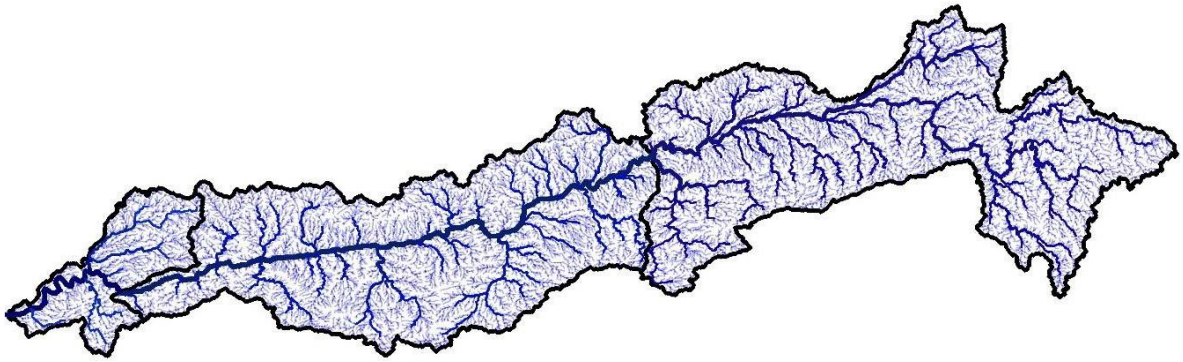




National River Conservation Directorate
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

Social Environment of Narmada River Basin

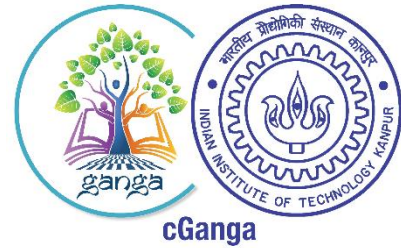


March 2025



© cNarmada, cGanga and NRCD, 2024

Social Environment of Narmada River Basin



National River Conservation Directorate (NRC D)

The National River Conservation Directorate, functioning under the Department of Water Resources, River Development & Ganga Rejuvenation, and Ministry of Jal Shakti providing financial assistance to the State Government for conservation of rivers under the Centrally Sponsored Schemes of 'National River Conservation Plan (NRCP)'. National River Conservation Plan to the State Governments/ local bodies to set up infrastructure for pollution abatement of rivers in identified polluted river stretches based on proposals received from the State Governments/ local bodies.

www.nrcd.nic.in

Centres for Narmada River Basin Management and Studies (cNarmada)

The Center for Narmada River Basin Management and Studies (cNarmada) is a Brain Trust dedicated to River Science and River Basin Management. Established in 2024 by IIT Gandhinagar and IIT Indore, under the supervision of cGanga at IIT Kanpur, the center serves as a knowledge wing of the National River Conservation Directorate (NRC D). cNarmada is committed to restoring and conserving the Narmada River and its resources through the collation of information and knowledge, research and development, planning, monitoring, education, advocacy, and stakeholder engagement.

www.cnarmada.org

Centres for Ganga River Basin Management and Studies (cGanga)

cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this, it is also responsible for introducing new technologies, innovations, and solutions into India.

www.cganga.org

Acknowledgment

This report is a comprehensive outcome of the project jointly executed by IIT Gandhinagar (Lead Institute) and IIT Indore (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRC D) in 2024. We gratefully acknowledge the individuals who provided information and photographs for this report.

Team Members

Pranab Kumar Mohapatra, cNarmada, IIT Gandhinagar
Deepak Singhania, cNarmada, IIT Gandhinagar
Vikrant Jain, cNarmada, IIT Gandhinagar
Vimal Mishra, cNarmada, IIT Gandhinagar
Udit Bhatia, cNarmada, IIT Gandhinagar
Ashootosh Mandpe, cNarmada, IIT Indore
Kiran Bala, cNarmada, IIT Indore
Manish Kumar Goyal, cNarmada, IIT Indore
Mayur Shirish Jain, cNarmada, IIT Indore
Preeti Sharma, cNarmada, IIT Indore
Priyank Sharma, cNarmada, IIT Indore
Vinod Tare, cGanga, IIT Kanpur

PREFACE

This report examines the key institutions, programmes, and stakeholders involved in the management of the Narmada River Basin. It outlines the role of central and state agencies, non-governmental organizations (NGOs), and community groups in shaping policies and interventions related to the river's governance. The report also discusses major environmental and social challenges, including pollution, displacement, and resource conflicts, while highlighting examples of enabling and constraining factors in policy implementation.

A key focus of this report is on how different actors interact in managing the river's resources. It explores strategies that have contributed to sustainable and inclusive governance, as well as barriers that have limited progress. Additionally, it identifies lessons from past initiatives, emphasizing approaches that have fostered cooperation between communities, government agencies, and civil society.

We would like to thank the individuals and organizations who contributed to the development of this report. In particular, we acknowledge the support and insights provided by government agencies, state institutions, NGOs, community organizations, and citizens who participated in our public outreach in the Narmada River Basin. Their input has been invaluable in shaping this work.

We hope that this report serves as a useful resource for policymakers, researchers, and practitioners working toward sustainable and equitable river basin management. By fostering informed dialogue and collaborative action, we can contribute to the long-term protection of the Narmada River and the well-being of the communities that depend on it.

Centre for Narmada River Basin Management and Studies (cNarmada)
IIT Gandhinagar

Table of Contents

PREFACE	4
Introduction	7
Identification of Key Institutions in Basin Areas	12
Central Government Agencies	12
State Government Agencies.....	15
Non-governmental Organisation.....	19
Community Organisations.....	19
Identification of Key Programmes (aims, outcomes, & gaps)	19
Central Government Agencies	Error! Bookmark not defined.
State Government Agencies.....	Error! Bookmark not defined.
Non-governmental Organisation.....	Error! Bookmark not defined.
Community Organisations.....	Error! Bookmark not defined.
Identifying Key Stakeholders (those with direct claim to river)	29
Households.....	29
Farmers	33
Workers	34
Local firms	Error! Bookmark not defined.
Examples of enabling/constraining elements to implementation of policies and programmes (e.g. role of information, awareness, social movements, litigations, etc.)	36
What works for co-existence.....	Error! Bookmark not defined.
What doesn't work for co-existence	Error! Bookmark not defined.
Identifying strategies to address constraints through creating public awareness and encouraging participation	37
REFERENCES	41

Table of Figures

Figure 1: Protest Against Omkareshwar Dam in 2007. Source: International Rivers (2012). 10

Introduction

The Narmada River, one of India's major rivers, flows westwards through central India—primarily in Madhya Pradesh and Gujarat states and parts of Chhattisgarh and Maharashtra—before reaching the Arabian Sea. The river basin provides crucial water resources for drinking, agriculture, and industry and sustains rich cultural and social landscapes. This report describes the social environment of the Narmada River Basin, identifying the key institutions and programmes influencing its management, the stakeholders who depend on its resources, and the factors that enable or constrain effective policy implementation. With a recognition of the governance framework set out by both the Union and State Governments (as per the federal sharing of powers in the Constitution of India), the report aims to present an understanding of current practices, challenges, and strategies for future inclusive and sustainable development.

Brief History of the Social Environment

The roots of social mobilizations along the Narmada can be traced back to the colonial period when the British administration introduced policies that restricted traditional access to forests and riverine resources (Gadgil & Guha, 1995). The colonial state's focus on revenue generation through commercial forestry and irrigation projects laid the foundation for negotiations between the state and local communities.

After independence, large-scale infrastructural projects gained momentum under India's planned economic development model. The idea of harnessing the Narmada's waters for irrigation and hydropower took shape in the 1940s and 1950s, culminating in the Narmada Valley Development Project (NVDP). However, even in these early years, affected communities and environmentalists began to challenge the wisdom of such projects, foreshadowing later movements.

In the 1970s, developmental projects accelerated, leading to increasing displacement and environmental degradation. The construction of smaller dams and mining expansion in the upper Narmada basin disrupted the lives of local villagers, predominantly tribal communities. Initial resistance was localized, focusing on land acquisition, deforestation, and the erosion of traditional rights (Baviskar, 1995).

During the 1980s, social movements gained more organized structures. The growing environmental consciousness among activists, coupled with the intensification of industrial activities, led to broader alliances between environmentalists, tribal leaders, and human rights organizations. This period marked the beginning of mass protests, demands for environmental assessments, and legal interventions to halt unregulated development.¹

Public Concerns

The contestation over the Narmada River is deeply tied to concerns about environmental degradation, deforestation, and pollution. For decades, activists, scholars, and local communities have voiced concerns about the impact of industrialization, mining, and dam construction on the river's ecological health. This section explores how these issues have unfolded as focal points of resistance.

Deforestation and Biodiversity Loss

The rapid expansion of mining and industrial activities along the Narmada's banks resulted in large-scale deforestation, which not only degraded the local ecology but also disrupted the traditional ways of life for indigenous communities. Activists argued that the loss of forests led to soil erosion, reduced water quality, and the overall destabilization of river ecosystems (Gadgil & Guha, 1995).

Water Pollution and Mining

Mining activities in the upper catchments of the river exacerbated water pollution, leading to contamination that affected agriculture and human health. Industrial effluents and mining waste poured into the river, affecting fish populations and drinking water quality. This contestation over water resources became a significant rallying point for activists, who demanded stricter enforcement of pollution control measures.

Displacement of Tribal Communities

One of the most emotive issues in the Narmada valley has been the displacement of tribal communities. Dam construction projects—most notably the Sardar Sarovar Dam—necessitated the relocation of thousands of indigenous people. The forced displacement led to the loss of traditional lands, livelihoods, and cultural practices. Prominent organizations such as the Arch-Vahini or Narmada Bachao Andolan (NBA) led by Medha Patkar emerged as

¹ For instance, Arch-Vahini (Action Research in Community Health) and Narmada Bachao Andolan, among other NGOs, were established in the 1980s.

vocal critics of the state's rehabilitation policies, arguing that compensation was inadequate and that the social fabric of tribal life was being irreversibly damaged (Kothari 1996).

Another prominent figure in the Narmada movement was Baba Amte, a social activist who initially gained recognition for his work with leprosy patients. He later dedicated himself to environmental causes, including the Narmada Bachao Andolan. His involvement brought significant attention to the movement, and his ashram became a hub for activists and supporters. His commitment to social justice and environmental preservation made him a revered figure in the struggle against large dam projects.

Court Proceedings and Legal Battles

The fight for land rights soon found its way into the judicial arena. Landmark court cases questioned the legality of land acquisition processes, the adequacy of rehabilitation measures, and the environmental clearances granted for dam construction. Several cases brought before the Supreme Court of India examined the balance between economic development and the preservation of ecological and cultural heritage. These judicial proceedings became emblematic of a broader struggle for accountability and transparency in developmental policies.

State-Centre Relations

The Narmada social movements have also highlighted the complexities of federal relations in India. The river flows through multiple states, making its management a contested issue between state governments and the Union government. The Narmada Control Authority (NCA), under the Ministry of Jal Shakti, oversees inter-state water disputes and project implementation. However, tensions between the Centre and state governments—especially Gujarat and Madhya Pradesh—have shaped policy decisions. While Gujarat has historically pushed for dam construction citing economic benefits, Madhya Pradesh has had to deal with the bulk of displacement.

Negotiating Development

While organizations like the NBA enjoyed broad support and played their part in holding the state to account, this support was not sustained. Judith Whitehead's (2007) article "Submerged and submerging voices: hegemony and the decline of the Narmada Bachao Andolan in Gujarat, 1998–2001" explains that the loss of popular support for the NBA in Gujarat was not due to a single failure, but rather a confluence of external pressures and internal missteps that eroded its grassroots appeal.

A primary external factor was the transformation of agrarian relations in rural Gujarat. Whitehead argues that the capitalist restructuring of agriculture—particularly through the expansion of sugarcane cultivation—created a repressive environment where rich farmers and agrarian capitalists maintained their dominance over tribal populations through force and debt. This “accumulation by dispossession” meant that many poor peasants and adivasis experienced relentless land appropriation and exploitation. In this context, the NBA’s focus on opposing the technological spectacle of dam construction failed to resonate with those who suffered under these broader economic forces. The movement’s singular emphasis on the negative impacts of large dams, without linking these to the pervasive patterns of dispossession affecting many rural communities, alienated those who were equally, if not more, affected by the changes in agrarian capitalism.



Figure 1: Protest Against Omkareshwar Dam in 2007. Source: International Rivers (2012).

Internally, the NBA was hampered by its own ideological choices. Whitehead highlights that the NBA adopted a neo-Gandhian environmental discourse that romanticized small-scale,

harmonious living and depicted large dams as the sole villains responsible for social injustice and ecological degradation. This narrative, while attractive on the international stage, resonated poorly with local adivasis. Instead of confronting the reality of a harsh agrarian economy where accumulation by dispossession was the norm, the NBA's emphasis on technology and environmental destruction came off as detached and idealistic. Many local supporters felt that the movement's rhetoric was imposed from above by urban, middle-class activists who did not fully understand the local context. As a result, the adivasis—whose lives were upended by both displacement and chronic exploitation—began to view the NBA as unrepresentative of their real struggles.

Whitehead also points to the consequences of legal setbacks, notably the negative Supreme Court decision in 2000, which further undermined the movement's credibility. The court's dismissal of the NBA's Public Interest Litigation not only symbolized the triumph of state and capitalist interests but also contributed to internal divisions. Some tribal leaders, facing the dual pressures of ongoing displacement and a pro-development state apparatus, opted to accept government settlements. This decision fractured the movement, as those who remained with the NBA became increasingly isolated and demoralized.

Looking to the future, Whitehead implies that social movements in the region must evolve if they are to regain legitimacy and effectiveness. Movements like the NBA need to broaden their critique to address the underlying processes of accumulation by dispossession rather than focusing narrowly on technology and legal battles. They must also strive to bridge the gap between urban activists and the local communities they claim to represent, ensuring that their strategies are rooted in the lived realities of those most affected. Without such a recalibration, future social movements risk remaining fragmented and vulnerable to state and capitalist pressures, ultimately failing to secure genuine social and environmental justice in the region.

The history of social movements along the Narmada River underscores the resilience of local communities in the face of developmental pressures. The struggles over environmental degradation, displacement, and cultural loss have shaped a highly conscious and engaged social environment. As the future unfolds, it is likely that the Indian state will face continued scrutiny and demands for greater accountability in policymaking. The growing awareness and

activism surrounding the Narmada suggest that future development projects will have to be approached with greater sensitivity to environmental and social justice concerns.

Identification of Key Institutions in Basin Areas

Central Government Agencies

Central government agencies provide overarching policy direction, technical expertise, and financial support for the integrated management of the Narmada Basin. Key agencies include the Ministry of Jal Shakti, Ministry of Environment, Forest and Climate Change (MoEFCC), National River Conservation Directorate (under the MOEFCC), and the Narmada Control Authority (NCA).

Ministry of Jal Shakti

Mandate & Functions: This ministry is the nodal authority for water resource management in India. It is responsible for formulating policies related to water conservation, irrigation, and sanitation. Within its structure, the Department of Water Resources, River Development & Ganga Rejuvenation (while primarily focused on the Ganga, its integrated water management approaches are also applicable to the Narmada Basin) plays a vital role in project planning and implementation.

Key Initiatives in the Basin: The ministry supports projects that promote integrated river basin management, encourages sustainable water use practices, and coordinates inter-state water sharing. It often collaborates with the Narmada Control Authority (NCA), a statutory body tasked specifically with overseeing the implementation of major river projects in the Narmada region.

Ministry of Environment, Forest and Climate Change (MoEFCC)

Mandate & Functions: MoEFCC is charged with ensuring that developmental projects in the basin comply with environmental norms. It oversees environmental impact assessments (EIA) for large-scale infrastructural projects, including dam construction and riverfront development, thereby ensuring that ecological and biodiversity concerns are addressed.

Role in the Narmada Basin: The ministry's guidelines help mitigate adverse environmental impacts, enforce pollution control measures, and promote restoration initiatives. It works

closely with state pollution control boards and environmental bodies to monitor compliance and safeguard local ecosystems.

National River Conservation Directorate

Mandate & Functions: Operating under the MoEFCC, this directorate is involved in river conservation efforts nationwide. Its responsibilities include coordinating pollution control measures, river rejuvenation projects, and the implementation of sustainable management practices.

Relevance to the Basin: In the context of the Narmada Basin, the directorate supports projects aimed at reducing industrial and municipal pollution, as well as promoting community-led river conservation initiatives.

Central Pollution Control Board

The Central Pollution Control Board (CPCB) is the apex environmental regulatory body in India, established under the Environment (Protection) Act, 1986. With its mandate to formulate and enforce national standards for water, air, and soil quality, the CPCB plays a pivotal role in monitoring and regulating river pollution across the country. This is particularly significant in river basins like the Narmada, where ecological sustainability, public health, and socio-economic activities depend heavily on maintaining good water quality.

One of the primary responsibilities of the CPCB is to develop and update guidelines for water quality monitoring. These guidelines are implemented through a nationwide monitoring network that gathers data on various parameters such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), pH, and the concentration of heavy metals and nutrients. This data not only helps in assessing the overall health of river systems but also serves as the basis for regulatory action against industries and municipal bodies that discharge pollutants into these water bodies (Central Pollution Control Board, n.d.).

In the context of the Narmada River Basin, the CPCB's role has been particularly significant. The Narmada is one of India's most important rivers, supporting millions of people along its course and contributing substantially to the state economies of Madhya Pradesh, Maharashtra, and Gujarat. Recognizing the vital importance of the Narmada, the CPCB has

been actively involved in monitoring its water quality. This includes regular sampling at strategic locations along the river, analyzing the data for compliance with national water quality standards, and identifying pollution hotspots where industrial effluents or agricultural runoff may be compromising the river's health.

CPCB's river pollution policies are closely aligned with the Water (Prevention and Control of Pollution) Act, 1974. Under this act, industries are required to obtain consent before discharging effluents into any water body. The CPCB, in collaboration with state pollution control boards, oversees the consent process, ensuring that all discharge limits are strictly adhered to. For the Narmada River Basin, this means that both point-source pollution from industrial units and non-point source pollution from agricultural activities are closely scrutinized. The Board's initiatives, such as the National River Conservation Plan (NRCP) and the subsequent National River Action Plan (NRAP), have also been instrumental in guiding river rejuvenation efforts, including those focused on the Narmada (Central Pollution Control Board, n.d.).

Beyond monitoring and enforcement, the CPCB also emphasizes public participation and awareness. The Board disseminates its monitoring results through regular reports and makes data accessible online, thereby empowering local communities, researchers, and policymakers with the information needed to advocate for improved water management practices. In regions like the Narmada Basin, where local communities are directly affected by pollution, such transparency helps build trust and fosters collaborative efforts between the government and the public.

Despite its comprehensive framework, the CPCB faces challenges including limited resources, the vast geographical spread of pollution sources, and the complexity of pollution in rapidly industrializing regions. In response, the CPCB continuously revises its monitoring protocols and explores technological advancements, such as real-time data transmission and advanced analytical methods, to enhance its regulatory effectiveness.

In summary, the Central Pollution Control Board is central to India's efforts to control river pollution. Its policies and monitoring systems ensure that critical river basins like the Narmada are regularly assessed, regulated, and protected. Through a combination of strict regulatory enforcement, data-driven monitoring, and active public engagement, the CPCB

strives to maintain the water quality of India's rivers, ensuring that they remain vital lifelines for both ecological balance and human development.

Narmada Control Authority (NCA)

Mandate & Functions: Although often referenced separately, the NCA is a key statutory body established by the Government of India. It supervises the planning, design, and execution of the Narmada Valley Development Projects.

Key Contributions: The NCA ensures that large infrastructural projects, such as the Sardar Sarovar Dam, adhere to established safety, rehabilitation, and environmental standards. It plays an essential role in balancing developmental goals with socio-environmental safeguards.

These agencies collectively frame the national strategy for managing water resources and environmental sustainability in the basin, ensuring that development is balanced with ecological preservation and social equity.

State Government Agencies

Madhya Pradesh Pollution Control Board (MPPCB) and River Pollution

The Madhya Pradesh Pollution Control Board (MPPCB) is the principal state agency responsible for preventing and controlling water pollution across Madhya Pradesh. Established under the Water (Prevention and Control of Pollution) Act, 1974, MPPCB is tasked with maintaining the health and usability of water bodies—including the vital rivers such as the Narmada, Chambal, and Betwa. The Board's efforts are critical for preserving river water quality, which directly affects agricultural productivity, public health, and ecosystem integrity (Madhya Pradesh Pollution Control Board, n.d.).

At the core of MPPCB's responsibilities is the regular monitoring of river water quality. The agency operates through a network of regional and district offices, each equipped with laboratories that perform periodic sampling and analysis of water. These laboratories measure key parameters like biochemical oxygen demand (BOD), chemical oxygen demand (COD), pH levels, and the concentration of industrial and domestic pollutants. Based on the findings, MPPCB enforces compliance with established standards and, where necessary, directs

industries to implement corrective measures before effluents are discharged into rivers. Such stringent monitoring is vital in a state where rapid industrial growth and intensive agriculture have raised significant concerns regarding river pollution (Madhya Pradesh Pollution Control Board, n.d.).

In addition to monitoring, MPPCB plays an active role in enforcing environmental regulations. The Board is empowered to take legal action against violators by imposing fines, suspending industrial operations, or mandating the installation of modern treatment technologies. These enforcement measures help curb the release of hazardous substances into the river systems and ensure that industries invest in adequate wastewater treatment facilities. This proactive approach not only protects aquatic ecosystems but also safeguards communities that rely on these rivers for drinking water and irrigation (Central Pollution Control Board, n.d.).

Collaboration with national agencies, particularly the Central Pollution Control Board (CPCB), further strengthens MPPCB's regulatory framework. Such coordination ensures that local measures align with national environmental objectives, thereby enhancing the overall effectiveness of river pollution control. Moreover, MPPCB conducts capacity-building initiatives aimed at educating local industries and communities on best practices in water management and pollution control. Through public awareness campaigns and training sessions, the Board encourages a culture of environmental stewardship among stakeholders, which is crucial for the long-term sustainability of the state's river resources.

Despite these robust efforts, challenges persist. Rapid industrialization and intensification of agricultural practices continue to strain river ecosystems, leading to instances of untreated sewage discharge and chemical runoff. Resource limitations and the vast geographical spread of pollution sources further complicate enforcement. In response, MPPCB is continuously revising its protocols, investing in advanced monitoring technologies, and collaborating with academic and research institutions to develop innovative solutions for water pollution control.

In summary, the Madhya Pradesh Pollution Control Board serves as a critical guardian of the state's river health. By combining rigorous monitoring, strict enforcement of environmental standards, inter-agency collaboration, and community engagement, MPPCB works tirelessly

to ensure that the rivers remain viable for both ecological and human use. Ongoing improvements in technology and policy, along with enhanced public awareness, are expected to bolster these efforts, ultimately contributing to a cleaner and more sustainable water environment in Madhya Pradesh (Madhya Pradesh Pollution Control Board, n.d.; Central Pollution Control Board, n.d.).

Gujarat Pollution Control Board (GPCB) and River Pollution

The Gujarat Pollution Control Board (GPCB) was established on October 15, 1974, under the provisions of the Water (Prevention and Control of Pollution) Act, 1974. Its primary mission is to protect the state's water resources by preventing and controlling pollution in rivers and other water bodies. Gujarat's major rivers, such as the Sabarmati and Mahi, are crucial for the state's agricultural, industrial, and urban activities; therefore, maintaining their water quality is a central focus for the GPCB (Gujarat Pollution Control Board, n.d.).

GPCB's responsibilities encompass a range of regulatory and monitoring functions. The Board issues consents for both the establishment and operation of industrial units that have the potential to pollute river water. This process involves a detailed assessment of proposed effluent treatment systems to ensure they meet the water quality standards stipulated under national laws. By enforcing strict guidelines on effluent discharge, GPCB minimizes the release of toxic chemicals and untreated wastewater into river systems, thereby reducing the risk of long-term environmental degradation (Gujarat Pollution Control Board, n.d.).

To monitor river water quality, GPCB has developed an extensive network of regional offices and laboratories that regularly sample water from critical points along the rivers. These samples are analyzed for pollutants such as heavy metals, organic compounds, and nutrients that may cause eutrophication. The data collected provides GPCB with a comprehensive understanding of the pollution levels in various river stretches, allowing the Board to pinpoint hotspots and implement targeted remediation measures. Such data-driven approaches are essential for prompt regulatory action and for devising long-term strategies to improve river health (Central Pollution Control Board, n.d.).

Moreover, the GPCB is actively involved in the enforcement of environmental regulations. It has the authority to impose penalties, suspend industrial operations, and require industries to upgrade their wastewater treatment processes if they fail to comply with the established

norms. This regulatory rigor is particularly important in an industrially dynamic state like Gujarat, where rapid economic growth has sometimes come at the expense of environmental quality.

In addition to its regulatory and monitoring functions, GPCB places a strong emphasis on public outreach and stakeholder engagement. The Board organizes various public awareness campaigns, workshops, and consultation meetings aimed at educating both industry representatives and the general public about the importance of river water quality. By fostering a culture of environmental responsibility, GPCB helps communities understand the adverse impacts of water pollution and encourages them to participate actively in pollution control initiatives.

Despite these extensive measures, GPCB faces challenges due to rapid industrial expansion and urbanization, which have increased the volume of effluent discharges into rivers. To address these challenges, GPCB continuously updates its monitoring systems and works closely with other state and central agencies to improve regulatory frameworks and enforcement mechanisms.

In conclusion, the Gujarat Pollution Control Board is a key institution in managing river pollution in Gujarat. Its multifaceted approach—combining rigorous consent procedures, continuous monitoring, stringent enforcement, and active public engagement—plays a vital role in protecting the state’s water resources. As industrial and urban pressures continue to mount, GPCB’s efforts to innovate and collaborate will be crucial in ensuring sustainable water quality and environmental health for future generations (Gujarat Pollution Control Board, n.d.; Central Pollution Control Board, n.d.).

Sardar Sarovar Narmada Nigam Limited (SSNNL)

Mandate & Functions: SSNNL is a state-run enterprise established to implement and manage the Sardar Sarovar Project. It is tasked with the development, operation, and maintenance of the Sardar Sarovar Dam and its associated infrastructure.

Role in the Basin: SSNNL oversees water supply, irrigation, and hydroelectric power generation. The organization is also involved in managing the resettlement and rehabilitation

of affected communities. By coordinating with local authorities and other state agencies, SSNNL is tasked with managing the challenges inherent in large-scale water resource projects.

Key Responsibilities:

Infrastructure Development & Water Distribution: SSNNL manages the operation and maintenance of the Sardar Sarovar Dam and its extensive canal network, ensuring irrigation supply to drought-prone areas in Gujarat and Rajasthan.

Hydropower Generation: The agency oversees the operation of hydroelectric power stations associated with the dam.

Resettlement & Rehabilitation: SSNNL is tasked with managing the resettlement and rehabilitation (R&R) process for communities affected by the construction of the dam. This includes compensating displaced families and developing alternative livelihoods for affected populations.

Inter-State Coordination: Since the Sardar Sarovar Project serves multiple states (Gujarat, Madhya Pradesh, Maharashtra, and Rajasthan), SSNNL plays a key role in coordinating water allocation agreements as per the Narmada Water Disputes Tribunal (NWDT) award.

Environmental Compliance & Sustainability: The agency implements afforestation, biodiversity conservation, and environmental monitoring programs to mitigate the ecological impacts of dam construction and operations.

Non-governmental Organisation

Community Organisations

Identification of Key Programmes

Participatory Irrigation Management in the Maan and Jobat Projects

In many rural regions of India, managing water resources for agriculture has historically been a top-down process where government agencies make decisions with little input from the local people who depend on these resources. In the state of Madhya Pradesh, however, a participatory approach was adopted in two irrigation projects—the Maan and Jobat Projects—to involve farmers directly in managing the water systems. This case study

examines how these participatory interventions were implemented, the strategies used to strengthen Water Users Associations (WUAs), and the impacts these interventions had on local livelihoods and irrigation management.

Background

The Maan and Jobat Projects are part of the larger efforts under the Narmada Valley Development framework in western Madhya Pradesh. Both projects were designed to provide irrigation water to thousands of hectares of farmland and to improve the overall agricultural productivity in the region. Before the intervention, water management was largely controlled by state agencies, and many small farmers had little say in how water was allocated or managed. As a result, issues such as inequitable water distribution, poor maintenance of canal systems, and inefficient irrigation practices were common.

In 2008, the Development Support Centre (DSC), in collaboration with the Narmada Valley Development Authority (NVDA) and the Madhya Pradesh Rural Livelihoods Project (MPRLP), launched a series of interventions aimed at strengthening Participatory Irrigation Management (PIM). The focus was to empower local communities by forming and strengthening WUAs—organizations made up of farmers who use the irrigation canals. These associations were intended to manage canal water distribution, collect service fees, and oversee the repair and maintenance of irrigation infrastructure.

Intervention Strategies

One of the core strategies was to enhance the capacity of existing Water Users Associations. In the Maan and Jobat Projects, WUAs were established based on local canal command areas. Each WUA consisted of a general body of farmers and an elected management committee. The management committees were responsible for organizing water distribution, maintaining records, and addressing disputes among members.

DSC played a crucial role by providing technical support and capacity-building training. Workshops, field visits, and hands-on training sessions were organized to educate the WUA members on best practices in water management. These programs were designed not only to improve technical knowledge but also to foster a sense of ownership among the farmers. For instance, farmers learned how to monitor water usage, maintain canal systems, and plan water distribution schedules (Misra & Raju, 2013).

Community Awareness and Capacity Building

Another significant part of the intervention was mass awareness. The project team organized

meetings, video shows, and school programs to spread information about the importance of efficient water use and the benefits of active participation in water management. This awareness-raising helped build a supportive environment for the WUAs, encouraging more farmers to join and actively participate in the decision-making process.

The DSC also developed various information, education, and communication (IEC) materials such as leaflets, posters, and videos. These materials highlighted the benefits of participatory irrigation management, including improved water distribution, enhanced agricultural productivity, and increased incomes. The materials were distributed widely, ensuring that even remote communities had access to the information (Misra & Raju, 2013).

Use of Convergence Funds

An innovative aspect of the intervention was the convergence of funds from different government schemes. For example, funds from the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) were used to support canal repair and maintenance work. This convergence helped ensure that adequate resources were available for the upkeep of the irrigation infrastructure, which in turn improved water delivery and increased irrigated areas. By leveraging these funds, the project was able to address some of the chronic issues affecting the canal systems and boost overall efficiency (Misra & Raju, 2013).

Outcomes and Impact

Improved Irrigation Infrastructure and Water Distribution: The interventions had a significant impact on the functioning of the irrigation systems in both projects. After the formation and strengthening of the WUAs, there was a noticeable increase in the area irrigated through the improved canal systems. In the Maan Project, for example, the irrigated area increased over successive cropping seasons as farmers began to better manage water distribution. Improved infrastructure—such as the lining of canals—further enhanced water delivery, reduced seepage losses, and increased the reliability of the water supply.

Enhanced Farmer Participation and Social Cohesion: One of the most positive outcomes of the participatory approach was the increased involvement of farmers in water management. With the support of capacity-building programs and improved communication, more farmers joined the WUAs, and there was a marked increase in local decision-making. This led to a sense of ownership among community members, which is essential for the long-term sustainability of any public resource management system.

Participation also helped resolve conflicts that had previously arisen due to unequal water

distribution. When disputes emerged, the WUA provided a platform for dialogue, enabling farmers to discuss their issues and reach mutually acceptable solutions. This participatory mechanism helped build social cohesion and reduced tensions among different groups within the communities (Misra & Raju, 2013).

Economic Benefits and Increased Agricultural Productivity: As water distribution became more efficient and equitable, farmers experienced tangible economic benefits. More consistent water supply translated into better crop yields and, in some cases, a shift toward higher-value commercial crops. The increased productivity not only improved the incomes of individual households but also contributed to the overall economic development of the region. Additionally, the improved infrastructure reduced the need for expensive and inefficient water extraction methods, such as deep tube-wells, thereby lowering production costs (Misra & Raju, 2013).

Environmental Sustainability: By ensuring that water distribution was managed more efficiently, the participatory approach also had environmental benefits. Improved irrigation practices meant that water was used more judiciously, helping to preserve the ecological balance of the river system. Moreover, the repairs and maintenance of the canals reduced water losses and prevented the degradation of the surrounding farmland. This, in turn, contributed to better groundwater recharge and supported the sustainability of both the natural ecosystem and agricultural activities.

Challenges and Lessons Learned

Institutional Coordination: While the interventions were largely successful, they also revealed several challenges. One of the key issues was the need for better coordination between the government agencies, the DSC, and the WUAs. At times, there was confusion over roles and responsibilities, which could hinder effective water management. This highlighted the importance of establishing clear protocols and regular communication channels to ensure that all stakeholders are aligned in their objectives.

Sustaining Financial Viability: Another challenge was maintaining the financial viability of the WUAs. Although the initial phases of the project saw enthusiastic participation, sustaining this momentum over time required consistent revenue generation through service fees and other mechanisms. In some cases, government policies—such as free water supply for a certain period—had inadvertently created a dependency that undermined the collection of service fees. Addressing these financial challenges remains an important area for further development and policy refinement (Misra & Raju, 2013).

Adaptability and Continuous Improvement: One of the major lessons from the Maan and Jobat Projects is the importance of adaptability. Water management is a dynamic process, and conditions can change due to factors such as climate variability or shifts in agricultural practices. The participatory approach must, therefore, be viewed as an ongoing process that requires continuous monitoring, feedback, and adjustments. Regular review workshops and the use of convergence funds for infrastructure repairs are examples of how the project has built in mechanisms for adaptive management.

The participatory approach to irrigation management in the Maan and Jobat Projects demonstrates how involving local communities in the planning and management of water resources can yield significant benefits. By forming and strengthening Water Users Associations, providing capacity-building support, and leveraging multiple funding sources, the project improved water distribution, increased irrigated areas, enhanced agricultural productivity, and fostered social cohesion. Importantly, these interventions also promoted environmental sustainability by encouraging more efficient water use and better maintenance of irrigation infrastructure.

This case study from Madhya Pradesh offers valuable lessons for similar initiatives elsewhere in India and beyond. It shows that when farmers are given a voice in decision-making, they are more likely to manage resources efficiently and work together to resolve conflicts. The experience of the Maan and Jobat Projects underscores the importance of participatory irrigation management as a means to achieve both economic and ecological goals. Future projects can build on this model by ensuring robust institutional coordination, maintaining financial viability, and embracing adaptive management practices to respond to changing conditions.

In summary, the Maan and Jobat Projects illustrate the power of participatory approaches in transforming irrigation management. They highlight that sustainable water management is not just a technical challenge but also a social one, requiring the engagement and empowerment of the very communities that depend on the river for their livelihoods.

Narmada Landscape Restoration Project (NLRP)

Context and Background

The Narmada Landscape Restoration Project (NLRP) was initiated against a backdrop of rapid environmental degradation along the Narmada River Basin. Over the years, mining, industrial activities, and unsustainable agricultural practices had led to severe deforestation and soil erosion, significantly impacting water quality and local biodiversity (Gadgil & Guha,

1995). Recognizing the need for an integrated approach to restore the basin's ecological balance and secure long-term water resources, state and central agencies sought to design an initiative that would not only reverse environmental decline but also engage local communities directly in the restoration process.

Agencies and Actors Involved

The NLRP is a collaborative effort involving multiple stakeholders. The primary partners include:

- **National Thermal Power Corporation (NTPC):** As a major industrial player, NTPC has a vested interest in environmental sustainability, given its role in energy production and its Corporate Social Responsibility (CSR) commitments.
- **Indian Institute of Forest Management (IIFM), Bhopal:** This academic and research institution provided technical expertise in sustainable forest management and participatory environmental planning.
- **Local Communities and Civil Society Organizations:** The project has actively engaged indigenous populations and local farmers, incorporating traditional knowledge and on-ground feedback into its operational design.
- **State Government Agencies:** In coordination with the Ministry of Jal Shakti and regional environmental departments, the project has received policy support and regulatory oversight (NTPC, 2020; IIFM, 2021).

Project Initiation and Timeline

The NLRP was officially launched in December 2020 as part of a broader strategy to mitigate the ecological impacts of decades of intensive industrial and mining activity in the basin. The project's design drew on prior lessons from similar restoration initiatives both within India and internationally. Initial assessments identified key areas where deforestation and land degradation were most acute, and participatory rural appraisal methods were employed to gather input from local residents regarding traditional land management practices (NTPC, 2020).

Challenges Faced and Strategies for Resolution

Several challenges emerged during the planning and implementation phases:

- **Fragmented Land Ownership:** The basin comprises numerous small landholdings managed by diverse groups. Coordinating restoration efforts across these fragmented parcels required extensive community engagement and trust-building (IIFM, 2021).
- **Skepticism and Past Experiences:** Local communities had experienced previous development projects that neglected their input, leading to distrust. To overcome this, the project implemented a series of transparent, consultative workshops, ensuring that every stakeholder had a voice in planning.
- **Technical and Institutional Coordination:** Integrating the varied expertise of NTPC, IIFM, and local civil society organizations presented logistical challenges. Regular inter-agency meetings and the establishment of a dedicated project management unit helped streamline communications and decision-making processes (IIFM, 2021).
- **Monitoring and Evaluation:** Ensuring accountability and tracking progress over a vast geographical area required innovative solutions. The project adopted community-based monitoring systems, training local residents to record ecological parameters, which were then integrated into a centralized database (NTPC, 2020).

Outcomes and Success Factors

Today, the NLRP is widely regarded as a success story for several reasons:

- **Enhanced Ecological Health:** Preliminary reports indicate measurable improvements in forest cover and water quality in pilot areas, suggesting that restoration efforts are taking root.
- **Empowered Communities:** By involving local communities in every stage—from planning to monitoring—the project has fostered a sense of ownership and stewardship over local natural resources.
- **Innovative Participatory Approach:** The blending of modern scientific techniques with traditional ecological knowledge has created a robust model for sustainable development that can be replicated in other regions.
- **Policy Implications:** The success of NLRP has influenced broader policy discussions at both the state and central levels, providing a blueprint for how participatory, state-led initiatives can address environmental challenges while ensuring social equity.

Participatory Management of Environmental Flows at Bargi Dam

Environmental flows, or “e-flows,” are the water levels and flow patterns that must be maintained in rivers to support healthy ecosystems. Managing these flows becomes especially important in river basins where dams and other water projects alter the natural water regime. The Bargi Dam on the Narmada River in the Jabalpur District of Madhya Pradesh is one such example where changes in water flow have had significant ecological impacts. In response, a novel participatory approach has been developed to determine and implement e-flow requirements by incorporating community perceptions. This case study explores how the approach was designed, the role of local stakeholders, and why it serves as a successful model for sustainable water management.

Background and Context

Dams like Bargi have multiple purposes – they provide water for drinking, irrigation, and power generation. However, when a dam is built, it changes the way water flows downstream. This alteration can lead to a variety of problems, such as reduced water quality, loss of fish habitat, and disrupted seasonal floods. Traditionally, water management decisions were made in a top-down manner by experts and government agencies, often without input from the people most affected by the changes.

Govind, Pandey, and Kumar (2025) describe a framework that integrates scientific data with the perceptions of local communities to estimate the minimum flow needed to support both the river’s ecosystem and the needs of the people. By combining an established hydrological model with community surveys, the approach seeks to balance human and environmental needs in an adaptive manner.

The Participatory Approach

At the heart of the approach is a series of stakeholder perception surveys conducted in villages along the stretch of the Narmada downstream from Bargi Dam. Researchers visited 15 villages – ranging from small hamlets to medium-sized settlements – to gather firsthand information about how changes in the river’s flow have affected local livelihoods and the environment. These surveys asked residents about several factors:

- The observed changes in fish catch before and after the dam’s construction.
- The minimum water depth needed for maintaining fish populations.
- The impacts of altered flow on agriculture and domestic water needs.

By involving people who live along the river, the researchers were able to capture detailed, on-the-ground insights that are often missing from purely technical studies. As noted by

Govind, Pandey, and Kumar (2025), local community members provided valuable input regarding the seasonal variations in water flow, which in turn influenced how the researchers defined the necessary environmental flow.

Integrating Scientific and Local Knowledge

The approach uses a two-part framework. First, it builds on an established environmental flow assessment framework called SUMHA (Sustainable Management of Hydrological Alteration), which outlines how changes in the flow regime affect river ecosystems. Second, it incorporates a perception-based Bayesian Belief Network (BBN) model. In simple terms, the BBN is a tool that helps predict outcomes based on different “if-then” scenarios. For example, if the water depth falls below a certain threshold during summer, then fish populations may decline.

The BBN model is “fed” with both scientific data and the perceptions collected from local communities. For instance, fishermen in the surveyed villages indicated that a water depth of 1.0 meter is the minimum required to maintain a viable fish catch. This locally derived figure was then used as a key input in the model. In this way, the model does not rely solely on technical measurements; it is enriched by the experiences and knowledge of the people who use the river every day.

The Process of Stakeholder Engagement

To ensure the participatory process was transparent and effective, researchers organized face-to-face interviews and community meetings. These interactions allowed residents not only to share their observations but also to learn about the technical aspects of e-flow management. This two-way communication helped build trust between the community and the researchers. The participatory approach ensured that all voices were heard—from local farmers and fishermen to engineers working for the Narmada Valley Development Authority. By creating a forum where diverse perspectives could be discussed, the project laid the groundwork for decisions that reflected both ecological needs and human priorities (Govind, Pandey, & Kumar, 2025).

Addressing Challenges

Implementing a participatory approach in river water management is not without challenges. One major issue is the variability of community responses. Different villages may have different experiences of water scarcity, fish catch, and agricultural productivity. To handle this diversity, the researchers used a sampling strategy that varied by village size – a higher percentage of households were surveyed in smaller villages where the community is more homogenous, while larger villages had a smaller sample percentage. This helped ensure that

the data was representative of local conditions.

Another challenge was bridging the gap between technical water management concepts and everyday experiences. Concepts such as “flow regime” or “environmental flow requirements” can be abstract for non-specialists. To overcome this, the research team used simple language during surveys and community meetings, and they employed visual aids like charts and maps that illustrated changes in the river over time. This made the information accessible and enabled meaningful dialogue between technical experts and local residents.

Why This Approach Is a Success Story

The participatory approach to managing e-flows at Bargi Dam has several notable strengths:

Balancing Ecological and Social Needs: By integrating community perceptions into the environmental flow assessment, the framework ensures that water management decisions are not made in isolation from those who depend on the river. This balance between technical data and lived experience helps safeguard both the river’s ecological functions and the livelihoods of local communities. For example, using community-derived data on minimum water depth for fish habitats led to more realistic and acceptable e-flow targets (Govind, Pandey, & Kumar, 2025).

Building Local Ownership and Trust: The process of engaging local stakeholders directly in water management has fostered a sense of ownership over the outcomes. When people see that their input influences policy, they are more likely to support and adhere to new management practices. This has long-term benefits because sustainable water management depends on the active participation of those who use the resource. In turn, improved trust between the community and water management authorities can lead to better collaboration in future projects.

Adaptability in Data-Scarce Conditions: In many developing regions, long-term ecological data may be limited. The Bargi Dam case study demonstrates how a perception-based approach can fill these gaps. When technical measurements are scarce or incomplete, community knowledge provides critical insights that help form a more comprehensive picture of the river’s health. This makes the framework especially useful in developing countries where data limitations are common.

Informing Policy and Practice

The lessons learned from the participatory approach at Bargi Dam have important implications for policy. They illustrate that involving communities in water management not only leads to better environmental outcomes but also strengthens social resilience.

Policymakers can draw on these insights to design more inclusive water management

strategies that combine scientific expertise with local knowledge. Such integrated policies are likely to be more robust in the face of climate variability and other future challenges.

The case study of the participatory approach to managing environmental flows at Bargi Dam serves as a powerful example of how combining scientific and community knowledge can lead to sustainable water management. By engaging local stakeholders through surveys and meetings, the framework developed by Govind, Pandey, and Kumar (2025) ensured that decisions on water flow were informed by both technical data and the lived experiences of those who depend on the river.

This approach has helped balance ecological needs with social and economic requirements, building local ownership and trust while addressing data limitations common in developing regions. As water scarcity and environmental degradation continue to pose challenges globally, the lessons learned from Bargi Dam highlight the importance of participatory water management strategies that are adaptive, inclusive, and sustainable.

In summary, the participatory approach to managing e-flows at Bargi Dam demonstrates that successful river water management is possible when local communities are not only consulted but actively involved in the decision-making process. This model holds promise for similar initiatives across India and other parts of the world facing comparable challenges, and it provides a roadmap for integrating community perceptions into technical water management frameworks (Govind, Pandey, & Kumar, 2025).

Identifying Key Stakeholders

The Narmada River Basin is characterized by a mosaic of communities and economic activities. The area is home to a large rural population, a significant number of forest-dependent tribal communities, and a growing number of small towns. At the same time, large urban centers are relatively few. The region's socio-economic landscape is further shaped by an evolving agricultural system, diverse industrial enterprises, and livelihoods linked to the river system. In this section, we examine the primary stakeholders—households, farmers, workers, and local firms—detailing their roles, challenges, and contributions to the basin's social fabric.

Households

Households along the Narmada River Basin are predominantly rural, with a large proportion of the population belonging to indigenous and tribal communities. These communities are historically forest-dependent, relying on the river not only for water but also for fishing, small-scale agriculture, and gathering forest products. Despite the relatively sparse

distribution of large urban centers, the region has witnessed the emergence of numerous small towns, spurred by infrastructure projects and economic opportunities. This demographic shift has led to increased migration from rural villages to these emerging urban areas, where access to municipal services is still developing.

For millions of households, the Narmada is a lifeline. It supplies water for drinking, cooking, and sanitation—services that remain critical in areas where piped water is not universally available. Rural households often rely on the river for irrigating small plots, supporting subsistence farming and traditional practices. In many tribal settlements, the river forms an integral part of cultural and religious practices, underscoring its multidimensional value.

Households in the Narmada basin face a range of challenges:

- **Water Scarcity and Pollution:** As urban centers expand and industrial activity increases, the quality of water in the Narmada is under threat. Pollutants from nearby industries and runoff from intensified agriculture have led to periodic shortages of safe drinking water .
- **Displacement and Resettlement:** Large-scale development projects, particularly dam constructions, have forced many households to relocate. This displacement often disrupts traditional lifestyles and erodes communal bonds that have been maintained over generations (Kothari 1996).
- **Inadequate Infrastructure:** In many rural areas and burgeoning small towns, basic infrastructure—such as sanitation, electricity, and healthcare—remains underdeveloped, making residents vulnerable to environmental hazards and economic instability.

Tribal Leaders

The paper by Thakur (2019) examines the dynamic process of subaltern leadership among the Bhil communities in the Narmada Valley. It traces how, in the face of forced displacement due to the Sardar Sarovar Project, two Bhil leaders emerged—Fattesing Pawara and Balram Vasave—to represent their community's interests, challenge state authority, and secure basic rights for their people. Unlike the dominant narrative presented by external urban activists of the Narmada Bachao Andolan, Thakur (2019) foregrounds the agency of these tribal leaders, demonstrating that resistance was not merely imposed by outsiders but was actively cultivated from within the community.

Large-scale projects like the SSP have long altered the socio-economic and environmental landscape of the Narmada Valley. The dam's construction led to the forced displacement of thousands of Bhil families from their ancestral homes in the hills to resettlement colonies on the plains. Traditionally, local governance among the Bhils was managed through decentralized leadership structures—local figures known as karbharis and police patils, who maintained social order using indigenous practices. However, with the onset of the dam projects in the 1980s, external urban activists of the Narmada Bachao Andolan (NBA) intervened to mobilize resistance. While these external forces garnered widespread attention, Thakur (2019) argues that the true agency lay with the Bhils themselves, who later developed independent leadership to negotiate directly with state authorities.

Fattasing Pawara is presented as a transformative figure in the struggle for tribal rights. Initially, he served as a foot soldier in the movement, relaying messages between local groups. His early experiences exposed him to the harsh realities of displacement and the inadequacies of state resettlement policies. Over time, Fattasing learned to navigate state bureaucracies; he began drafting petitions and organizing protests to demand better compensation and land rights for his people. His grassroots efforts were rooted in the lived experiences of his community, and he leveraged traditional local knowledge to articulate claims that resonated with both villagers and state officials. Fattasing's journey—from a messenger to an effective negotiator—illustrates how tribal leaders can transform personal struggle into collective empowerment (Thakur, 2019).

Balram Vasave, another key leader, emerged with a distinct approach. Unlike Fattasing, whose leadership was built on relentless local mobilization, Balram combined traditional authority with formal education. His schooling enabled him to communicate effectively with government agencies and participate in broader political processes. Balram became a spokesperson for his community, representing the Bhils in negotiations with state authorities and external organizations. His articulate advocacy and strategic alliances helped secure incremental improvements in resettlement policies. By engaging both with local networks and with external political forums, Balram ensured that the specific needs of the Bhils—such as adequate land allocation and culturally appropriate rehabilitation measures—were brought to the forefront of state discussions (Thakur, 2019).

The paper emphasizes that both Fattesing and Balram were not merely representatives of their community; they were active negotiators who pressed the state for accountability. Their negotiations revealed the deep-seated discrepancies in state policies on resettlement and rehabilitation. While some states, like Gujarat, adopted relatively generous policies, others, including Maharashtra and Madhya Pradesh, implemented more restrictive measures. This uneven approach often left tribal communities, many of whom were treated as landless encroachers, without sufficient support to restore their livelihoods.

Civil society organizations and local activists played a significant supporting role in these negotiations. They provided platforms for the tribal leaders to voice their concerns and helped amplify the call for reforms. Media coverage and public protests further pressured state authorities to reconsider their policies. Thakur (2019) points out that the sustained pressure exerted by these leaders, combined with external advocacy efforts, forced the state to at least acknowledge the shortcomings in the resettlement process. However, the struggle was far from over, as the systemic challenges and historical injustices remained deeply embedded in state practices.

The emergence of subaltern leadership among the Bhils fundamentally altered the power dynamics in the Narmada Valley. Leaders like Fattesing and Balram not only secured improvements in the resettlement process but also reshaped how the Bhils engaged with the modern state. Their efforts helped foster a sense of ownership and empowerment, transforming what was once a narrative of victimhood into one of active resistance and self-determination.

The success of these leaders illustrates that meaningful change can be achieved when affected communities are given a voice in policy negotiations. Their ability to negotiate with state officials and advocate for better conditions underscores the importance of integrating traditional leadership with modern governance structures. This model of subaltern agency provides valuable lessons for other regions facing similar challenges of displacement and environmental disruption.

Thakur's (2019) paper offers a compelling account of how tribal leadership among the Bhils

in the Narmada Valley played a pivotal role in holding the state to account and safeguarding community interests. The independent, resilient leadership of figures like Fattesing Pawara and Balram Vasave exemplifies the power of subaltern agency. Their efforts in negotiating for better resettlement terms and ensuring that the state addresses their needs have redefined the struggle against forced displacement. More such accounts are available in Oza et al (2022) in “The Struggle for Narmada: An Oral History of the Narmada Bachao Andolan, by Adivasi Leaders Keshavbhau and Kevalsingh Vasave.”

By actively engaging with the state, leveraging both traditional and modern forms of knowledge, and collaborating with civil society organizations, these leaders not only challenged the inequities of the past but also paved the way for a more inclusive and accountable future. Their stories serve as an important reminder that sustainable development and effective governance require genuine participation from those most affected by policy decisions.

Farmers

Agriculture is the backbone of the Narmada River Basin. Historically, the region has supported subsistence farming with a mix of traditional crops. However, recent decades have seen a marked shift toward commercial cropping. Farmers are increasingly cultivating water-intensive crops such as rice and sugarcane alongside cash crops like cotton, driven by market incentives and government policies. This transition has significant implications for water usage patterns, as the irrigation demands of commercial agriculture far exceed those of traditional subsistence farming.

The adoption of commercial crops has heightened the basin's overall water-use intensity. Large-scale irrigation projects—both government-led and privately financed—have led to an over-reliance on surface water, while many farmers have also turned to groundwater extraction to meet demand. In some areas, declining groundwater levels have become a critical concern, as over-extraction threatens long-term sustainability and can lead to conflicts among users. Efforts to introduce water-efficient practices, such as drip irrigation and crop diversification, have met with mixed success due to infrastructural and economic constraints. The transition to commercial agriculture has reoriented local economies and social structures (Whitehead 2007). While cash crops can potentially increase income, they also expose farmers to market volatility and increased indebtedness. In contrast, traditional crops,

although less lucrative, are more resilient to local environmental conditions. This shift has spurred debates within rural communities over the balance between modernization and the preservation of indigenous agricultural practices.

Challenges Faced

Farmers in the Narmada basin contend with several critical issues:

- **Water Allocation Conflicts:** The competing demands for water between agriculture, households, and industry have led to disputes, especially in years of drought or when upstream dam operations alter river flows (Ramachandra, 2004).
- **Economic Uncertainty:** With the move towards commercial cropping, farmers are increasingly exposed to the risks of fluctuating market prices and external debt. These factors contribute to a cycle of vulnerability and limit investment in sustainable practices.
- **Environmental Degradation:** Intensive agriculture, combined with industrial pollution, has degraded soil quality and reduced the natural fertility of lands, further stressing agricultural productivity.

Workers

Workers in the Narmada River Basin derive their livelihoods from a variety of sectors linked to the river. This includes traditional fisheries, which have historically been a significant source of income for many communities, as well as employment in industries such as sand mining, construction, and hydropower. Each of these sectors has distinct characteristics and faces its own set of challenges.

Fishing has long been a staple of the riverine economy. For generations, local communities have depended on the Narmada for sustenance through artisanal fishing practices. However, dam constructions and industrial pollution have significantly disrupted these traditional practices. The alteration of natural river flows has affected fish migration patterns, while increased pollution has led to a decline in fish populations. As a result, many fishing communities have seen their livelihoods erode, leading to calls for better regulation and rehabilitation measures (Joshi, 2019).

Excessive sand mining in the Narmada River Basin has emerged as a serious environmental and socio-economic concern. Over the past few decades, unregulated sand extraction from riverbeds, banks, and adjacent areas has led to dramatic alterations in the river's natural dynamics. Sand, a finite and critical resource, is extensively used in construction, and its

uncontrolled removal has far-reaching impacts on the river's ecology and the communities that depend on it.

One of the most significant consequences of sand mining is the destabilization of riverbanks. As sand is removed at unsustainable rates, the structural integrity of the riverbanks diminishes, leading to accelerated erosion. This erosion not only undermines the stability of the river's course but also causes the loss of fertile land in the surrounding areas. Agricultural communities along the Narmada are particularly affected, as soil erosion reduces the productivity of the land and disrupts traditional farming practices.

Furthermore, the depletion of sand alters the sediment balance within the river system. Natural sedimentation processes are crucial for maintaining the river's morphology and for supporting habitats in both the riverbed and floodplains. When sand is extracted in large quantities, the sediment supply decreases, leading to a reduction in the formation of sandbars and islands that serve as breeding grounds for various species. This, in turn, disrupts the life cycles of aquatic organisms, including fish. The ecological consequences are particularly visible during the dry season, when reduced sediment replenishment exacerbates the loss of aquatic habitats, further endangering local fisheries.

Sand mining also has a direct impact on water quality. The process of extraction often involves the disturbance of river sediments, which can release trapped pollutants and increase turbidity. Higher turbidity levels reduce the penetration of sunlight, affecting photosynthesis in aquatic plants and altering the overall health of the ecosystem. For communities that rely on the river for drinking water and other domestic uses, degraded water quality can lead to health hazards and increased treatment costs.

Local communities, especially fish workers and small-scale farmers, have long voiced their concerns over the unchecked extraction of sand. In Gujarat, where many fish-dependent communities have observed a decline in fish populations, the negative impacts of sand mining have compounded existing challenges related to dam operations and water management. These groups have organized protests and public campaigns demanding stricter regulation of sand mining activities. They argue that the continued removal of sand not only jeopardizes their livelihoods by reducing fish catches but also disrupts the broader ecological

balance of the river (SandRP, 2017).

In response, civil society groups and environmental activists are urging both state authorities and policymakers to adopt more stringent measures to control sand mining. Proposed actions include the development of clear regulatory frameworks that set limits on extraction, the establishment of monitoring systems to track sand removal rates, and the promotion of alternative building materials to reduce dependency on river sand. Additionally, there is a call for more comprehensive environmental impact assessments that consider the cumulative effects of sand mining along with other infrastructural projects in the basin.

Ultimately, addressing sand mining problems in the Narmada River Basin requires coordinated efforts between government agencies, local communities, and civil society organizations. Only by integrating robust regulatory mechanisms with community-based monitoring and enforcement can sustainable sand extraction be ensured—thereby protecting the river’s ecological integrity and the livelihoods of those who depend on it.

Examples of enabling/constraining elements to implementation of policies and programmes

Enabling Factors:

- **Community Involvement:** Policies that engage local communities in decision-making tend to have greater acceptance and long-term success.
- **Institutional Support:** Strong governmental and non-governmental institutions that ensure proper implementation and monitoring aid policy effectiveness.
- **Legal Frameworks & Advocacy:** Legal rulings, such as those requiring rehabilitation and compensation, provide legitimacy and enforceability to policy measures.
- **Public Awareness Campaigns:** Increased environmental and social awareness helps mobilize public opinion and resources toward effective implementation.
- **Alternative Livelihood Programs:** When policies integrate employment and skill-building initiatives, displaced communities are more likely to adapt successfully.

Constraining Factors:

- **Political and Bureaucratic Resistance:** Government agencies may prioritize economic growth over social and environmental concerns, delaying or blocking policy

execution.

- **Lack of Resources & Funding:** Insufficient financial and infrastructural support results in incomplete or ineffective policy rollout.
- **Fragmented Social Movements:** Internal divisions within activist groups weaken their bargaining power and reduce policy impact.
- **Legal Setbacks & Institutional Failures:** Court rulings that favor development over displacement concerns limit the reach of progressive policies.

What Works for Co-existence?

- **Participatory Decision-Making:** When affected communities have a voice in planning, they are more willing to adapt to changes.
- **Compensation & Resettlement Done Right:** Policies ensuring fair land distribution and livelihood restoration foster better integration.
- **Decentralized Water Management:** Small-scale irrigation and watershed management approaches are more inclusive and sustainable.
- **Cultural Sensitivity in Development Projects:** Recognizing and respecting indigenous traditions helps reduce conflict.
- **Transparent Governance:** Clear communication and accountable institutions help bridge gaps between development and displacement concerns.

What Doesn't Work for Co-existence?

- **Top-down Policy Decisions:** Imposed solutions without community consent lead to resistance and non-compliance.
- **One-size-fits-all Resettlement Plans:** Programs that fail to account for local economic and social realities often leave displaced populations worse off.
- **State Repression & Coercion:** The use of force to suppress protests or enforce policies alienates communities and escalates conflicts.
- **Over-reliance on Legal Solutions:** Courts alone cannot resolve deeply embedded socio-economic tensions without broader policy changes.
- **Movements Without Local Grounding:** When social movements prioritize external narratives over local realities, they lose legitimacy among those they aim to support.

Identifying strategies to address constraints through creating public

awareness and encouraging participation

The information in our report emphasizes that the challenges—ranging from water quality degradation and displacement to inadequate infrastructure and conflicts over water allocation—are best tackled when local stakeholders are not only informed about these issues but are also actively engaged in crafting solutions.

One key strategy highlighted in the report is the establishment of effective information, education, and communication (IEC) campaigns. For instance, the document details how diverse communication methods—such as community meetings, local radio programs, and the distribution of posters and leaflets—have been used to disseminate critical information about the adverse effects of industrial pollution, deforestation, and unsustainable water extraction practices. These campaigns have been instrumental in raising public consciousness about the link between environmental health and quality of life. By translating complex technical data into accessible messages, the report shows that residents can be empowered to identify local constraints and demand more accountable water management policies.

The report also underscores the importance of leveraging existing community structures to foster participation. The experiences of groups like the Narmada Bachao Andolan serve as a vivid example. Historically, this movement not only mobilized public support for better water governance but also created a platform for marginalized communities—particularly indigenous groups affected by large-scale dam projects—to voice their concerns. The report explains that the success of such movements hinges on their ability to merge traditional knowledge with modern environmental science, thereby ensuring that the voices of those directly impacted by river management decisions are heard. This model of grassroots activism illustrates that public awareness is not a one-way dissemination of information but rather a dialogue that fosters mutual trust and collaborative problem-solving.

Capacity building is another cornerstone of the strategy. The report describes several capacity-building initiatives where community members are trained in aspects of water resource management, environmental monitoring, and sustainable agricultural practices. Workshops and training sessions not only impart technical know-how but also build a sense of ownership among local stakeholders. As residents become better equipped to monitor water quality and manage local resources, they are more likely to hold government agencies accountable and actively participate in decision-making processes. This empowerment

through education helps overcome the traditional top-down approach, ensuring that policies are informed by local realities.

In addition, the report highlights the role of participatory platforms that institutionalize public engagement. Local water user associations and community committees have been set up as formal bodies through which citizens can collaborate with local government and technical experts. These platforms provide a structured mechanism for sharing feedback and discussing proposals related to water management. The report emphasizes that when community members are included in advisory panels or decision-making boards, their insights can lead to more adaptive and context-specific solutions. For example, when local farmers and fishermen contribute their experiential knowledge regarding seasonal water flow variations or pollution hotspots, the resulting policies are more likely to address actual on-the-ground challenges.

Technology and digital tools also play a significant role in this participatory framework. Mobile applications and online dashboards can be used to report environmental issues such as illegal sand mining, water pollution, and the failure of infrastructure projects. These digital tools not only ensure transparency but also allow for rapid dissemination of information. They could enable community members to quickly alert authorities to emerging problems, thus bridging the gap between citizens and policymakers. By fostering a real-time, interactive dialogue, these technological interventions could enhance the responsiveness of water management strategies.

Moreover, the report points to the need for continuous evaluation and feedback mechanisms. Public awareness and participation are most effective when they are integrated into a dynamic process of monitoring and learning. Regular public hearings and community review workshops are effective methods for ensuring that policies remain responsive to local needs. Such forums allow stakeholders to reassess priorities and adapt strategies based on evolving environmental and social conditions. The iterative nature of these consultations ensures that strategies are not static but evolve with the challenges they aim to address.

In summary, the strategies identified to address constraints through public awareness and participation include robust IEC campaigns, the empowerment of local communities through capacity building, the creation of formal participatory platforms, and the utilization of

technology for real-time information sharing. These measures not only enhance the effectiveness of water management policies but also build a foundation of trust and accountability between communities and government agencies. The information and experiences documented in the report will be useful for sustainable river basin management will be achievable when informed, engaged, and empowered citizens are at the heart of the process.

REFERENCES

- Bandyopadhyay, J. (2009). *Water, ecosystems, and society: A confluence of disciplines*. SAGE Publications.
- Baviskar, A. (1995). *In the belly of the river: Tribal conflicts over development in the Narmada valley*. Oxford University Press.
- Central Pollution Control Board. (n.d.). Guidelines for water quality monitoring. Retrieved March 21, 2025, from <https://www.cpcb.nic.in>
- Gadgil, M., & Guha, R. (1995). *Ecology and equity: The use and abuse of nature in contemporary India*. Routledge.
- Government of Madhya Pradesh. (1988). *Bargi Dam: Irrigation and local participation report*. Government of Madhya Pradesh.
- Govind, M. P., Pandey, R. U., & Kumar, P. (2025). A framework for implementation of environmental flow requirements through community perceptions: The case of Bargi Dam, Jabalpur District, Madhya Pradesh. *Hydrological Sciences Journal*, 70(2), 193–208. <https://doi.org/10.1080/02626667.2024.2434139>
- Gujarat Pollution Control Board. (n.d.). About GPCB. Retrieved March 21, 2025, from <https://gpcb.gujarat.gov.in/webcontroller/page/head-office>
- IIFM. (2021). *Narmada Landscape Restoration Project: Impact Assessment Report*. Indian Institute of Forest Management.
- International Rivers. (2012). *Protest Against Omkareshwar Dam in 2007* [Photo]. <https://www.flickr.com/photos/internationalrivers/7646764340/>
- Joshi, H. (2019). Farmers who turned to fishing after construction Narmada dams are finding it hard to make a living. Scroll. Retrieved March 20, 2025, from <https://scroll.in/article/936142/from-farming-to-fishing-occupational-change-hasnt-helped-the-people-affected-by-dams-on-narmada>
- Kothari, S. (1996). Whose Nation? The Displaced as Victims of Development. *Economic and Political Weekly*, 31(24), 1476–1485.
- Madhya Pradesh Pollution Control Board. (n.d.). Introduction. Retrieved March 21, 2025, from <https://www.mppcb.mp.gov.in/Introduction.aspx>
- Misra, H. K., & Raju, K. V. (2013). Impact assessment of participatory irrigation management in Maan and Jobat projects. Institute of Rural Management Anand. Retrieved from <https://www.irma.ac.in>
- Narmada Bachao Andolan. (n.d.). Official website. Retrieved from <http://www.narmada.org>
- NTPC. (2020). *Narmada Landscape Restoration Project: Overview*. NTPC Press Release.
- Oza, N., Vasāve, K., Vasāve, K. B., & Chowdhury, I. (2022). The struggle for Narmada: An oral history of the Narmada Bachao Andolan, by Adivasi leaders Keshavbhai and Kevalshingh Vasave (S. Paranjape & S. Manorama, Trans.). Orient BlackSwan.
- Ramachandra, G. (2004). *The politics of displacement: Narmada Valley and beyond*. Orient BlackSwan.
- SandRP. (2017). On World Fisheries Day: Gujarat Fish Workers Dependent on Narmada River Demand Cancellation of Bhadbhut Dam Rejuvenation of River. Retrieved from <https://sandrp.in/2017/11/21/on-world-fisheries-day-gujarat-fish-workers-dependent-on->

[narmada-river-demand-cancellation-of-bhadbhut-dam-rejuvenation-of-river/](#)

Thakur, V. (2019). Learning and leading: Resistance, subaltern leadership and the making of two Bhil community leaders from the Narmada Valley, Western India. *South Asia Multidisciplinary Academic Journal*, 21. <http://journals.openedition.org/samaj/5661>

Whitehead, J. (2007). Submerged and submerging voices: Hegemony and the decline of the Narmada Bachao Andolan in Gujarat, 1998-2001. *Critical Asian Studies*, 39(3), 399–421. <https://doi.org/10.1080/14672710701527527>