respondents expressed concerns about the reduction of green cover due to the dam's construction. When building dams, this leads to changes in land use, especially if forests are removed to create roads, which is the loss of biodiversity and the acceleration of erosion (Patz et al., 2000). Additionally, green spaces play a vital role in promoting human health and well-being. Access to these areas has been proven to alleviate stress and enhance mental health. Preserving green cover amidst large-scale construction projects, like dams, is crucial not only for environmental conservation but also for the welfare of local ecosystems and the communities relying on them. Whereas, Land use change is a fundamental process driven by human activity, altering natural landscapes to serve economic functions. (Beilfuss et al., 2000) Balancing the benefits of hydropower with its ecological impacts remains a crucial challenge in sustaining both energy needs and environmental conservation. Efforts to minimize adverse land-use changes while harnessing hydropower's potential are imperative for a sustainable future.

Rivers serve as vital components within diverse landscapes, acting as natural conduits for energy, matter, and various species, crucial in regulating and preserving landscape biodiversity (Nilsson and Jansson, 1995). The closing of the rivers by the dams deeply modify the local aquatic ecology, which shift from river to lake habitat (Ward et al., 1998). Dams suppress sediments that would naturally regenerate downstream ecosystems and because of this, some endemic species may or may not survive environmental changes. However, dams have altered and made the main ecosystem. It adapts to this change, and it is clear from the construction of dams and reservoirs that they reduce the diversity of wildlife, either for better or for worse, and also leads to the loss of habitats for many organisms (Power et al., 1996). The impact of dam construction on biodiversity loss has sparked notable concern, with 78% of affected individuals expressing heightened worries about the consequences. The loss of biodiversity presents a critical issue due to its adverse effects on ecosystem functionality and the provision of essential services for human well-being, including clean air, water, food, and medicinal resources.

The construction of a hydropower project has caused the depletion of natural resources due to various prevalent activities linked with the project. There is a timber and/or biomass clearance this could disturb many of the larger animals and cause them to leave the area. Even if these activities do not occur most large animals, and highly mobile small animals, will successfully leave the area as the water rises (Barraclough and Ghimire, 1995)

Consequently, this has had a detrimental impact on the growth and yield of wild plants and crops in terraced hill farming. The loss of natural resources, including forests, freshwater, minerals, and wildlife, has significantly impacted the environment and social fabric. It is imperative to address these issues for the preservation of the environment and the communities reliant on these resources. Concerns arise regarding the impact of Dam or

Hydropower projects on local ethnobotanical plant use and wild fruit plants. Local reliance on these plants for their various uses reflects a rich tapestry of traditional knowledge and practices. However, the perceived impact of large-scale infrastructure projects, like dam construction, raises concerns about the potential loss or disruption of these valuable botanical resources. Preserving and understanding the ethnobotanical heritage is crucial for sustaining this intricate relationship between communities and their plant resources. The conflict arises as local people accuse the authorities of not considering the ecological and environmental impact in their compensation and long-term planning following the construction. This oversight has led to distress and concern among the community due to the loss of these vital resources and the lack of foresight in preserving the local ecosystem.

Ecological cycle disturbances encompass disruptions to the intricate balance of natural processes vital for the functioning of ecosystems. Large dam construction can significantly impact ecological cycles. Dams alter the natural flow of rivers, disrupting the water cycle and the habitats of various species. These structures impede the movement of sediments and nutrients downstream, affecting the soil fertility and the survival of organisms that rely on these resources.

Additionally, dam construction can influence the life cycles of aquatic species, blocking fish migration routes and altering their breeding and feeding patterns. Reservoirs may contribute to changes in Earth's climate. Hot climate reservoirs generate methane, which is one of the greenhouse gases at stratigraphic reservoirs, which are below the oxygen layers (meaning they lack oxygen), and this leads to the degradation of biomass through anaerobic processes (Roht-Arriaza, 2009). In the borrowing area, noise and dust are generated by vehicles, earth moving equipment, various sirens, sirens and the occasional detonation of explosives affects the habitat of wildlife such as birds and animals (Schexnayder and Ernzen 1999; Ouren et al., 2007).

Thus, a wide array of renewable energy technologies like biomass, hydel, solar etc. have been harnessed especially for rural areas .At one time, the water mill (*Gharats)* were considered as the life line and an integral part of the villagers inhabiting rural mountain areas. Many places of district Chamba, which were accustomed to grinding flour and other foods of antiquity, are witnessing a decline in the number of *Gharats* at present. The construction of various hydro-electric projects have led to changed water courses causing decline in the number of water mills due to which the *Gharatis* find difficulty in operating *Gharats* (Sharma & Rana, 2014; Slariya, 2013; Wilson, 2007). Consequently, Gharatis now struggle to operate their mills due to the changed water dynamics. While higher authorities offer compensation to the mill owners, these gestures result in the removal of these cultural symbols without any plan for their revival, depriving local communities of an integral part of their heritage.

Microclimate change a significant majority, comprising 83% of respondents living near a hydropower project, attribute local climate changes to the construction of large dams.

The impounding of the reservoir creates a large water body that may influence the local climate (Marsalek et al.,2008). Microclimates, delicate and localized climatic conditions, are subject to a variety of influences. These encompass topography, vegetation cover, human activities, and local weather patterns. In the context of dam construction, the potential impact on the microclimate arises from the extensive drying of river segments. This drying is linked to changes in the immediate weather patterns and conditions, which, in turn, can lead to alterations in the local climate of the river valley.

Conclusion

Global conflicts over natural resources have surged in recent decades, becoming pervasive on a global scale. In the context of modern capitalism, a profound structural conflict emerges between the economy's inclination towards globalization and its vehicle for realization, the nation-state. Resolving this conflict appears contingent on the global expansion of not just the economy, but also politics and culture. This expansion serves as a key factor in comprehending the escalating disputes over natural resources. Environmental conflicts, therefore, manifest when social groups with distinct approaches to appropriating, utilizing, and attributing meaning to territory find their established environmental practices threatened by undesired impacts. These impacts, transmitted through soil, water, or living systems, arise from the activities of other social groups, giving rise to tensions and conflicts on a global scale.

The study's primary focus was on assessing the profound impacts of dams, with particular attention to their repercussions on water and air quality, as well as natural resources. These aspects, being fundamental elements directly affecting both humans and animals, were identified as pivotal considerations. The adverse effects on water quality were attributed to excessive sediment release, pollution from hazardous materials, household wastewater, and solid waste. Equally concerning was the emission of greenhouse gases, identified as the most perilous impact on air quality. Additionally, the environmental footprint extended to encompass submergence, deforestation, loss of flora and fauna, and soil erosion.

Despite the myriad of environmental impacts, the report acknowledged the implementation of comprehensive mitigation measures. The NHPC (National Hydroelectric Power Corporation) undertook these measures to counterbalance the adverse effects of dam construction and enhance the overall socio-economic environment in the region. However, the study underscored the insufficiency of these mitigation efforts.

While the local community acknowledged the Chamera Hydropower project for providing them with ample electricity, discontent loomed on the environmental and ecological fronts. The key recommendation for policymakers emphasized the imperative inclusion of public participation at critical stages of energy projects, particularly at the project's inception. This inclusion should specifically address concerns related to the local environment and natural resources. By incorporating public perspectives on future

developments, planners and investors could proactively avoid and manage potential social and environmental conflicts.

An ethical recommendation proposed the integration of environmental justice criteria into Environmental Impact Assessments (EIA), with a focus on addressing inequality. This measure aimed to prevent disadvantaged areas from becoming preferred destinations for polluting enterprises. The report highlighted the consensus among policymakers that sustainable development necessitates public participation in decision-making processes. However, it raised concerns about the tribal landscape where projects, despite local opposition, receive EIA approval, potentially perpetuating tensions between local communities and environmental decision-making bodies.

To foster a sustainable future in developing countries, the report advocated for a shift in decision-making logic from a "top-down" approach to one that is socially inclusive in a substantive manner. Emphasizing social participation as a means to enhance communication between local communities, authorities, and investors, the study concluded that a truly sustainable future requires a departure from exclusive decision-making practices.

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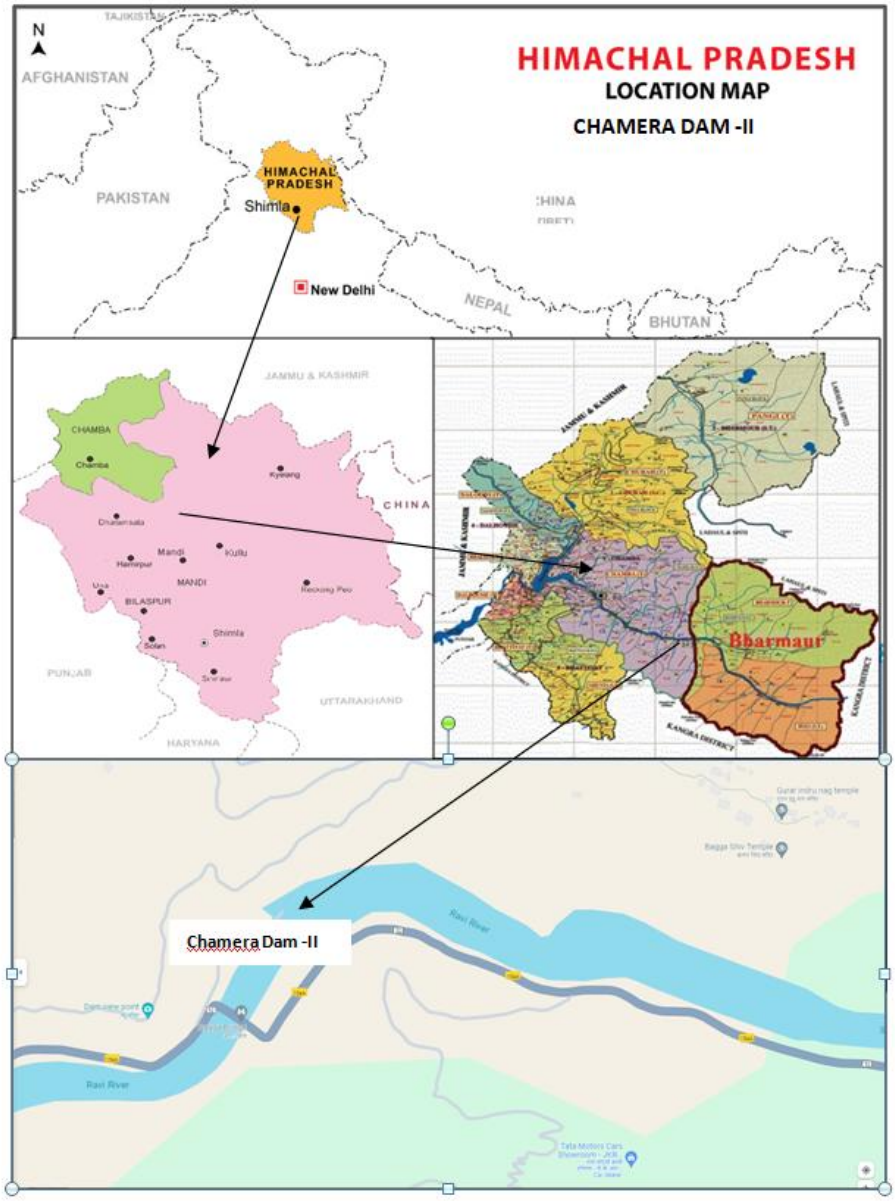

Fig: Location Map of Chamera Dam -II

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Fig 1:-People Perception vis-à-vis Environmental Conflict due to Hydropower Projects

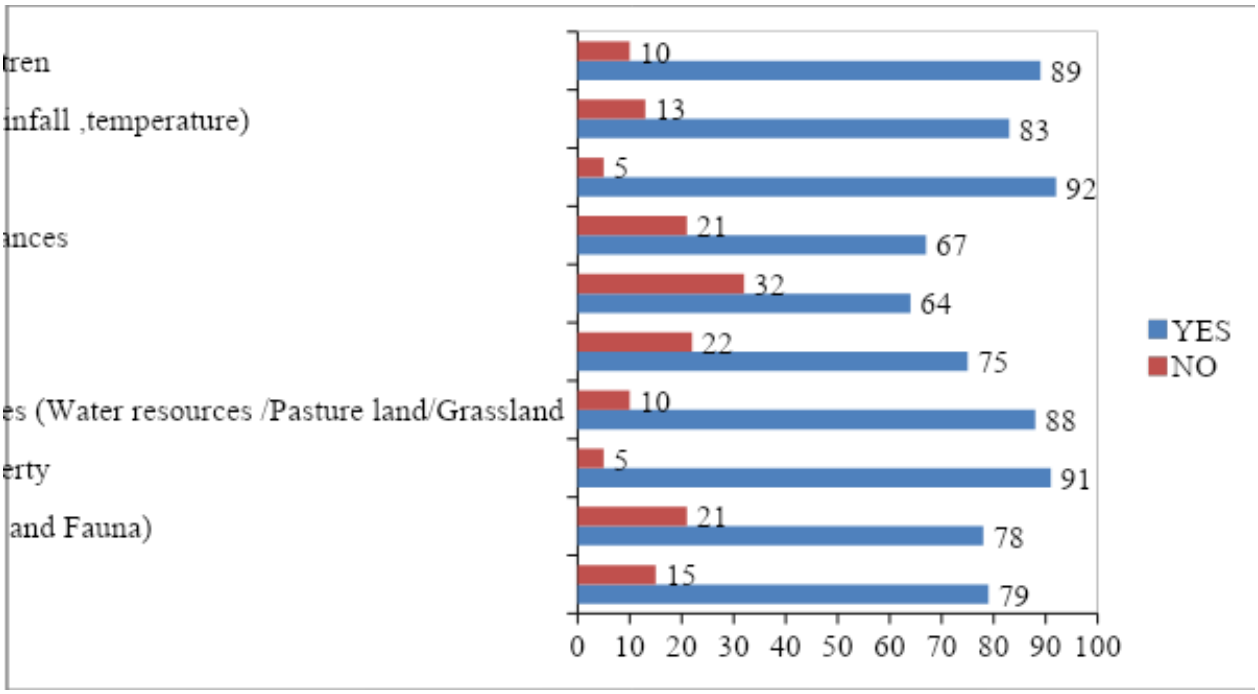

Fig: Pic of Chamera Dam -II