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

River-People Connect

Mahanadi River Basin

August 2025

River-People Connect

Mahanadi River Basin

National River Conservation Directorate (NRCD)

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

www.nrcd.nic.in

Centres for Mahanadi River Basin Management Studies (cMahanadi)

The Centres for Mahanadi River Basin Management Studies (cMahanadi) is a Brain Trust dedicated to River Science and River Basin Management. Established in 2024 by NIT Raipur and NIT Rourkela, under the supervision of cGanga at IIT Kanpur, the center serves as a knowledge wing of the National River Conservation Directorate (NRCD). cMahanadi is committed to restoring and conserving the Mahanadi River and its resources through the collation of information and knowledge, research and development, planning, monitoring, education, advocacy, and stakeholder engagement.

www.cmahanadi.org

Centre 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 NIT Raipur (Lead Institute) and NIT Rourkela (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRCD) in 2025. We gratefully acknowledge the individuals who provided information and photographs for this report.

Team Members

NIT Raipur	NIT Rourkela
Dr. Samir Bajpai, Coordinator & Head	**Dr. Kishanjit Kumar Khatua**, Coordinator & Head
Dr. Ishtiyaq Ahmad, Co-coordinator & PI	**Dr. Sanat Nalini Sahoo,** Co-coordinator & PI
Dr. Kshitij Upadhyay, Project Scientist	**Dr. Minakshee Mahananda,** Co-coordinator & PI
Dr. Sandeep Soni, Sr. Project Scientist	**Dr. Snigdha Sarita Mohapatra,** Postdoc Fellow
Dr. Sahajpreet Kaur Garewal, Sr. Project Scientist	**Mr. Piyush Paritosh Sarangi,** Junior Research Fellow

Preface

In an era of unprecedented environmental change, understanding our rivers and their ecosystems has never been more critical. This report aims to provide a comprehensive overview of our rivers, highlighting their importance, current health, and the challenges they face. As we explore the various facets of river systems, we aim to equip readers with the knowledge necessary to appreciate and protect these vital waterways.

Throughout the following pages, you will find an in-depth analysis of the principles and practices that support healthy river ecosystems. Our team of experts has meticulously compiled data, case studies, and testimonials to illustrate the significant impact of rivers on both natural environments and human communities. By sharing these insights, we hope to inspire and empower our readers to engage in river conservation efforts.

This report is not merely a collection of statistics and theories; it is a call to action. We urge all stakeholders to recognize the value of our rivers and to take proactive steps to ensure their preservation. Whether you are an environmental professional, a policy maker, or simply someone who cares about our planet, this guide is designed to support you in your efforts to protect our rivers.

We extend our heartfelt gratitude to the numerous contributors who have generously shared their stories and expertise. Their invaluable input has enriched this report, making it a beacon of knowledge and a practical resource for all who read it. It is our hope that this report will serve as a catalyst for positive environmental action, fostering a culture of stewardship that benefits both current and future generations.

As you delve into this overview of our rivers, we invite you to embrace the opportunities and challenges that lie ahead. Together, we can ensure that our rivers continue to thrive and sustain life for generations to come.

Centre for Mahanadi River Basin
Management and Studies (cMahanadi)
NIT Raipur & NIT Rourkela

Contents

List of Figures

List of Tables

Abbreviations and Acronyms

CAMP	Condition Assessment and Management Plan
CGWB	Central Ground Water Board
cMahanadi	Centre for Mahanadi River Basin Management and Studies
CWC	Central Water Commission
DEM	Digital Elevation Model
GD	Gauge Discharge
GDSQ	Gauge Discharge Sediment Water Quality
GIS	Geographic Information System
IIT	Indian Institute of Technology
IMD	Indian Meteorological Department
JAXA	Japan Aerospace Exploration Agency
LULC	Land Use Land Cover
MRB	Mahanadi River Basin
NASA	National Aeronautics and Space Administration
NGA	National Geospatial-Intelligence Agency
NIT	National Institute of Technology
OSDMA	Odisha State Disaster Management Authority
OUAT	Odisha University of Agriculture and Technology
SRTM	Shuttle Radar Topography Mission
WIO	Water Initiatives Odisha
WMO	World Meteorological Organization
WRD	Water Resource Department
WRIS	Water Resource Information System

EXECUTIVE SUMMARY

The Mahanadi River or the 'Great River', revered as "Mahanadi Maiyya," flowing through Chhattisgarh and Odisha, has long been central to the region's ecological, economic, and cultural fabric, shaping the livelihoods, traditions, and identities of communities along its banks. Historically, the river was deeply intertwined with daily life—supporting agriculture, fisheries, artisanal crafts, and serving as a spiritual and cultural anchor through festivals, rituals, and oral traditions. Communities such as the Gond, Kandha, Binjhal, Mirdhas, Saora, Shabar, Kolha, Dal, Kamar, and Binjhwar tribes developed intricate knowledge systems and sustainable practices, including flood-recession agriculture, artisanal fishing, and the stewardship of sacred groves and fish sanctuaries, which collectively ensured ecological balance and resilience.

However, in recent decades, this profound connection has been disrupted by a convergence of large-scale infrastructural interventions, rapid industrialization, urban expansion, and shifting socio-economic dynamics. The construction of major dams like Minimata Bango, Hirakud, and Ravishankar Sagar has led to widespread displacement, the submergence of villages, and the erosion of traditional knowledge and cultural sites. Industrial growth, particularly in water-intensive sectors such as mining, steel, and power, has resulted in severe pollution, biodiversity loss, and health risks, further alienating communities from the river. Urbanization has restricted access to riverbanks, degraded water quality, and shifted recreational and ritual practices away from direct engagement with the river, while modern irrigation and chemical-intensive agriculture have reduced dependence on natural river cycles, leading to groundwater depletion and the loss of indigenous seed diversity. The proliferation of illegal sand mining has also altered river morphology, depleted groundwater, and marginalized traditional sand collectors.

These changes have had far-reaching implications. Ecologically, the loss of traditional stewardship has weakened conservation efforts, increased the spread of invasive species, and diminished community advocacy for river protection. Socio-economically, traditional livelihoods have declined, economic inequality has deepened, and distress migration has increased as river-dependent communities face growing uncertainty. Culturally and psychologically, the erosion of identity, spiritual alienation, and the loss of communal spaces have weakened social cohesion and interrupted the transfer of intergenerational knowledge. In response, grassroots movements such as the Mahanadi Bachao Andolan and Nadi Bachao Abhiyan have mobilized citizen science, legal advocacy, and intergenerational knowledge transfer to restore river-people connections, while documentation projects and community-managed fish sanctuaries are working to preserve cultural heritage and promote ecological restoration. Government initiatives have focused on riverfront development, wetland restoration, and participatory governance through River Basin Management Committees, though balancing access, ecological integrity, and community needs remains a challenge.

To address these issues, the report recommends scaling community-based water conservation by restoring traditional water structures and empowering women-led stewardship, institutionalizing

inclusive governance with stronger legal frameworks for community participation and ecological flow mandates, and promoting sustainable livelihoods through incentives for river-friendly agriculture, fisheries, and ecotourism. It also calls for the revitalization of cultural heritage through the protection and documentation of river-related traditions and educational engagement, as well as a phased action plan that prioritizes immediate community engagement and monitoring, followed by medium-term institutional reforms and long-term structural changes to enhance resilience. Ultimately, restoring the river-people connection in the Mahanadi basin is essential for sustainable development, ecological health, and cultural continuity. Achieving this goal will require inclusive governance, recognition of traditional knowledge, and the integration of community-led initiatives with policy and institutional support, ensuring that the Mahanadi continues to serve as a “Great River” and a vital social-ecological legacy for future generations

1. Introduction

The Mahanadi River, coursing through the heart of Chhattisgarh and Odisha, has historically been much more than a geographical feature; it is a living entity that has shaped the region's ecological, economic, cultural, and spiritual landscapes for centuries. Traditionally, the river has sustained complex systems of agriculture, fisheries, trade, and artisanal livelihoods, while also serving as the axis of cultural identity, religious practice, and social organization for countless communities. From the sacred ghats of Binka, Cuttack, Sirpur and Rajim to the fertile floodplains of Mahanadi delta, Mahasamund and Dhamtari, the Mahanadi has been revered as "Mahanadi Maiyya"—a nurturing mother and a source of both material sustenance and spiritual meaning. The river valley is dotted with temples, including those at Rajim and Sirpur in Chhattisgarh, and the famed leaning shrine at Huma near Sambalpur in Odisha, all of which continue to draw devoted pilgrims.

However, the last few decades have witnessed a profound transformation in the nature of river-people interactions in Chhattisgarh and Odisha. Large-scale infrastructural interventions, rapid industrialization, urban encroachment, and changing socio-economic contexts have led to what can be termed a 'river-people disconnect.' Displacement due to dam construction, pollution from industrial effluents, loss of traditional livelihoods, and exclusion from river governance have collectively weakened the deep-rooted bonds that once defined the region's relationship with its river. This disconnect is not merely a local phenomenon but echoes broader patterns seen across India, where development paradigms have often prioritized resource extraction over ecological integrity and community well-being.

Against this backdrop, the present report undertakes a comprehensive analysis of the current state of river-people relationships in the Chhattisgarh and Odisha portions of the Mahanadi River Basin (MRB). By integrating historical perspectives, empirical data, and case studies, the report aims to highlight both the enduring significance, and the contemporary challenges of the river-people connect, with a goal of informing more inclusive and sustainable river basin management.

1.1 Scope and Objectives of the Report

This report focuses on the Chhattisgarh and Odisha portions of the MRB, encompassing a diverse range of rural, peri-urban, and tribal communities whose lives and livelihoods are intertwined with the river. The analysis spans economic, cultural, ecological, and social dimensions of river-people interactions, drawing on both historical continuity and recent transformations.

The specific objectives of the report are as follows:

a) To document and analyze the current nature of people-river interactions in the MRB across Chhattisgarh and Odisha, with attention to economic, cultural, and ecological aspects.
b) To identify and examine the key drivers of river-people (dis)connect, including infrastructural development, industrialization, displacement, and environmental degradation.
c) To assess the implications of these changing relationships for livelihoods, social cohesion, and ecological sustainability.

d) To review and evaluate the efforts of NGOs, local governments, and community organizations in restoring or enhancing river-people connections.
e) To provide evidence-based recommendations for policy and practice that can strengthen the river-people relationship and contribute to more resilient river basin management.

1.2 Overview of River-People Interactions in the Mahanadi Basin

The traditional relationship between communities and the Mahanadi River in Chhattisgarh and Odisha has been characterized by a remarkable degree of interdependence and adaptability. Agricultural communities synchronized their cropping cycles with the river's seasonal rhythms, utilizing flood-recession agriculture and nutrient-rich silt deposits to sustain productivity. Indigenous fishing communities developed sophisticated ecological knowledge, adapting their techniques to the river's changing flows and fish migration patterns. The river also served as a vital artery for trade and transport, supporting a network of boatmen, artisans, and local markets.

Culturally and spiritually, the Mahanadi has been venerated in local folklore, rituals, and festivals such as Bali Jatra, Boita Bandāna (Dangā Bhasā), Chhath Puja, and Rajim Kumbh, which draw thousands to its banks each year. The river's presence permeates every stage of life, from an organism's orogin (birth) to its eventual termination (death), with rituals and ceremonies reinforcing the sense of belonging and stewardship. Tribal communities, such as the Binjhal, Binjhwar, Dal, Gond, Kamar, Kandha, Kolha, Mirdhas, Saora, and Shabar, have maintained intricate knowledge systems related to biodiversity, flood prediction, and medicinal plants, further underscoring the river's centrality in local life.

Yet, this symbiotic relationship has been increasingly disrupted. Large dam projects—such as the Hirakud, Minimata Bango and Ravishankar Sagar dams—have displaced tens of thousands, severing generational ties to the river and undermining traditional livelihoods. Industrial pollution, sand mining, and urban sprawl have degraded water quality and reduced access to riverine resources. The cumulative effect has been a weakening of both material and intangible benefits, with significant consequences for community resilience and ecological health.

1.3 Importance of River-People Connect in River Basin Management

The strength of river-people connections is fundamental to the success of river basin management. Where these connections remain vibrant, communities function as active stewards of river health, integrating traditional knowledge with contemporary management practices. This synergy fosters collective action, enhances compliance with conservation measures, and ensures that management strategies are contextually grounded and socially legitimate.

Conversely, the erosion of these connections undermines stewardship, accelerates environmental degradation, and diminishes the capacity for adaptive management. Displacement, exclusion from governance, and loss of traditional knowledge not only disrupt livelihoods but also weaken the social fabric that underpins sustainable resource use. Recognizing, restoring, and strengthening river-people relationships is thus essential for achieving equitable, resilient, and ecologically sound river basin management in the Mahanadi and beyond.

1.4 Data Collection and Methodological Approach

To develop a comprehensive understanding of river-people interactions in MRB, a multidisciplinary and participatory approach to data collection was used. This report employs a combination of primary and secondary data sources, including:

- **Field surveys and participatory rural appraisals** to capture local perceptions, practices, and changes in river use.
- **Hydrological and ecological assessments** using secondary data to understand the impact of human interventions in changes in river flows, water quality, and biodiversity.
- **Case studies and oral histories** that provide nuanced insights into the lived experiences of river-dependent communities, including those affected by displacement, pollution, or livelihood transitions.
- **Review of government reports, academic research, and NGO documentation** to triangulate findings and ensure analytical rigor.

2. Current nature of people-river interactions in Mahanadi River Basin

2.1 Reliance on Mahanadi River for livelihood (Economic)

The Mahanadi River is a critical economic artery for Chhattisgarh and Odisha, underpinning the livelihoods of millions through agriculture, industry, and fisheries. Its waters, floodplains, and associated ecosystems have shaped the region's economic landscape for centuries, supporting both traditional livelihoods and modern development. The river serves as a backbone for multiple economic activities. This section examines the patterns and hotspots of agricultural, industrial, and fishery activities that depend on the Mahanadi, highlighting their significance, spatial distribution, and emerging challenges.

2.1.1 Agricultural Activities (Hotspots)

Agriculture is the cornerstone of rural livelihoods in the Mahanadi basin, shaping the socio-economic fabric of the region for generations. The river, its tributaries and distributaries provide essential water resources, supporting both traditional and modern farming systems across a landscape marked by diverse agro-ecological zones. The basin's agricultural sector contributes significantly to Chhattisgarh and Odisha's economy, accounting for over 15% and 19% of value added, substantially higher than the national average and employs a large proportion of the rural population. Agriculture in the Mahanadi basin is characterised by a mix of traditional and modern practices. The region's fertile alluvial soils and assured water supply support paddy-dominated cultivation, with increasing diversification into pulses, oilseeds, vegetables, and commercial crops.

In Chhattisgarh region, the **gross cropped area** in the basin is estimated at **2.5 million hectares**, with **rice occupying nearly 70%** of the cultivated area. The basin contributes **over 65% of the state's rice production**, amounting to more than **10 million tonnes annually**. In well-irrigated zones, cropping intensity reaches **150–180%**, enabling double and even triple cropping. Similarly, Odisha has a predominantly agricultural landscape, with a gross cropped area estimated at around **4.3 million hectares**. Rice remains the dominant crop, accounting for over 67% of the total cropped area, especially concentrated in both the western and coastal parts of the state, producing over 9 million tonnes annually. Cropping intensity in irrigated

areas is relatively high, estimated between **110% and 150%**, particularly in regions supported by projects like the Mahanadi–Rushikulya link canal system.

In both states, the irrigation is primarily supported by surface water from the Mahanadi River and its tributaries, supplemented by tanks and groundwater systems. MRB hosts major irrigation structures such as the **Ravishankar Sagar (Gangrel) Dam**, which commands an irrigation potential of over **150,000 hectares,** and **Hirakud Dam**, which alone irrigates nearly **155,600 hectares in the Kharif season and over 108,000 hectares in the Rabi season.** In total, the MRB in Chhattisgarh contributes more than **60% of the state's surface irrigation potential, while in Odisha it contributes approximately 48%.** Additionally, the Mahanadi River supports an extensive network of irrigation canals in Chhattisgarh and Odisha, playing a crucial role in both states' agricultural economy. For example, major canal systems in Western Odisha and the Mahanadi Delta Canal System in the coastal districts distribute water to vast areas across regions such as Sambalpur, Bargarh, Cuttack, and Puri. Originating from key infrastructure like the Hirakud Dam and Naraj Barrage, these canals irrigate lakhs of hectares, enabling multi-season cropping and enhancing food security.

Table 1 Irrigation and Production Indicators in the Mahanadi Basin (Chhattisgarh and Odisha)

Indicator	Value / Description	
	Chhattisgarh	**Odisha**
Gross Cropped Area	2.5 million hectares	4.3 million hectares (both Kharif and Rabi)
Dominant Crop	Rice (~70% of total cropped area)	Rice (~67% of total cropped area)
State Rice Production Share (from basin)	>65% of ~10 million tonnes annually	>63% of ~9 million tonnes annually
Cropping Intensity in Irrigated Areas	150–180%	110–150%
Surface Irrigation Share (Canals)	43% of net irrigated area	86% of net irrigated area
Groundwater Irrigation (Wells & Tubewells)	35–40% of net irrigated area	10–14% of net irrigated area
Major Irrigation Structure	Ravishankar Sagar Dam (~150,000 ha command area)	Hirakud Dam (~155,600 ha in kharif + 108400 ha in rabi)
Length of Canal Network	>1,500 km of main canals and distributaries	
Number of Minor Irrigation Tanks	>5,000 tanks across the basin	

2.1.1.1 Agro-Ecological Hotspots Across River Segments

The MRB in Chhattisgarh and Odisha can be divided into three agro-ecological segments—upper, middle, and lower—each with distinct cropping patterns, water management systems, and traditional practices. These segments are not only agronomically significant but also culturally and socially unique in their river-dependence.

In the upper basin of Chattisgarh, the **Diyara** system requires **zero chemical inputs**, relying on silt-enriched soils and flood-recession dynamics. The **middle basin** alone contributes around **42%** of Chhattisgarh's total rice output. The **lower basin of Odisha,** approximately **68%** of farmers practice integrated aquaculture–paddy farming. **Bargarh's** reputation as the rice bowl of Odisha is supported by its intensive paddy cultivation and the presence of numerous rice mills. The district produces approximately **6,00,000 metric tonnes of rice annually**. This

high yield is partly due to the irrigation provided by the Hirakud Dam, which also benefits other parts of western Odisha.

Table 2 Agricultural Hotspots in the Mahanadi Basin

River Segment	Key Districts	Main Crops	Traditional Practice	Productivity
Upper Basin (Sihawa–Dhamtari)	Gariaband, Dhamtari	Kodo rice, Kutki millet, Tur dal	Diyara flood-recession farming	2.1 t/ha (rice)
Middle Basin (Raipur–Mahasamund)	Raipur, Mahasamund	Sona Mansuri rice, vegetables	Kata tank irrigation	3.8 t/ha (rice)
Middle Basin (Janjgir–Korba)	Bilaspur, Korba	Sugarcane, banana, paddy, fish	Integrated rice–fish farming	65 t/ha (sugarcane)
Lower Basin (Sambalpur–Sonepur)	Sambalpur, Subarnapur (Sonepur), Bargarh	Irrigated paddy, pulses, vegetables	Kata tank irrigation, canal irrigation, SRI adoption	~3.5–4.0 t/ha (irrigated rice)
Lower Basin (Boudh- Angul)	Angul, Boudh, Athagarh parts of Cuttack	Rainfed rice, pulses (tur), oilseeds	Mixed cropping, drought-resilient paddy, podu in forest zones	~2.0–2.5 t/ha (rainfed rice)
Lower Basin (Cuttack–Delta)	Cuttack, Jagatsinghpur,	Paddy, banana, vegetables, and aquaculture (fish)	Integrated rice–fish farming in floodplains and delta	~3.5 t/ha (rice); higher in integrated systems

Table 3 Description of key Agricultural Hotspots in Mahanadi Basin

Hotspot/Practice	Location/Area	Description
Rice-Growing Plains	Raipur, Durg, Dhamtari, Mahasamund, Janjgir-Champa, Bilaspur, Rajnandgaon, Cuttack, Subarnapur, Bargarh, Sambalpur, Angul	Extensive paddy cultivation, dependent on both monsoon and river irrigation.
Riverbed Farming	Mahasamund (Paragaon, Ghodari) and Near Hirakud tail-end (Mahanadi sandy beds)	Seasonal cultivation on sandy riverbeds from December to May, utilizing receding river water.
Irrigated Command Areas	Dhamtari, Balod, Janjgir-Champa, Bargarh Jagatsinghpur, Cuttack	Intensive agriculture supported by major irrigation projects (Ravishankar Sagar, Dudhawa, Sondur, Hasdeo Bango, Tandula and the Mahanadi–Chitrotpala Island project irrigating ~6,400 ha).
Horticulture & Diversification	Upper basin, canal networks, Patnagarh (Balangir), Kandhamal, Banki	Cultivation of Mango (Amrapali, Langra, Dasheri), turmeric (GI-tagged Kandhamal haladi), jackfruit, guava, banana, litchi, and pulses alongside paddy.

2.1.1.2 Traditional and Modern Farming Systems

Traditional knowledge systems, especially those practiced by tribal communities, coexist with modern agriculture in the basin. The **Kamar tribe's Diyara system, in the upper basin,** is a notable example, using receding floodwaters to grow millet and tur dal. Along 140 km of riverbanks, women cultivate vegetables like spinach and cucumber using natural silt beds, without chemical inputs. The **Bhitri model**, increasingly adopted in the lower basin, integrates rice fields with fish ponds, boosting income and resource efficiency. Meanwhile, modern farming in irrigated areas relies on chemical inputs, high-yielding varieties, and market linkages. Recent efforts are also reviving organic methods to balance productivity with soil health.

Table 4 Comparison of Farming Systems in the Basin (2023)

Practice	Rice Yield	Input Cost (₹/acre)	Soil Health Index	Remarks
Traditional Diyara	2.4 t/ha	₹8,200	82	Flood-recession; no external inputs
Conventional Farming	3.6 t/ha	₹14,500	61	Irrigation + chemical fertilizers
Organic Revival	3.1 t/ha	₹9,800	75	Compost + improved seed + SRI methods

Despite the sector's importance, only about 39% of the cultivated land in the basin is irrigated, leaving the majority of farmers dependent on monsoon. This reliance on rainfed agriculture makes communities acutely vulnerable to climate variability, particularly erratic rainfall and frequent droughts. Fourteen districts in central Chhattisgarh are officially classified as drought-prone, with farmers reporting a shift in drought frequency from every 8–10 years to every 2–3 years in recent decades. This has led to increased adoption of hybrid and drought-resistant crop varieties, but also to a gradual erosion of traditional cropping systems and native agrobiodiversity. Similarly, several districts in western Odisha are identified as drought-prone areas. These include Bolangir, Bargarh, Nuapada, Kalahandi, Kandhamal and Phulbani. These districts are located in the middle part of the MRB.

Agriculture in the MRB is both highly productive and deeply vulnerable. While the river supports a vibrant agricultural economy, the combined pressures of climate change, water scarcity, industrial competition, and pollution threaten the sustainability of rural livelihoods and the long-term food security of the region.

2.1.2 Industrial Activities (Hotspots)

Chhattisgarh and Odisha's rapid industrialization has transformed the Mahanadi River into a critical resource for the state's burgeoning mining, power generation, cement, iron, and steel sectors. This expansion has dramatically increased the demand for river water, with the region now hosting some of India's largest clusters of water-intensive industries.

2.1.2.1 Industrial Hotspots in the Mahanadi Basin

Industrial development is clustered in distinct regional hotspots. These zones have grown around mineral reserves, strategic transport links, and access to river water for large-scale manufacturing and power generation. The detailed overview of **major industrial regions** within the MRB in Chhattisgarh and Odisha is presented in Table 5.

Table 5 Major Industrial Hotspots in Mahanadi Basin (Chhattisgarh and Odisha)

Region	Key Features	Major Industries
Raipur Region	- Rich reserves of minerals, limestone, and coal - Naya Raipur as new administrative capital - 158 large and mid-scale industries	Monnet Ispat, Jindal, Century Cement, Lafarge, Ambuja Cement, Ultratech Cement
Bilaspur Region	- Hub for South Eastern Coalfields Ltd (SECL) - Sirgitti Industrial Growth Centre (338 Ha) - Zonal HQ of SECR, among India's most profitable railway zones (17% of national revenues)	Ancillary coal units, paper mills, engineering works
Korba Region	- Known as the "Power Capital of India" - Rich coal and bauxite reserves - Linked to Bilaspur and Raipur via road and rail	NTPC thermal power plants, BALCO aluminium smelters, coal mining
Durg–Bhilai Region	- Rich deposits of iron ore, limestone, quartzite - 50 km from Raipur airport - Borai Industrial Growth Centre (397 Ha)	Bhilai Steel Plant (SAIL), ACC Cement
Sambalpur–Hirakud	- Hydroelectric power from Hirakud Dam - Early aluminium and cable manufacturing hub- Hindalco smelter at Hirakud	Aluminium smelter (Hindalco), cable manufacturing, steel re-rolling mills
Jharsuguda–Sambalpur	- Coal mining (Mahanadi Coalfields Ltd. HQ in Sambalpur) - Aluminium hubs- Cement and refractories plants	MCL coal mines, Vedanta aluminium, UltraTech cement, and refractories
Cuttack–Jagatsinghpur	- Port access via Paradip- Fertilizer plants - Cardboard and sugar processing- Breweries	IFFCO & Paradip Phosphate fertilisers, paper/cardboard mills, sugar & beverage units
Angul	- Rich iron ore, bauxite	Jindal Steel, speciality steel processing

2.1.2.2 Regional Profiles of Industrial Hotspots

Industrial development in the basin is shaped by transport infrastructure, mineral access, and planned industrial estates. The key industrial infrastructure in MRB is discussed below.

a) Raipur Region

Raipur is a prominent industrial centre due to its rich **mineral resources (limestone, coal, iron ore)** and central geographic location. The development of **Naya Raipur** as the planned capital has further added infrastructure and urbanisation momentum. With over **158 large and mid-scale industries**, the district is home to major players in **steel, cement, and power generation**.

b) Bilaspur Region

Bilaspur serves as a strategic hub for **coal mining and transport**. The presence of **South-Eastern Coalfields Ltd. (SECL)** drives mining operations and ancillary industries. The **Sirgitti**

Industrial Growth Centre (338 hectares) supports diverse manufacturing. Bilaspur also houses the zonal headquarters of the **South-East Central Railway (SECR)**—one of India's most profitable railway zones, contributing ~17% of national railway revenues. Key industries include **coal processing, paper production, rail-based logistics**, with major effluent concerns (coal ash, BOD, chlorinated compounds).

c) Korba Region

Nicknamed the "**Power Capital of India,**" Korba has abundant **coal and bauxite reserves**. It is connected to Bilaspur and about 200 km from Raipur airport. Industrial activity in the region is dominated by **thermal power generation (NTPC, CSEB)**, **aluminium production (BALCO)**, and extensive **coal mining**. Korba's thermal power plants consume over **680 MLD of water**, leading to environmental issues such as **fly ash contamination**, **thermal effluents**, and **fluoride pollution**. The **Hasdeo River stretch** has been declared "critically polluted," with biodiversity loss including a **92% reduction in fish species** near the Hasdeo–Mahanadi confluence.

d) **Durg–Bhilai Region**

Durg-Bhilai Region is rich in **iron ore, limestone, and quartzite**, and is well-connected (just **50 km from Raipur**). It hosts the iconic **Bhilai Steel Plant (SAIL)**, one of India's largest integrated steel facilities, alongside major cement manufacturers like **ACC**.

e) **Jharsuguda Region**

Jharsuguda has emerged as one of Odisha's fast-growing industrial district, driven by its abundant coal reserves, robust transport connectivity (including an airport), and power-intensive infrastructure. The district is home to **Vedanta Aluminium, one of India's largest aluminium smelters**, as along with several sponge iron, ferroalloy, and cement units. Jharsuguda Industrial Estate and SEZs support export-oriented industries. However, this rapid industrial growth has bought up significant environmental challenges—such as **air pollution** from sponge iron units and coal dust, and water quality degradation in local streams that feed into the Mahanadi.

f) Hirakud–Sambalpur Corridor

Centred around the Hirakud Dam, one of the longest earthen dams in the world, this corridor integrates hydroelectric power generation with aluminium and cable manufacturing. Hindalco Industries operates a smelter unit at Hirakud, utilizing both hydropower and thermal energy to produce value-added aluminium products. The region benefits from the dual advantage of water security (through the reservoir) and its proximity to raw materials and labour markets. This zone also includes multiple rice mills and agri-based processing units that tap into the irrigated agricultural hinterlands. While less polluted than the thermal hotspots of Jharsuguda and Angul, the backwaters of Hirakud have experienced sedimentation, pesticide runoff, and invasive aquatic species due to agricultural intensification.

g) Paradip–Cuttack–Jagatsinghpur Region

The coastal industrial cluster surrounding Paradip Port is vital for the export-import economy of Odisha. It hosts large-scale fertilizer and petrochemical units such as Indian Farmers Fertilizer Cooperative Limited (IFFCO), Paradip Phosphates Ltd. (PPL), and the Indian Oil Corporation's refinery. The region also supports agro-processing, packaging, and marine-based industries, leveraging both inland water transport and port access. Cuttack, with its heritage in

small-scale industries (like surgical instruments and textiles), contributes to trade and logistics for the coastal corridor. However, the area faces environmental challenges such as coastal erosion, saline water intrusion, and industrial effluents entering the estuarine delta systems of the Mahanadi.

h) Athagarh–Kalinganagar Region

Situated in the eastern mining belt of Odisha, Athagarh-Kalinganagar region has become a major centre for steel and downstream metal industries. The Kalinganagar Industrial Complex in Jajpur district, often reffered to as "Steel Hub of India", hosts giants like Tata Steel, Jindal Steel & Power, Shyam Steel, and several medium scale rolling and forging units. The complex is regionally linked to Cuttack (at Kalinganagar), enhancing logistical integration. Athagarh complements this ecosystem with industrial estates and railway links that connect mineral supply chains. These developments are transforming the region into a high-output manufacturing zone. However, this has led to environmental concerns include deforestation, riverbank encroachment, and pollution in tributaries feeding into the Mahanadi due to untreated industrial discharge.

2.1.2.3 Industrial Water Dependence and Pollution

Industrial hotspots along the MRB in Chhattisgarh—including Raipur, Bilaspur, Korba, and Durg–Bhilai—are marked by high water demand and diverse pollution profiles. Water use in these regions ranges from 310 to 680 million litres per day (MLD), supporting sectors such as steel, cement, power generation, coal mining, and aluminium production. This heavy dependence on the river system for process operations and cooling needs is coupled with the discharge of pollutants like suspended solids, heavy metals, fly ash, fluorides, and organic wastes. The environmental consequences evident are: increased water hardness in the Middle Mahanadi River, declining dissolved oxygen levels in the Arpa tributary, and “critically polluted” stretches in the Hasdeo River.

In Odisha, industrial hotspots, particularly Angul, Jharsuguda–Sambalpur, Cuttack, Khordha, and Paradip–Jagatsinghpur, also exhibit substantially high water demand and complex pollution footprints. These regions host major industries such as aluminium smelters (NALCO, Vedanta), steel and ferroalloy units (Jindal, Shyam Steel), fertilizer plants (IFFCO, PPL), petrochemical complexes (IOCL), and food/agro-processing zones. Water consumption in these clusters ranges from 300 to over 650 MLD, primarily sourced from the Mahanadi River and its tributaries, as well as from groundwater in fringe areas. The intensive use of water for process operations and cooling is accompanied by pollutant discharge, including heavy metals, thermal effluents, fly ash, nitrates, fluorides, and industrial organics. In Angul and Jharsuguda, coal-fired power and aluminium industries release significant quantities of ash slurry and effluents, contributing to the degradation of river stretches and adjacent wetlands. The Cuttack–Khordha industrial corridor, including sectors like packaging, small-scale chemicals, electronics, and logistics, adds urban-industrial runoff that enters river channels through storm drains and old nallas. In Paradip, port-based fertilizer and petrochemical units contribute to estuarine pollution through nutrient-rich discharges and hydrocarbon residues.

2.1.3 Fish and Fishery Activities (Hotspots)

Fisheries and aquaculture constitute vital components of the rural economy in the MRB, playing a crucial role in providing livelihoods, food security, and cultural continuity. In Chhattisgarh, T

these activities support over 210,000 people, many of whom belong to Scheduled Castes and Tribes with deep-rooted traditions in fishing and riverine resources management. In Odisha, the sector sustains a much larger population - over 1.5 million fishermen - according to the Times of India. making it the eighth largest fishing community in India. Chilika Lake alone supports more than 200,000 fishermen, with 132 fishing villages around its shores and a combined population of over 150,000. Despite its importance, the sector faces mounting pressures arising from hydrological alterations, pollution, habitat loss, and socio-economic shifts. Ensuring its sustainability is critical for maintaining the basin's river–people connect.

2.1.3.1 Fisheries Hotspots and Production Zones

Fishing in the MRB is geographically diverse, with productivity shaped by river morphology, floodplain dynamics, and reservoir development. In the upper basin, including regions like Gariaband and Kurud, artisanal fisheries are prevalent, targeting species such as Mahseer, Catla, and Rohu. The middle basin, encompassing Arang and Rajim, is the most productive zone, contributing nearly half of the basin's total inland catch. Here, extensive floodplains, seasonal channels, and irrigation networks create rich aquatic habitats supporting species such as Mrigal, Calbasu, and Prawns. The lower basin, covering Bilaspur and Champa, fisheries once supported substantial Hilsa populations. However, catches have declined significantly due to altered flow regimes and barriers to fish migration. Nevertheless, reservoir-based fisheries remain an important component of the basin's production system. Managed sites such as Gangrel and Dudhawa employ fish stocking programs that help sustain yields, although they have often displaced traditional fishing communities and altered customary practices.

Fishing is a vital livelihood in Odisha's Mahanadi basin, shaped by riverine, deltaic, and estuarine systems. Districts like Boudh and Angul support small-scale inland fisheries in river channels and tanks, where artisanal fishers target species such as Rohu, Catla, and Mrigal in flow-sensitive, low-yield environments. Sambalpur, Subarnapur, and Cuttack form the basin's most productive inland fishing zone, benefiting from the Hirakud Reservoir's canal network and floodplain connectivity. Managed stocking supports harvests of Calbasu, Pangasius, and prawns, with growing integration of rice–fish farming enhancing productivity. In the deltaic stretches of Jagatsinghpur and Puri, estuarine and brackish water conditions shape fisheries. Chilika Lake—a Ramsar site and Asia's largest brackish lagoon—supports over 200,000 fisherfolk and species like Hilsa, mullet, crabs, and tiger prawns. However, catch levels are affected by salinity shifts, hydrological changes, and siltation. Sustaining this diversity requires ongoing restoration and adaptive governance.

2.1.3.2 Traditional and Modern Fishing Practices

Fishing practices in the basin reflect both indigenous knowledge and technological modernization. Traditional methods include bamboo trap systems (*Bheda Jal*) in the upper basin floodplains, seasonal weir structures (*Khola Machhi*) in the middle basin, and moon-cycle-based Hilsa netting in the lower basin. In the deltaic and coastal regions, particularly Jagatsinghpur, and the Chilika Lake area, artisanal fishing traditions are deeply tied to tidal cycles and salinity changes. One of the most culturally and economically significant practices here is moon-cycle-based netting for Hilsa, using techniques such as stake nets (Khanda Jal) and drift nets. In addition to these, prawn culture in "gheris"—large embanked enclosures created within brackish water zones of Chilika Lake—has become widespread. These prawn gheris, primarily used for Tiger Prawn (Penaeus monodon) farming, represent a hybrid model of traditional brackish water aquaculture and commercial enterprise. However, unregulated expansion of these gheris has raised ecological concerns over lagoon hydrology and native fish

biodiversity. These systems have supported generations of rural households and are often managed collectively by extended families, with significant participation by women and youth in harvesting and marketing.

In contrast, modern aquaculture has expanded rapidly through government-supported programs. Fish seed farms produce over 80 million fry annually, supporting reservoir stocking and integrated rice–fish culture on approximately 12,000 ha. Managed reservoirs such as Kharkhara, Tandula, and Kodar further illustrate the shift toward planned, cooperative-based culture fisheries that aim to stabilize yields and incomes. In Odisha, through state-led initiatives over 12,000 hectares are now under integrated rice–fish farming, and hatcheries produce more than 100 million fry annually.

2.2 Role of Mahanadi River as part of cultural practices

The Mahanadi River has been central to the cultural life and identity of Chhattisgarh and Odisha for centuries, shaping not only the material livelihoods of its people but also their rituals, festivals, folklore, and social organization. Revered as "Mahanadi Maiyya" (Mother Mahanadi), the river is deeply woven into the spiritual, cultural, and everyday practices of communities along its banks, reflecting a worldview in which the river is both a living entity and a source of collective memory.

Fig. 1 Gendi dance (sometimes referred to as Daini dance)

Fig. 2 Karma Dance

2.2.1 Cultural Practices and Oral Traditions

The Mahanadi is deeply personified in local songs, folk tales, and oral histories. Traditional folk performances, such as the Daihani and Sua dances, often reference the river's gifts—fertile soil, fish, and water—highlighting its vital role in sustaining agriculture and daily life. These performances are integral to community gatherings and seasonal celebrations, especially during the post-harvest period when the river's generosity is most keenly felt.

Rituals marking life's milestones like birth, marriage, and death, often involve the river. Newborns are brought to the river for blessings, marriages incorporate river water in ceremonial rites, and cremation ashes are immersed in the river to ensure spiritual liberation. These practices create a continuous thread linking individual and communal life cycles to the river's natural rhythms.

Fig. 3 Dalkhai Folk Dance Celebrating Harvest, Life, and Unity

Fig. 4 Sua Dance

Folk performances such as the Dalkhai, Karma Naach, Rasarkeli, particularly popular among tribal and rural communities in districts like Sambalpur, Boudh, and Subarnapur, often celebrate the Mahanadi's benevolence. These dances and songs narrate tales of the river's life-giving waters, its power to nourish fields, and its role in shaping the landscape. During post-harvest festivals such as Nuakhai, the river is invoked and offered thanks for its essential role in ensuring agricultural prosperity and food security.

Communities such as the Nolias and Kaibartas (Keuta), who depend on fishing for livelihood, revere Chilika as a sacred mother. Local legends associate the lagoon with divine presence, especially the goddess Kalijai, whose island temple within Chilika draws thousands of pilgrims annually.

2.2.2 Traditional Occupations and Cultural Identity

Traditional fishing communities along the Mahanadi have developed elaborate cultural practices around their occupation that are unique to this river system.

Fig. 5 Kaibarta Community Fishing

Fig. 6 Koli Community Fishing

The Koli, Kaibarta, Nolias, and Kandaras communities have maintained distinct cultural identities centered around their relationship with the Mahanadi, including specific rituals for the start of fishing seasons, community festivals celebrating good catches, and traditional knowledge systems about fish behavior and river ecology. These communities have developed unique boat-building techniques adapted to the Mahanadi's flow patterns and seasonal variations, along with specialized fishing methods that have been passed down through generations.

2.2.3 Case Studies

a) Case Study 1: Rajim Kumbh Mela

The Rajim Kumbh is not only a religious congregation but also a cultural phenomenon that revives and reinforces the river's centrality in regional identity. During the festival, families return from distant districts to their ancestral ghats, rekindling kinship ties and reaffirming their connection to the river. Elders recount how the festival serves as an annual homecoming, restoring a sense of belonging and continuity across generations.

Fig. 5 Rajim Kumbh fair

Fig. 6 Shivrinarayan Temple

b) Case Study 2: Shivrinarayan Temple and Rituals

At Shivrinarayan, one of the oldest temple towns on the Mahanadi, the river is integral to daily worship and temple rituals. Local priests emphasize that the purity of the river is essential for the efficacy of religious ceremonies. Community members actively participate in river-cleaning drives before major festivals, demonstrating the seamless integration of ecological stewardship and spiritual practice.

c) Case Study 3: Bali Jatra

Mahanadi is not just a water source—it is revered in songs, folktales, and rituals. The river features in Odia literature and folklore, often symbolizing life, abundance, and resilience. Women perform 'Puspunjali' and 'Boita Bandana' along its banks during Kartika month. One of the most prominent cultural practices linked to the Mahanadi River is Bali Jatra, a grand maritime festival celebrated annually on the banks of the river in Cuttack, particularly near the Gadagadia ghat.

Fig. 7 Bali Jatra Festival at Cuttack

This week-long festival commemorates the ancient boita-bandana tradition, when Sadhabas (Odia mariners) would sail from the Mahanadi delta to Southeast Asia for trade. On the full moon day of Kartika (Kartik Purnima), thousands of devotees float miniature boats made of banana stem or paper in the river, symbolizing the historical voyages. Women dress in traditional attire and sing folk songs like "Aa ka ma boi," preserving oral heritage tied to river navigation. The ritual highlights not only the river's role in sustaining commerce and livelihood in the past but also its revered position in seasonal and collective cultural memory.

d) Case Study 4: Dhabaleswar Temple and it's rituals

Dhabaleswar Temple, located on an island in the Mahanadi River near Athagarh, constructed during the rule of the Somavamshi dynasty by King Yayati Keshari, is dedicated to Lord Shiva and is known for its unique rituals and festivals, particularly during the Shravan month, Panchuka and Maha Shivaratri. Devotees visit the temple to offer prayers, especially Bel leaves and milk, and participate in various rituals seeking blessings from Lord Shiva. The temple is embellished with stone carvings that date back to the early 10th and 11th century.

Fig. 8 Dhabaleswar Temple

e) Case Study 5: Maa Samaleswari Temple and it's rituals

Fig. 9 Samaleswari Temple

The Samaleswari Temple, located on the banks of the Mahanadi River in Sambalpur, is a significant Hindu temple dedicated to Goddess Samaleswari (known among the natives as *samalei maa*), the presiding deity of the region. It is known for its unique Kalinga style architecture, characterized by a rectangular sanctum and intricately carved stone walls, rich rituals, and vibrant festivals, particularly Nuakhai, the harvest festival. The temple holds immense cultural and spiritual importance for the people of Sambalpur and western Odisha.

2.2.4 Unique Practices Specific to Mahanadi and Chhattisgarh and Odisha

a) **Flood Rituals:** In many riverside villages, the arrival of the monsoon and the swelling of the Mahanadi are welcomed with songs, offerings, and communal prayers, seeking the river's blessings for a bountiful harvest and protection from floods.

b) **Riverbank Fairs:** Weekly and seasonal markets (haats) are often held on the riverbanks, turning these spaces into vibrant centers of trade, social interaction, and cultural exchange.

c) **Artisanal Traditions:** Pottery, mat weaving, and boat making, using materials sourced from the riverbanks, are not only economic activities but also expressions of cultural identity, with skills and stories passed down through generations. The Mahanadi's gifts extend beyond water. Potters in Dhamtari, Banki and Cuttack shape ritual idols from its clay, while artisans in Kurra weave river reeds into baskets and mats. use its clay to mold ritual idols and cooking pots. In the Chilika region, boat-building remains an artisanal tradition passed down through generations.

d) A Stage for Celebration: The river transforms into a vibrant cultural stage during festivals like Boita Bandana, Makara Sankranti, and Nuakhai and in Hareli, when farmers honor the Mahanadi's life-giving floods with bullock races on its silt-rich banks. In villages like Arang, elders still recall how monsoon festivals began only after observing the river's "first swell"—a natural marker now lost to dam-controlled flows. Further, in Chilika, **Kalijai Mela** is a major event that blends devotion with community celebration. Folk dances and songs such as **Danda Naata**, **Ghudki**, and **Pala** are performed on the banks, reflecting gratitude for the river's life-sustaining role.

e) **Ceremonial Baths:** The Pola festival brings another kind of rhythm, as cattle are led to the water's edge for ceremonial baths. Farmers sing "Pola geet", folk songs that praise the river's generosity while lamenting its shrinking grasslands. Additionally, during festivals like Kaudia Jatra and Kartika Purnima, ceremonial baths are held in the Mahanadi and its tributaries and distributaries. Folk songs like "Loka Geeta" are sung by farmers, praising the river's generosity. These melodies, passed down through generations, are fading—not from lack of memory, but because the river they celebrate is changing.

f) **The River in Song and Story:** Along the Mahanadi, culture flows as freely as water. Women gathering at ghats sing "Nadiya mori Maiyya" ("O Mother River"), their voices rising above the slap of wet laundry on stone. Fishermen of the Kewat community once mapped fishing grounds through work chants, their lyrics holding generations of ecological wisdom. The river also lives in bedtime tales. Grandparents recount how the Mahanadi's moods, sometimes nurturing, sometimes fierce, taught respect for nature's balance. These stories, like the river itself, are a living library of survival and adaptation.

The Mahanadi thus remains a vital cultural force in Chhattisgarh and Odisha, shaping rituals, festivals, and social organization. Even as modern pressures challenge these traditions, the river continues to inspire adaptation, resilience, and a deep sense of belonging among the people of the basin.

2.3 Role of Mahanadi River for religious purposes

The Mahanadi River flows not just through the land, but through the spiritual consciousness of Chhattisgarh and Odisha state. For countless generations, its waters have served as both physical and metaphysical bridges, connecting devotees to the divine, the living to their ancestors, and earthly rituals to cosmic cycles. This sacred relationship manifests in profound ways along the river's course.

The Mahanadi River holds profound religious importance in Hindu cosmology, with numerous sacred sites dotting its course. The river's cultural calendar is punctuated by numerous festivals that celebrate its life-giving properties and cyclical nature. Major celebrations include the Rajim Kumbh Mela, Kartik Purnima, Teej, Hareli, Pola, Karma Festival, Maghi Purnima, Chhath Puja, Savitri Amavasya, Khudurukuni Osha, Maha Shivaratri, Maghamela, Diwali & Kalipuja, Dhanu Yatra, Chaitra Parva, Asokastami, Gamha Purnima & Rakhi Purnima, Sital Sasthi, Chatar Jatra, Nuakhai, Ganesh Puja, Chhau Festival, Rath Yatra and Durga Puja and numerous regional festivals. In Chhattisgarh and Odisha, local festivals such as Navakhai, Chherta, Teeja, Sarhul, Kathori, Mahua, Dola Purnima & Holi Festival, Bali Jatra, Makar Mela, and Hareli are celebrated with particular reverence to the river.

The practice of Aarti along the Mahanadi follows ancient traditions where worship of the river as a deity has its roots in Hindu tradition, which believes that washing oneself in its waters will cleanse the body and mind from sin. The Aarti is a symbolic tribute to the power and sanctity of the Mahanadi where the river is revered with the spiritual intensity.

2.3.1 Rajim Kumbh Mela

The Rajim Kumbh Mela, recognized as the "Fifth Kumbh" of India, exemplifies the river's central role in Hindu religious practices. The spiritual significance is most prominently displayed at Rajim in Chhattisgarh, where the confluence of the Mahanadi, Pairi, and Sondur rivers creates a sacred triveni (three-river junction) that has been revered since ancient times as a place of spiritual purification and divine blessing. Held annually during February-March, this festival attracts millions of pilgrims who come to take holy dips in the sacred waters. The ritual of Kalpwas - a period of spiritual observance similar to that practiced at Allahabad - is performed here, where devotees undertake a month-long spiritual journey living on the riverbanks.

The surrounding area becomes a temporary city during festival seasons, with pilgrims from diverse backgrounds creating a vibrant cultural mosaic that demonstrates the Mahanadi's role as a unifying force across different communities.

Fig. 10 Rajim Kumbh fair

2.3.2 Hareli Festival - Celebration of agricultural heritage

The Hareli festival represents one of Chhattisgarh's most distinctive cultural practices directly connected to the Mahanadi River and its agricultural significance. The word 'Hareli' comes from 'Haryali' in Hindi, meaning greenery, and the festival celebrates the monsoon season and agricultural prosperity that the Mahanadi brings to the region.

Fig. 11 Hareli festival

On these days, gratitude is offered by farming communities to tools, land, nature, and animals, acknowledging the integral role played by various non-human actors in agricultural activities. The festival features traditional dances, music, and folk performances showcasing the artistic heritage of the region and includes community feasts and gatherings.

This festival demonstrates unique cultural practices specific to the Mahanadi basin, where farmers perform rituals near the riverbanks to ensure good harvests. Communities gather along the Mahanadi to plant saplings, particularly bamboo and banana plants, in a practice that combines environmental conservation with spiritual observance. The festival involves the preparation of special dishes using newly harvested grains and the worship of agricultural tools, demonstrating how the river's seasonal patterns have shaped local cultural traditions. Women and children participate in folk songs and dances that narrate the story of the Mahanadi's life-giving properties and its central role in sustaining agricultural communities. The ritual planting of bamboo and banana plants during Hareli creates green corridors along the riverbanks, serving both ecological and spiritual purposes.

2.3.3 Pola Festival - Honoring agricultural partners

The Pola festival represents another unique cultural practice of Chhattisgarh that demonstrates the intimate connection between the Mahanadi River, agriculture, and community life. Pola involves farmers worshipping their bulls with colorful decorations and rituals, underscoring the importance of agriculture in Chhattisgarh's culture. The festival is marked by elaborate rituals, including the worship of bullocks, as well as lively processions and races that bring the community together, with villagers participating in grand feasts and sharing traditional foods.

This festival showcases cultural practices specific to the MRB, where bulls and oxen are decorated with vibrant colors and ornaments before being brought to the riverbanks for ritual baths. The animals are considered sacred partners in agriculture, and their worship near the Mahanadi symbolizes gratitude for the river's role in enabling agricultural prosperity. Communities organize bull races along the riverbanks, followed by communal feasts where traditional Chhattisgarhi cuisine is prepared using ingredients grown in the fertile Mahanadi basin. The festival includes specific rituals where farmers seek blessings from the river for the upcoming agricultural season, demonstrating how the Mahanadi serves as both a practical resource and a spiritual entity.

Fig. 12 Pola festival

2.3.4 Kartika Purnima (Boita Bandana)- Celebrating Odisha's ancient maritime heritage

One of the most widely celebrated festivals along the Mahanadi and its distributaries, Kartika Purnima marks the beginning of the Bali Jatra festival, which involves the ritual floating of miniature boats (Boita) in the river. It commemorates Odisha's ancient maritime heritage, when traders (Sadhabas) sailed to Southeast Asia. The banks of the Mahanadi, especially near Cuttack, become vibrant with songs like "Aa ka ma boi," early morning rituals, and community offerings. The phrase ଆ କା ମା ବୈ (ā kā mā bai) refers to the four sacred months of Asadha, Kartika, Magha and Baisakha, which represent the duration of voyage for ships to Southeast Asian Island countries in ancient times. The river is honoured as both a carrier of commerce and a divine witness to history.

Further, the Ta'apoi folktale has hence formed the base for one of the popular religious festivals of the Odia community practiced by unmarried girls who keep a fast (brata) in the month of Bhadraba for the well-being of their brothers and future husbands. The folktale's incorporation as the *Khudurukuni Osha* festival is an important indicator of the preservation of maritime folk traditions of the region.

Fig. 13 Kartika Purnima Festival and Bali Jatra on the Bank of Mahanadi at Cuttack

2.3.5 Dola Purnima and Holi – A Celebration of Colour and Spirituality

In western Odisha, Dola Purnima and Holi are celebrated with processions of Radha-Krishna idols, many of which are bathed in the Mahanadi or its tributaries like the Tel and Ong. These ceremonial baths are believed to purify and sanctify both the deities and the people. River ghats become focal points of spiritual congregation, singing, and rituals performed by priests and local communities.

Further, the festival is also known as Dola Yatra or Dola Jatra and falls on the full-moon day in the month of Phalguna. On this day, the Odia calendar becomes ready, and it is worshipped on Dolabedi in front of Dolagovinda. Dola Purnima is a Hindu festival of paramount importance, and the deities inside the sanctum sanctorum of Jagannath temple are decked up in gold jewellery embellished with diamonds and gems. This ritual is popularly known as Raja Dhiraj Besa or Suna Besa.

Fig. 14 Dola Purnami Melana Jatra at Khordha

2.3.6 Bhai Jiuntia and Pua Jiuntia – A celebration of life

Hindu women and girls across Western Odisha, particularly in districts like Bargarh, Sonepur, Sambalpur, and Balangir, perform rituals such as Bhai Juitia and Pua Juitia. These are deeply emotional festivals celebrated near the Mahanadi and its tributaries. In Bhai Jiuntia, sisters fast and pray for the longevity of their brothers. In Pua Jiuntia, mothers pray for their sons' well-being. River water plays a central role in the rituals—used for snana (bathing), blessings, and purification rites. These festivals also involve folk songs and community gatherings near river ghats, where rituals are often held collectively.

Fig. 15 Pua Jiuntia and Bhai Jiuntia

2.3.3 Other Festivals

The **Teeja festival** is celebrated mainly by women in Chhattisgarh for the well-being and longevity of husbands, involving a three-day-long festival with fasting, singing folk songs, and swinging on tree swings, often performed near the Mahanadi's banks where women gather to perform traditional rituals. Married women fast during this holiday and perform customary rites, wear vibrant clothing, and sing folk songs while seeking blessings from the river for their

families' welfare. Women's riverside rituals during Teeja festival include the preparation of special offerings that are floated in the river, symbolizing prayers for prosperity and protection.

Chhath Puja, another significant festival, involves prayers dedicated to the solar deity, Surya, to express gratitude for the blessings of life on Earth and to seek the fulfilment of personal wishes.

Fig. 16 Teeja festival

Fig. 17 Chaath puja

During this festival, devotees gather along the Mahanadi to offer water to the rising and setting sun, performing the ritual of arghya while standing in the river waters. The festival demonstrates the river's role as a medium for solar worship and cosmic connection and symbolizes the cultural unity and diversity.

Beyond the Rajim Kumbh, several festivals and religious events are centered on the Mahanadi:

- Maghi Purnima and Makar Sankranti are celebrated with ritual baths and offerings along the riverbanks, marking auspicious transitions in the Hindu calendar.
- Local temple fairs in towns such as Arang, Mahasamund, and Dhamtari involve processions to the river, where deities are ritually bathed and worshipped, reinforcing the river's role as a conduit between the earthly and the divine.

Fig. 18 Akshaya Tritiya & *Ratha Katha Anukula for Ratha Jatra*

While the majority of the country celebrates **Akshaya Tritiya** as an auspicious day for new beginnings, investments, and charity, Odisha takes a different turn. Here, the focus shifts from gold and material wealth to 'investments' of an agrarian kind: the first sowing of the paddy seeds. This unique celebration, known as *Akhi Muthi Anukula*, marks the official

commencement of the agricultural season, transforming the auspicious day into a ritual deeply rooted in the state's agrarian heartland. The festival also marks the beginning construction of chariots for the **Ratha Yatra of Lord Jagannath** and his siblings

Makar Sankranti in Odisha, also known as Makar Mela, is a harvest festival deeply rooted in spirituality and tradition, marking the end of winter and the beginning of longer days. It signifies the Sun's entry into the Makara zodiac sign (Capricorn) and is considered a sacred time for offering prayers and seeking prosperity. Devotees also take holy dips in rivers such as Mahanadi, Baitarani, and Brahmani, believing it purifies their souls and washes away sins. The festival is celebrated among the tribals, like the Santhals, Kondhs, and Sauras, who have their own unique customs, including folk dances and bonfires, and the preparation of traditional delicacies like Makar Chaula (a mix of rice, jaggery, and banana).

Fig. 19 Makar Sankranti: Festival of Harvest in Odisha

In Odisha, during Durga Puja, Ganesh Chaturthi, and Saraswati Puja, idol immersion (**visarjan**) into the Mahanadi is a common and sacred practice, reinforcing the river's cleansing and transitional symbolism.

The '**Mahanadi Aarti**' at Sambalpur is modeled after Varanasi's Ganga Aarti, drawing religious tourists and reviving cultural pride. Sages and pilgrims often perform 'tapasya' (penance) along riverbanks, reinforcing the perception of the river as sacred.

Fig. 20 Mahanadi Arati at Sambalpur

Despite the challenges posed by modernization, pollution, and displacement, the Mahanadi continues to inspire deep religious reverence in Chhattisgarh and Odisha. Its role as a sacred river is not only preserved through rituals and festivals but also through evolving community efforts to protect and restore its purity. The river remains a living symbol of spiritual resilience, ecological stewardship, and collective memory for the people of the basin.

2.4 Mahanadi River for Tourism/Leisure/Recreation

The Mahanadi River, with its sweeping landscapes, historical sites, and vibrant riverine culture, plays a pivotal role in the tourism and leisure economy of Chhattisgarh and Odisha. Beyond its utilitarian functions, the river has evolved into a magnet for visitors seeking natural beauty, spiritual solace, cultural immersion, and recreational activities. The river's course is punctuated by a series of destinations that showcase the diversity of experiences it offers to both local residents and tourists from across India.

2.4.1 Heritage and Cultural Tourism

The historic town of Sirpur, once a thriving center of Buddhism and Hinduism, remains one of the most significant cultural destinations along the Mahanadi. Visitors flock to its 7th-century Laxman Temple, a masterpiece of brick architecture, and explore the archaeological remains of monasteries and stupas. During the annual Sirpur National Dance Festival, performances take place on floating stages over the river, creating a magical fusion of art and nature. Further downstream, Rajim often called the "Prayag of Chhattisgarh" hosts the sacred confluence of the Mahanadi, Pairi, and Sondur rivers. Pilgrims and tourists alike gather here for the Rajim Kumbh Mela, where the riverbanks transform into a vibrant fairground with sand art displays, spiritual discourses, and traditional craft markets. Simga's floating markets offer a unique cultural experience, where vendors sell fresh produce, handmade crafts, and local delicacies directly from their boats—a tradition revived to promote sustainable tourism. Famed for its temple dedicated to Lord Rama and its mention in the Ramayana, Shivrinarayan is both a pilgrimage site and a tranquil getaway for those seeking spiritual reflection by the river. The ghats here are frequented by devotees and leisure visitors alike, who come for ritual bathing, picnics, and riverside strolls.

Fig. 21 Shivrinarayan

In Odisha, several destinations along the Mahanadi serve as focal points of heritage and religious tourism. The city of Cuttack, located on the banks of the Mahanadi and Kathajodi rivers, is one of the oldest urban settlements in eastern India. Known for its historic Barabati Fort, colonial-era buildings, and silver filigree craftsmanship (*tarakasi*), Cuttack blends riverside history with vibrant cultural life. The Bali Yatra, held annually on the riverbanks during Kartika Purnima, commemorates Odisha's ancient maritime trade with Southeast Asia and draws lakhs of visitors with its floating lamps, craft stalls, and food fairs. Downstream, Naraj—the confluence point of the Mahanadi with the Kathajodi—hosts scenic riverbanks, centuries-old temples, and spiritual retreats. It is a popular site for picnics, boating, and ritual bathing. Further inland, Boudh and Subarnapur offer tranquil heritage spots, with ancient Shaivite and Vaishnavite temples lining the river, attracting pilgrims and heritage tourists seeking serenity away from urban bustle.

Fig. 22 Barabati Fort and Silver Filigree Craftsmanship

2.4.2 Adventure and Eco-Tourism

The Mahanadi basin in Odisha offers rich opportunities for **adventure and eco-tourism**, with destinations that highlight the region's natural diversity and promote conservation-based travel. The Satkosia Gorge in Angul district, where the Mahanadi cuts through the Eastern Ghats, is a UNESCO-recognized biosphere reserve and a hotspot for ecotourism. Its rich biodiversity—home to mugger crocodiles, elephants, birds, and otters—attracts nature lovers and researchers. Tourists enjoy river safaris, trekking, camping, and birdwatching, especially near Tikarpada and Baliput.

The Satkosia Sand Resort and Satkosia Nature Camp, located within the dramatic gorge landscape of the Satkosia Tiger Reserve (spanning Angul and Boudh districts), offer river-based adventures such as boating, kayaking, trekking, and wildlife safaris—ideal for eco-tourists and thrill-seekers alike.

Fig. 23 Satakosia Sand Resort (Badmul)

Fig. 24 Satakosia Tiger Reserve and Chandaka Elephant Reserve

Fig. 25 Satakosia Nature Camp, Debrigarh Nature Camp, Chillika Nature Camp

Further west, the Debrigarh Nature Camp on the banks of the Hirakud reservoir in Bargarh district combines heritage with adventure, offering trekking, cycling, birdwatching, and stunning views of the surrounding hills and water bodies. The Chilika Nature Camp, operating across eco-sensitive zones like Mangalajodi and Kalijai, provides boat safaris to watch thousands of migratory birds and the endangered Irrawaddy dolphins, creating a blend of ecological immersion and soft adventure.

In the forested outskirts of Bhubaneswar, the Chandaka Elephant Reserve enables guided jeep safaris and nature walks, introducing visitors to Odisha's dry deciduous forest ecosystems. These eco-tourism ventures not only serve as platforms for environmental education and recreational adventure, but also support local employment and conservation awareness, making them key components of sustainable tourism in the MRB.

Fig. 26 Hirakud Eco Retreat and Water Sports

For thrill-seekers, the Mahanadi presents exciting opportunities. Near Dhamtari, the Gangrel Dam, also known as Ravishankar Sagar and Hirakud Dam has emerged as a major destination for water-based recreation. The expansive reservoir is popular for boating, jet-skiing, and fishing. The dam's scenic setting, with its lush surroundings and sunset views, attracts families, adventure seekers, and photographers. The area is also a favored picnic spot, with government-run resorts and guesthouses catering to tourists.

Fig. 29 Water sports activities at Gangrel Dam

Wildlife lovers find solace in the Barnawapara Wildlife Sanctuary, where the Mahanadi's waters sustain rich biodiversity. Guided kayak safaris allow visitors to glide through riverine forests, spotting crocodiles, migratory birds, and even the occasional tiger. Winter brings flocks of bar-headed geese from Siberia, making it a prime season for birdwatching.

Fig. 27 Adventure and eco-tourism sites

At Chitrakote Falls, often dubbed the "Niagara of India," the Mahanadi plunges dramatically over a 100-foot horseshoe-shaped cliff. Bamboo rafting near the base of the falls provides an exhilarating way to experience its raw power, while viewpoints like Moon View Point offer breathtaking photo opportunities.

Located in Dhamtari district, Dudhawa Dam is another popular site for leisure and eco-tourism. The dam's reservoir, fringed by forests and hills, offers opportunities for boating, birdwatching, and nature walks. Local festivals and fairs often coincide with the tourist season, enhancing the visitor experience.

Fig. 28 Serenity of Dudhawa Dam

Futrher, Chilika Lake, Asia's largest brackish water lagoon, connected to the Mahanadi basin through several distributaries, is a jewel of Odisha's tourism sector. Tourists flock to Satapada, Rambha, Barkul, and Mangalajodi for boat rides, dolphin sightings (notably the endangered Irrawaddy dolphin), and panoramic views of sunrises over the lagoon. The Chilika Bird Festival, held annually, celebrates the arrival of over 1 million migratory birds including flamingos, pelicans, and sandpipers from Siberia and Central Asia.

Kalijai Island, home to the revered Kalijai Temple, is a popular pilgrimage and leisure destination. Devotees visit especially during Makar Sankranti, while others come to explore the island's cultural myths, enjoy boat rides, and relax in the lagoon's serene waters. The blend of spirituality, folklore, and scenic beauty makes Chilika an enduring destination.

Fig. 29 Barkul Water Sport Complex & Kalijai Island

2.4.3 **Leisure and Community-Based Tourism**

The Mahanadi's serene stretches are perfect for relaxed exploration. In Dhamtari, anglers indulge in catch-and-release fishing for the mighty Mahseer, known as the "tiger of the river." Traditional fishermen still use bamboo traps, and early mornings are filled with the melodic Dhela geet (boat songs) of the local Kewat community.

Sihawa's sandy riverbanks have become popular camping spots, where tourists can spend nights under the stars, listening to folk tales narrated by tribal guides. Meanwhile, Raipur's riverfront development has introduced cycling tracks, light-and-sound shows on water screens, and designated picnic zones, making the river accessible to urban dwellers.

A growing trend is community-led tourism, where tribal villages like those of the Baiga and Gond people offer immersive experiences. Visitors can join heritage walks, learn traditional fishing techniques, or savor authentic Chhattisgarhi cuisine at riverside shacks serving Chousera roti and spicy fish curry.

Besides the aforementioned activities, the Mahanadi River is a gateway to the local people for adventure, fun, and leisure activities. Locals of often use the river for the following -

a) **Boating and Water Sports:** Boating is a favored activity at major reservoirs like Gangrel and Dudhawa, with both paddle boats and motorboats available for hire. During festivals and weekends, the riverfronts bustle with families and groups enjoying boat rides, fishing, and water sports.

b) **Picnics and Family Outings:** Riverbanks and dam sites are popular for picnics, especially during the winter and post-monsoon months. Local residents and tourists frequent these spots for their scenic beauty, cool breezes, and relaxed atmosphere.

c) **Birdwatching and Nature Walks:** The Mahanadi and its wetlands are habitats for a variety of resident and migratory birds, making the river a destination for birdwatchers and nature lovers. Trails along the river and around reservoirs offer opportunities for guided walks and wildlife photography.

d) **Local Fairs and Melas:** Seasonal fairs and weekly haats (markets) are often held on riverbanks, turning these areas into vibrant centers of trade, entertainment, and social interaction. These gatherings provide tourists with an authentic taste of local cuisine, crafts, and performing arts.

e) **Community and Social Recreation:** For local communities, the Mahanadi remains a vital space for everyday recreation and social life. Riverbanks serve as communal spaces for morning walks, yoga, swimming, and informal gatherings. Children play along the ghats, elders meet for conversation, and families celebrate festivals and special occasions by the water.

The Mahanadi River is a dynamic axis for tourism, leisure, and recreation in Chhattisgarh and Odisha. Its scenic landscapes, cultural heritage, and opportunities for adventure and relaxation draw a diverse array of visitors, while continuing to serve as a cherished space for community life and celebration. Despite its potential, tourism along the Mahanadi faces challenges. Sand mining has degraded once-pristine swimming spots in Bhatapara and Routapada, while industrial pollution near Korba, Angul and Sambalpur limits water-based activities. Dams upstream have altered natural flows, sometimes reducing the spectacle of Chitrakote Falls during lean seasons.

2.5 Role of Tribals

The tribal communities of Chhattisgarh and Odisha, most notably the Gond, Kamar, Binjhwar, Kandha, Binjhal, Mirdhas, Saora, Shabar, Kolha, Dal, and Baiga, have played a foundational role in shaping and sustaining the relationship between people and the Mahanadi River. For centuries, these indigenous groups have developed a way of life intricately tied to the river's rhythms, resources, and spiritual essence. Their contributions span traditional livelihoods, ecological stewardship, cultural practices, and community governance, making them both custodians and beneficiaries of the riverine ecosystem.

The Baiga tribes of Kawardha believe the Mahanadi was created when the earth goddess shook her water-filled hair. Their sacred groves along the river host the Bhimlatika festival, where shamans channel river spirits through hypnotic drumming. The Kewat community once performed Chandra Puja on full moon nights, offering the first catch to the river while singing: "Oh silver-faced mother, keep your fish pregnant As you keep the moon glowing in your waters." With fish stocks depleted, only three elders in Kurra village remember the complete hymn.

Fig. 30 Kandh Tribe Women fetching water for daily usage near Kalahandi

In the Odisha stretch of the MRB, tribal communities have long maintained spiritual, ecological, and cultural relationships with the river and its tributaries. For many Adivasi groups such as the Kondh, Saura, Juang, and Bonda, the Mahanadi is more than a source of water—it is a living ancestor, a spirit force, and a cyclical being that governs life, death, and regeneration.

In the hilly upper basin regions of Boudh, Kandhamal, and Nayagarh, Kondh tribes believe that the Mahanadi and its tributaries were born from the footsteps of the Earth Mother (*Dharani Ma*), who danced during creation. Sacred groves (*jharnas*) near river springs are sites of annual rain-invoking rituals, where tribal shamans (*bejuni* or *dishari*) drum, chant, and offer forest flowers and millets to appease river spirits. These rituals blend spiritual cosmology with an intimate understanding of hydrology and seasonal changes.

In the Tel River basin—a major tributary of the Mahanadi flowing through Nuapada and Kalahandi—the Juang and Bhunjia tribes still carry out "Jal Sanskar" rituals during the monsoon, offering rice cakes, turmeric, and eggs to river bends believed to be inhabited by ancestral water spirits. Oral stories passed through generations describe fish and crocodiles as messengers of the spirits, and many Bhunjia elders still recount dreams in which river spirits offer guidance or warnings.

2.5.1 Traditional Livelihoods and Subsistence

a) Agriculture and Fishing:

The economic life of tribal communities along the Mahanadi is deeply rooted in the river's seasonal rhythms and resources. Fishing is a cornerstone of subsistence, with communities such as the Kewat, Kondh, Kandha Dora, Bhumia, Bonda, Saura, and Bhunjia and Dhimar employing a remarkable diversity of techniques, from bamboo trap systems (bheda jal) and seasonal weirs (khola) to moon-cycle regulated hilsa netting. However, recent decades have seen troubling declines: fish catches have dropped from 18 kg per day in 1990 to just 5 kg per day by 2022, and only a fraction of the youth retain knowledge of traditional fishing songs. Of the 37 native fish species once common in the river, 12 are now endangered.

Floodplain agriculture is another pillar of tribal livelihoods. The Kamar and Oraon tribes practice diyara farming on nutrient-rich silt deposits, cultivate dozens of climate-resilient rice varieties, and maintain dongar terrace systems along river slopes. Specifically, the Kondhs and

Saura communities have preserved agro-biodiverse farming systems, known locally as dongar cultivation, also known as shifting cultivation or podu, which is a traditional agricultural practice involving clearing forest land, typically on hillsides, for farming. Studies indicate that tribal farms in the region maintain significantly higher agrobiodiversity and water retention than non-tribal farms, supported by a dense network of traditional water management structures. Forest-based economies are equally vital, particularly for the Baiga, who sustainably harvest medicinal plants, mahua flowers, and tasar silk cocoons, supporting both household needs and local markets. This method not only ensures food security but also maintains soil health without artificial inputs. According to a 2015 study by the Central Inland Fisheries Research Institute, about 65% of rural households along the Mahanadi in Chhattisgarh, many of them tribal, depend directly on such agricultural systems.

b) Artisanal Activities

Tribal artisans utilize riverbank clay, reeds, and grasses to craft pottery, mats, and boats. In villages like Kurra and Belpan, these crafts are not only economic activities but also expressions of cultural identity, with skills and stories passed down through generations. Additionally, the Kondh, Saura, Bhunjia, and Kandha Dora—are deeply tied to the river's ecology and seasonal cycles. Using materials like riverbank clay, bamboo, reeds, and grasses, these communities produce pottery, fishing traps, mats, baskets, and lightweight wooden boats, blending utility with cultural expression.

2.5.2 Ecological Knowledge and Conservation

Tribal communities have long maintained sacred groves (such as the Malguzari forests near Rajim and Gariaband) along the riverbanks. These groves serve dual purposes: as sites for religious rituals and as ecological buffers against floods and erosion. Certain deep pools in the river, known locally as 'dahars,' are designated as sacred fish sanctuaries, where fishing is strictly prohibited during breeding seasons. These practices reflect a sophisticated understanding of ecological cycles and a commitment to sustainable resource management.

Indigenous knowledge systems encompass detailed understanding of local biodiversity. In villages like Sikasar and Khallari, tribal fishers can identify over 40 fish species based on seasonal patterns. Healers in Kanker and Gariaband document the use of more than 60 medicinal plants found in riparian zones, underscoring the river's role as a source of both nutrition and health.

Odisha's tribal communities possess a deep ecological understanding of the Mahanadi ecosystem. Fishing is ritually prohibited in sacred deepwater pools during spawning seasons—a practice still observed in villages like Belpada and Kegaon, where tribal elders enforce customary conservation laws. The Bonda and Kandha Dora tribes also maintain ancestral water ponds and check-dams, constructed through collective labor to store monsoon water.

Tribal healers and shamans, particularly among the Bhunjia and Saura, possess intricate knowledge of over 70 aquatic and riparian plant species used in traditional medicine. This ecological intelligence extends to flood forecasting: elders observe kingfisher nesting behavior, ant migration, and plant flowering as indicators of seasonal shifts—knowledge that has historically protected villages from flood disasters and enabled adaptive settlement patterns.

Tribal water management practices include the construction and maintenance of small-scale water harvesting structures that capture monsoon runoff and maintain groundwater levels.

2.5.3 Cultural and Spiritual Practices

The river is deeply embedded in tribal cosmology and ritual life. Festivals, dances (such as Daihani and Sua), and oral traditions often invoke the river as a nurturing mother and a source of spiritual power. Seasonal rituals mark the arrival of the monsoon, the harvest, and other ecological events, reinforcing the sense of connection between the community and the river.

The riverbanks are dotted with over 140 sacred sites, including Jal Devta shrines at major confluences, Mandar stones marking divine manifestations, and sacred groves that protect headwater springs. These sites serve as spiritual anchors, where rituals are performed by community priests such as the Panda and Dehuri, who preserve oral histories stretching back fifteen generations. The river is present at every major life transition: newborns receive their first water from the Mahanadi in the Jal Sanskar ceremony, wedding rituals involve circling pots of river water, and ashes of the deceased are immersed in designated sacred stretches during Niravapanjali rites.

Seasonal festivals mark the river's rhythms: the Gond new year (Chherta Puja) begins with riverbank dancing, while the Bija Pandum ceremony blesses seeds before monsoon planting. The Baiga tribe's Khidkhi festival gives thanks after flood waters recede. Sacred confluences are tended by Panda priests, while Dehuri ritual specialists conduct water ceremonies and Gunia shamans interpret the river's signs.

In Gariaband district, tribal communities protect specific river pools as abodes of spiritual beings. Fishing is forbidden in these pools during certain months, and annual rituals are performed to honor the river spirits. These practices have helped maintain fish populations and aquatic biodiversity. The tribal village of Basna maintains a network of traditional tanks and ponds that capture runoff from the Mahanadi and its tributaries. These structures, managed collectively, ensure water availability during dry months and support both agriculture and livestock. Tribal elders in the upper Mahanadi basin use bio-indicators—such as the nesting behavior of kingfishers and the flowering of riparian plants—to predict floods. This indigenous knowledge has historically enabled timely evacuation and adaptive settlement patterns, reducing disaster risk.

For Odisha's tribal communities, the Mahanadi and its tributaries are sacred entities enshrined in rituals, songs, and spiritual traditions. Along the Tel and Ong, sacred groves and "jal devta sthal" (water deity shrines) are maintained within forests. Sacred pools, stone shrines, and riverside platforms serve as physical and spiritual anchors in tribal villages across Boudh, Subarnapur, and Nayagarh. These are places where oral histories are recited, ancestral spirits are invoked, and the river is praised through folk songs and chants. However, many of these practices are now endangered, with only a few elders able to recall complete rituals or sacred hymns.

2.5.4 Social Organization and River Governance

Tribal communities have established systems of collective management for river resources, often governed by customary laws and village councils. These institutions oversee access to fishing grounds, resolve disputes, and organize communal activities such as riverbank cleaning and canal maintenance. Settlement patterns are also shaped by the river's seasonal behavior, with houses built on elevated land to avoid floods and communal spaces centered on the riverbank.

Despite their deep-rooted knowledge and stewardship, tribal communities face growing challenges due to displacement from dam projects, loss of access to traditional lands, and environmental degradation. The construction of large dams such as Minimata Bango, Hirakud

and Gangrel has displaced thousands of tribal families, disrupting their livelihoods and weakening their cultural ties to the river. Industrialization and pollution further threaten the ecological balance that these communities have maintained for generations.

The tribals of Chhattisgarh and Odisha remain vital stewards of the Mahanadi River, embodying a holistic approach to resource use, conservation, and spiritual life. Their practices and knowledge systems offer valuable lessons for sustainable river basin management and underscore the importance of preserving indigenous rights and participation in contemporary governance frameworks. As the region navigates rapid change, the continued engagement and empowerment of tribal communities will be essential for the health and resilience of the Mahanadi and its people.

3. River-People (Dis)connect in the Mahanadi River Basin

The Mahanadi River, flowing predominantly through Chhattisgarh and Odisha, has historically been an integral part of the cultural, social, economic, and spiritual fabric of the communities residing along its course. For centuries, this mighty river sustained livelihoods, shaped settlements, influenced cultural practices, and defined the ecological landscape of the region.

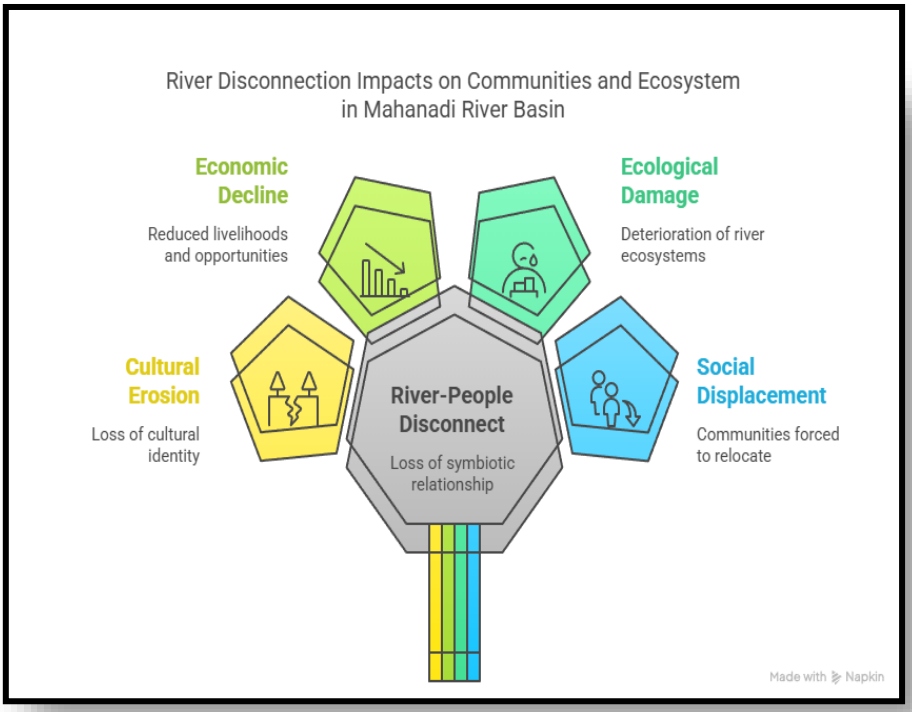

Fig. 31 RiveroPeople Disconnect and its impact

However, in recent decades, this relationship has undergone significant transformation, in the Mahanadi River basin. This section examines the historical connection between the people of Chhattisgarh, Odisha and the Mahanadi River, traces the processes that have led to disconnection, and analyzes the multifaceted impacts of this changing relationship on communities, ecosystems, and livelihoods. Traditionally, communities along the river maintained a symbiotic relationship, deriving livelihoods, cultural identity, and spiritual sustenance from it.

3.1 Historical River-People Connection in the Mahanadi Basin

The relationship between communities and the Mahanadi River in Chhattisgarh and Odisha represents a complex amalgam of cultural, spiritual, economic, and ecological dimensions developed over centuries. These connections formed the foundation of social identity, prosperity, and sustainable resource management practices that persisted until relatively recent times. Fig. 35 summarizes the key historical river-people connection in the Mahanadi basin before analyzing the current disconnect.

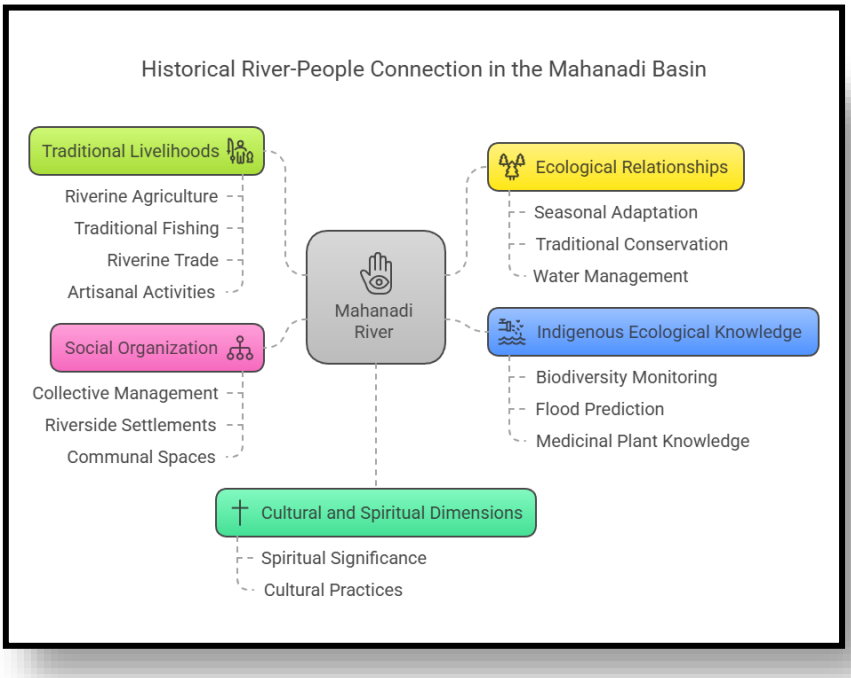

Fig. 32 Historical river-people connection in the Mahanadi basin

3.1.1 Cultural and Spiritual Dimensions

The Mahanadi River, whose name translates to "Great River," has held profound spiritual significance for riverside communities throughout Chhattisgarh and Odisha's history. The river is personified as "Mahanadi Maiyya" (Mother Mahanadi) in local folklore, songs, and rituals. This veneration manifested in numerous ways that embedded the river deeply within cultural identities of local populations.

Riverbanks in Chhattisgarh and Odisha became natural sites for important temples and religious establishments, including the ancient temples at its origin, in Sirpur, Shivrinarayan, Sambalpur, Sonepur, Nayagarh, Cuttack and numerous riverside ghats in different cities. These locations served as interfaces between human settlements and the sacred waters, creating designated spaces for ritual interaction with the river. The physical arrangement of these sites reflected understanding that positioned rivers as co nduits between earthly and divine realms.

The Rajim Kumbh exemplifies the river's centrality in regional cultural practices. Celebrated at the sacred confluence (sangam) of the Mahanadi, Pairi, and Sondur rivers, this festival has drawn thousands of devotees annually, connecting communities across geographical divides through shared veneration of riverine spirituality. Similarly, traditions like Chhath Puja, where

devotees offer prayers to the sun god while standing in river waters, physically immerse practitioners in direct connection with the river's flow, creating embodied spiritual experiences that reinforce river-human bonds.

Gada Gadia Ghat, located on the banks of the Mahanadi River in Cuttack, is steeped in historical, cultural, and ritual significance. Traditionally, it served as the main waterway gateway to the Barabati Fort. Culturally, the ghat is the stage for major religious festivals and traditional rituals. It plays a central role during Durga Puja immersions and the Boita Bandana festival, where thousands of people gather to float miniature boats in homage to Odisha's ancient maritime heritage.

Another significant cultural event associated with Gada Gadia Ghat is the Kaudia Jatra, a vibrant festival rooted in Shaivite devotion. During this festival, devotees—known as Kaudias—carry holy water from the Mahanadi, collected at the ghat, and walk barefoot to offer it at nearby Shiva temples, reinforcing both spiritual discipline and collective identity. Further, for the 'bhoomi pujan' ceremony of the Ram temple in Ayodhya, soil from the Konark Sun Temple and water from the Mahanadi and Bindusagar Lake in Odisha were sent.

3.1.2 Traditional Livelihoods and Subsistence Patterns

Traditional communities along the Mahanadi maintained economic systems intimately connected to the river's seasonal behaviour, flows, and resource provisions. These livelihood patterns created direct dependencies that reinforced daily interactions with the waterway.

a) Riverine Agriculture

Traditional agricultural practices were synchronized with the river's seasonal flow patterns, creating a sustainable dependence. The fertile floodplains of the Mahanadi supported diverse agricultural practices. Traditional farming communities in villages like Sivni, Bhatapara, and Mahasamund and in districts like Boudh, Subarnapur, Cuttack, Nayagarh, and Kalahandi practiced flood recession agriculture, utilizing the nutrient-rich silt deposits left behind after seasonal flooding. A study by the Central Inland Fisheries Research Institute in 2015 found that approximately 65% of rural households along the Mahanadi in Chhattisgarh were directly dependent on floodplain agriculture for their livelihoods.

Agricultural communities in Odisha and Chhattisgarh's Mahanadi basin developed sophisticated understanding of flood patterns and soil dynamics. Farmers timed their cultivation cycles to synchronize with the river's annual flooding, which naturally irrigated fields and deposited nutrient-rich silt across floodplains. These natural processes enhanced soil fertility without requiring artificial inputs, creating agricultural systems that functioned as extensions of natural river processes rather than impositions upon them.

b) Traditional Fishing

Indigenous fishing communities established specialized ecological knowledge systems based on generations of observation and practice. Groups including the Kewats, Mallah, Dhimar Kaibartas (Keuta), Bhunjia, and Kandha Dora communities developed fishing techniques specifically adapted to the Mahanadi's characteristics. Their knowledge encompassed detailed understanding of fish species distributions, breeding cycles, migration patterns, and river behavior indicators. Using traditional fishing technique like bamboo traps, these communities harvested fish sustainably. This knowledge represented not merely economic information, but

comprehensive ecological wisdom accumulated through continuous interaction with the riverine ecosystem.

c) Riverine Trade

The Mahanadi served as a crucial trade artery connecting interior regions of Odisha and Chhattisgarh with coastal areas. Before the expansion of road networks, the Mahanadi served as a critical transportation route. Local boats called "dongas" facilitated the movement of people and goods between riverine settlements. Local boatmen transported agricultural produce, forest resources, and artisanal products downstream while bringing coastal goods to interior markets. These trade networks created economic interdependencies between different regions of the river basin while reinforcing the river's role as a connector rather than a divider of communities. Historical records from the colonial period document that in the early 20th century, over 200 small-scale boat operators plied the Chhattisgarh stretch of the Mahanadi. The river-based trade systems supported specialized occupations like boat-building and navigation that required intimate familiarity with the river's channels, currents, and seasonal changes. Communities in Banki, Naraj, and Boudh built and operated small river boats to transport rice, forest produce, and pottery downstream, while bringing salt, textiles, and oil from coastal traders.

d) Artisanal Activities

Numerous artisanal traditions developed in direct relationship to river resources. Pottery crafted from riverbank clay, mats woven using riverine grasses, and boats constructed from local timber represented specialized economic niches embedded within the river ecology. In villages like Kurraand Belpan, artisans crafted items from water reeds, while potters in Dhamtari, Mahasamund, Khurha and Banki used clay from the riverbanks. In 2010 that nearly 12,000artisan families derived their livelihoods from river-based crafts. These crafts required practitioners to maintain detailed knowledge of specific riverine resources, their properties, and sustainable harvesting practices that maintained resource viability across generations. In the Chilika lagoon region, small fishing boats and paddles were custom-crafted by artisans. These river-based crafts not only supported economic activity but reinforced cultural identity and were sustained by detailed ecological knowledge of raw materials and harvesting times.

3.1.3 Ecological Relationships

Indigenous communities in the Mahanadi basin maintained sophisticated ecological relationships with the river system, developing adaptive practices that responded to natural cycles while maintaining ecosystem health.

a) **Seasonal adaption and Resource Management**

Communities structured their activities according to the river's seasonal rhythms, demonstrating remarkable adaptability to changing water conditions. During monsoons, settlements would retreat from floodplains, allowing natural inundation processes to occur without catastrophic impacts on human habitation. As waters receded, communities would utilize the moisture-retained areas for cultivation, effectively transforming potential flood hazards into resource opportunities. This seasonal movement pattern created a dynamic rather than static relationship with the river ecosystem.

b) Traditional Conservation Practices

Traditional conservation practices emerged organically within river-dependent communities. Many groups observed norms restricting fishing during breeding seasons, maintained sacred

groves along riverbanks that served as de facto conservation zones, and protected certain deep pools (known locally as 'dahars') as fish sanctuaries. Designated stretches of the river were managed as community fishing grounds with customary rules governing access and harvesting practices. The village of Nandini, for instance, maintained a community-managed stretch of the river where fishing was prohibited during breeding seasons.

c) Indigenous Water Management

Indigenous water management systems complemented rather than replaced natural river processes. Local knowledge systems included techniques for small-scale water harvesting, protection of natural springs, and maintenance of community ponds that worked alongside river resources. Villages like Pithora, Basna, and Saraipali maintained elaborate networks of interconnected tanks called "kataas" and "bandhas" that captured monsoon runoff from the Mahanadi and its tributaries. In Subarnapur and Nayagarh, small check-dams built from stone and earth redirected rainwater into ponds, recharging aquifers and supporting dry-season agriculture.

3.1.4 Indigenous Ecological Knowledge

Indigenous communities in the Mahanadi basin, particularly the Gond, Kamar, and Binjhwar tribes, possessed sophisticated knowledge of riverine ecosystems. This knowledge encompassed biodiversity monitoring, flood prediction and medicinal plant knowledge.

3.1.5 Social Organization

River-centric social arrangements were common in riverside settlements:

a) **Collective Management:** Many villages had traditional institutions for managing river resources, resolving conflicts, and organizing collective activities like canal maintenance or flood response.

b) **Riverside Settlements:** Settlement patterns were strategically designed with respect to flood levels, with housing structures built on elevated lands while keeping agricultural fields in floodplains.

c) **Communal Spaces:** Riverbanks served as important communal spaces for social gatherings, cultural events, and everyday activities like washing clothes and bathing.

3.2 The Process of Disconnection: Factors Driving the River-People Disconnect in Mahanadi River Basin

Over the past several decades, the traditional bonds between the people of Chhattisgarh, Odisha and the Mahanadi have been systematically eroded. A combination of large-scale infrastructural projects, environmental degradation, and socio-economic transformations (Fig. 36) has redefined the river-people dynamic and affects the symbiotic relationship, resulting into degradation of river system and affecting the inhabitants.

3.2.1 Large Dam Projects and Displacement

The construction of large dams on the Mahanadi has been one of the most significant factors disrupting traditional river-people relationships in Chhattisgarh. The most significant projects

include Hirakud, Minimata Bango dam, Ravishankar Sagar dam (Gangrel dam), and Dudawa dam.

Displacement through dam construction has led to a cascading series of effects: loss of riparian rights, cultural disintegration, and the forced migration of communities away from the river's nurturing environment. This not only breaks the traditional ties to the river but also initiates a cycle of poverty and ecological mismanagement that continues to impact subsequent generations. Few studies have concluded that third-generation displaced families from the dam projects showed significantly diminished cultural connection to the river compared to communities that maintained continuous residence along unregulated river stretches. The consequences of these dam projects extend beyond physical displacement:

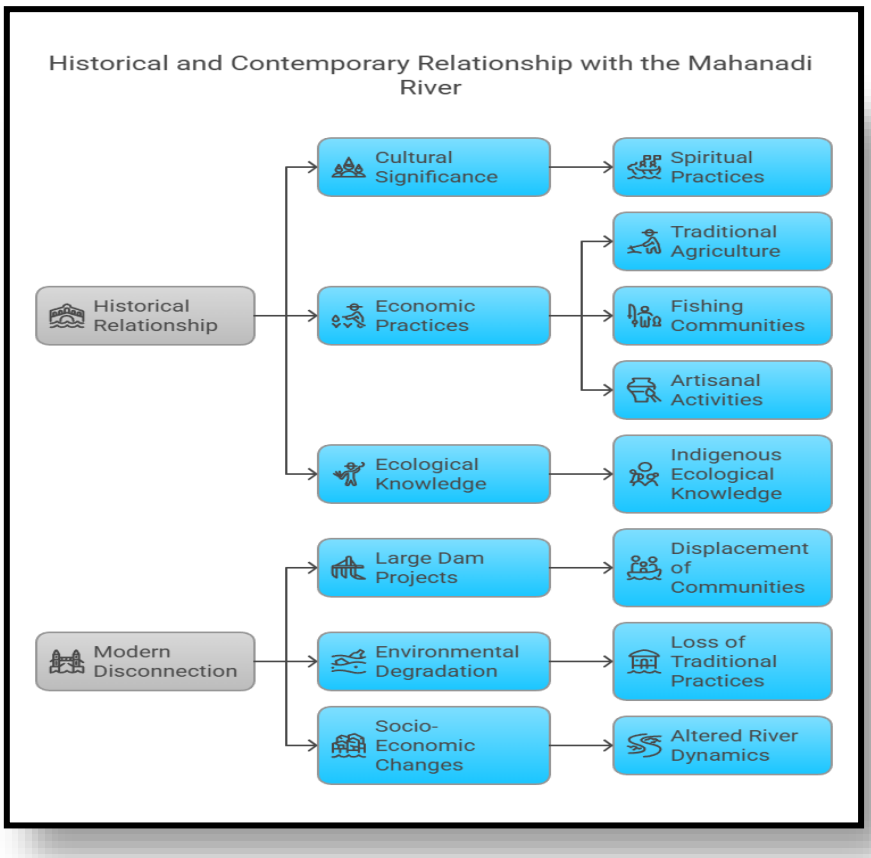

Fig. 33 Historical and contemporary river-people connect.

a) **Loss of Traditional Knowledge:** Displaced communities' lost access to familiar river sections where they had accumulated generations of ecological knowledge, resulting in erosion of traditional wisdom about river management.

b) **Cultural Disruption and Disintegration:** Resettlement often scattered communities, disrupting cultural practices tied to specific river locations and collective rituals.The submergence of ancestral villages led to the loss of cultural sites, sacred groves, and community spaces. For example, the ancient temple of Shivnath in the now-submerged village of Beltukri under the Minimata Bango Dam was a significant cultural loss for local communities. One of the most poignant cultural losses was the submergence of

the ancient village of Padmapur, which housed the old shrine of Maa Samaleswari, a local river goddess worshipped by tribal communities in Sambalpur district.

c) **Livelihood Transformation:** Many displaced families were forced to transition from river-dependent livelihoods to unfamiliar occupations, particularly when resettled away from the river.

d) **Altered River Relations:** Even for communities that remained near the river, the transformation of the free-flowing river into a regulated reservoir fundamentally changed their relationship with the waterway.

e) **Loss of Riparian Rights**: Displaced communities' lost access to the river, severing traditional connections and usage rights that had been established over generations.

Large dam projects in the Mahanadi basin have triggered a profound and lasting impact on the lives of thousands through forced displacement and socio-economic disintegration. The creation of reservoirs has submerged entire villages, fertile agricultural lands, and cultural landmarks, uprooting communities that have long depended on the river for their livelihoods and cultural identity. As families are displaced from their ancestral homelands, they lose not only their homes but also the deep, generational ties to the river, which once provided both sustenance and a sense of belonging. The disruption of traditional water management systems and indigenous practices results in the erosion of centuries-old knowledge about sustainable living, leaving displaced populations struggling to adapt to unfamiliar and often less fertile environments.

Furthermore, the compensation and rehabilitation measures provided to these communities frequently fall short of addressing the multifaceted losses incurred. Resettlement areas are typically located far from the river, cutting off communities from the natural resource that was central to their social, cultural, and economic lives. This physical separation from the river also leads to a psychological disconnection, where the displaced experience profound feelings of loss and alienation. The breakdown of established social networks and communal support systems further exacerbates the challenges, as traditional mechanisms for mutual aid and resource sharing dissolve in the wake of displacement. Over time, these factors contribute to a cycle of poverty and diminished quality of life, undermining the long-term sustainability of both the displaced communities and the river ecosystem they once helped to nurture.

3.2.2 Industrialization and Pollution

Chhattisgarh and Odisha's abundant mineral resources have driven rapid industrialization in the Mahanadi basin, resulting in severe pollution impacts that have profoundly alienated communities from the river. Industrial corridors have developed along the Mahanadi in regions like Angul, Cuttack, Sambalpur, Jharsuguda, Jagatsinghpur, Raipur-Bhilai-Durg and Korba, hosting steel plants, thermal power stations, aluminium smelters, fertiliser, and chemical industries. These industrial concentrations have transformed once-pristine river sections into heavily degraded waterways. The physical transformation of river appearance - from clear flowing waters to discolored, malodorous streams - creates immediate sensory disconnection for riverside communities. The visible degradation contradicts cultural understandings of rivers as purifying entities, creating cognitive dissonance between traditional reverence and current realities.

Water quality assessments reveal alarming deterioration in the Mahanadi system. A 2018 Central Pollution Control Board assessment identified several stretches of the Mahanadi in Chhattisgarh as "critically polluted," with dissolved oxygen levels and biological indicators well below acceptable standards. Industrial effluents containing heavy metals, chemicals, and thermal pollution have created conditions inhospitable to many native species and potentially harmful to human users. The technical parameters of contamination translate into practical prohibitions against traditional river uses, effectively barring communities from interactions their ancestors practiced for generations. In Angul and Talcher, home to major coal-fired power plants and coal mines, water pollution is driven by fly ash discharge, heavy metal seepage, and thermal effluents entering the Nandira and Brahmani tributaries, ultimately affecting the Mahanadi. Similarly, Jharsuguda, with its dense network of aluminium and steel industries, contributes fluoride contamination and industrial sludge that flows through the Ib and Bheden tributaries. The CPCB has flagged stretches of the river and its tributaries in these zones for critically low dissolved oxygen and high chemical loads, impacting aquatic life and human use.

The concentration of thermal power plants around Korba, often called Chhattisgarh's "power capital," has particularly affected the Hasdeo River. Fly ash contamination and thermal pollution have decimated fish populations and rendered water unsuitable for domestic use in many downstream villages. The fishing communities dependent on these waters have experienced not merely economic hardship but existential threat to cultural practices built around specific fish species and harvesting traditions.

Industries in Bhilai and Korba release heavy metals including lead, mercury, and cadmium into the river system. Environmental monitoring by the Chhattisgarh Environment Conservation Board in 2021 detected mercury concentrations up to 0.08 mg/L in river sediments near Korba, eight times the permissible limit. Effluents from the Bhilai Steel Plant have historically affected the Shivnath River, with documented cases of heavy metal contamination. These pollutants create long-term bioaccumulation issues in river ecosystems, affecting not only current users but potentially extending impacts across generations.

The invisible nature of many chemical contaminants creates uncertainty and fear regarding river use, further distancing communities from waterways. The paper mills in Raigarh district discharge approximately 15 million litters of effluent daily into the Kelo River, another tributary of the Mahanadi.

In Cuttack and Jagatsinghpur, pollution from industrial effluents and port activities near Paradeep—especially along the Mahanadi's delta—has created saline intrusion, oil spills, and organic load buildup that disrupt estuarine fisheries and damage mangrove habitats.

The psychological dimension of this transformation should not be underestimated. The visible change of the Mahanadi from a revered life-source to a polluted industrial drain has created profound alienation among riverside communities. This parallels experiences in other industrialized river basins, such as the Damodar River in eastern India, where intensive industrialization transformed what was once called the "Sorrow of Bengal" into the "Country's Most Polluted River," completely severing traditional community connections with the waterway.

3.2.3 Mining Activities and Forest Degradation

The Mahanadi basin in Chhattisgarh overlaps with mineral-rich regions, leading to extensive mining operations that have disrupted the river ecosystem and associated human connections. The impact of mining activities has visible impact on the local ecosystem that transcends to the inhabitants, affecting the ways they are connected with the river systems, and forcing them

away from their lifeline. These brings major changes to the local ecosystem –

a) **Coal Mining Impact:** Coal mining has created particularly significant impacts in the basin. Open-cast operations in districts like Ib valley, Korba and Raigarh have caused extensive environmental disruption affecting river systems. The Hasdeo-Arand region, containing one of central India's largest contiguous forest patches and critical Mahanadi tributaries, continues facing mining expansion that threatens both forest integrity and river health. These operations not only affect immediate mining locations but create watershed-level impacts that propagate throughout river systems.

b) Forest Cover Reduction: Forest cover analysis reveals alarming trends in the region. Satellite imagery analysis between 1985 and 2020 indicates a reduction of over 40% in dense forest cover in the Chhattisgarh portion of the Mahanadi basin, with mining being a major contributor. Specifically, Kalahandi has seen the highest decline in forest cover, with a reduction of 61.94 sq km between 2021 and 2023. In Sambalpur–Deogarh–Sundargarh mining belts, some pockets have lost up to 35–40% of their canopy over the last four decades. This deforestation fundamentally alters watershed hydrology, reducing water retention capacity, increasing erosion, and disrupting seasonal flow patterns. Communities that developed livelihood practices adapted to natural flow regimes suddenly face unpredictable and often destructive hydrological conditions.

c) Sedimentation Issues: Mining operations have significantly increased sedimentation in tributary systems. The Lilagar River, a Mahanadi tributary flowing through mining areas, shows sedimentation rates five times higher than comparable unpolluted tributaries. For another instance, the Ib River has seen acid mine drainage and high sediment loads, affecting water quality and fish habitats downstream. A 2022 analysis by the Odisha State Pollution Control Board found sedimentation levels in these streams to be 3–5 times higher than in non-mining tributaries. This excessive sedimentation alters river morphology, affects aquatic habitats, reduces water quality, and can exacerbate flooding by decreasing channel capacity. Traditional fishing techniques and knowledge become less effective as river conditions change, creating practical barriers to continuing traditional practices.

d) Disruption of Tributary Systems: Small streams and tributaries that traditionally supported local water needs have been particularly affected by mining operations. Many seasonal streams now flow only during heavy monsoons rather than maintaining longer flow periods that previously supported local use. These smaller waterways often held particular cultural significance for nearby communities, with specific traditions, deities, and practices associated with their waters. Their degradation represents loss not merely of water sources but cultural anchoring points within local landscapes.

The impacts on river-people connections manifest in multiple dimensions. Many mining areas overlap with traditional tribal territories, leading to displacement of communities with deep cultural connections to forest-river ecosystems. Indigenous groups that maintained holistic relationships with interconnected forest-river systems face fragmentation of these natural networks, disrupting traditional resource use patterns that depended on intact ecosystem connections.

The loss of forest cover has reduced watershed water retention capacity, affecting groundwater recharge and stream flow patterns that local communities relied upon. Springs that previously provided reliable year-round water now fluctuate seasonally or disappear entirely, disrupting

water security systems that evolved around predictable hydrological patterns. These changes force communities to seek alternative water sources, often transitioning from direct ecosystem reliance to infrastructure dependence.

Many indigenous communities maintained sacred sites at natural springs and stream origins, which have been destroyed by mining operations. These sites often served as focal points for cultural practices that connected communities to water sources through ritual observances and oral traditions. Their destruction represents not merely physical loss but erasure of cultural anchoring points that maintained community-water relationships across generations.

Similar experiences have been documented in adjacent regions, such as among the Gondwana tribes in the neighboring Godavari basin, where mining activities in the Bailadila range similarly disrupted traditional connections to river-forest ecosystems. These parallels suggest regional patterns of disconnection driven by resource extraction priorities that inadequately account for cultural and ecological values of intact watersheds.

3.2.4 Urbanization and Changing Lifestyles

Rapid urbanization in Chhattisgarh and Odisha, particularly in Mahanadi basin cities like Raipur, Bilaspur, Sambalpur, Angul, Cuttack, and Durg, has fundamentally transformed traditional relationships with the river through physical, infrastructural, and cultural changes.

Urban expansion has progressively encroached upon riverbanks, converting traditional community access zones into private developments or concrete embankments. In Raipur, over 60% of traditional river access points have been lost to urban development in the past three decades. Similarly, in Cuttack, which lies at the confluence of the Mahanadi and Kathajodi, satellite assessments and field surveys indicate that over 55% of traditional public access points along the river have been blocked or transformed due to infrastructure development and flood protection walls since the 1990s. Further, in Sambalpur, the stretch between Sakhigopal Ghat and Binakhandi has seen increased encroachment from residential and transport development; and in Khordha and Bhubaneswar, planned urban sprawl near the Daya and Kuakhai tributaries has altered natural riparian zones, converting community river edges into engineered channels. This physical restriction of access creates immediate barriers to river interaction, preventing continuation of practices that previously connected urban residents to the waterway. When cities turn their backs to rivers through development patterns, they physically embed disconnection into the urban fabric.

People's connection to the river is deeply rooted in its pristine state and the cultural belief in its sacredness, making water quality a matter of great significance. However, urbanization, unsustainable resource consumption, and inadequate waste management practices have led to severe pollution, compromising the river's purity. This degradation not only disrupts the ecological balance and harms the river's biota but also weakens the bond between people and the river, diminishing its cultural and spiritual significance.

Inadequate urban sewage infrastructure has transformed river stretches near cities into heavily polluted zones. The inadequate infrastructure for treating domestic sewage in the Chhattisgarh portion and Odisha specifically in the delta region of the Mahanadi Basin leads to untreated urban sewage being directly discharged into the river, exacerbating water pollution and environmental degradation. The resulting contamination makes direct river contact unpleasant or hazardous, deterring recreational and ritual use of urban river sections. When rivers become associated with sewage and waste rather than vitality and purity, cultural perceptions fundamentally shift away from traditional reverence.

Increasing urbanization has not only intensified religious activities along the river but also altered their scale and impact. The Rajim Kumbh Mela, now drawing over 1.5 million visitors, generates approximately 120 tonnes of solid waste and religious offerings, much of which is directly disposed of in the river and during Bali Jatra, held on the banks of the Mahanadi in Cuttack, crowd sizes exceed 1 million visitors over a week, leading to an estimated generation of 80–100 tonnes of waste, including thermocol idols, incense residues, and non-biodegradable packaging. This is just a glimpse of the broader issue. Given the deep religious and cultural significance of the river, many riverbanks and ghats serve as sites for both worship and cremation. However, these sacred spaces also face persistent pollution due to the direct disposal of religious waste and funeral remains, further degrading water quality and threatening the river's ecological balance.

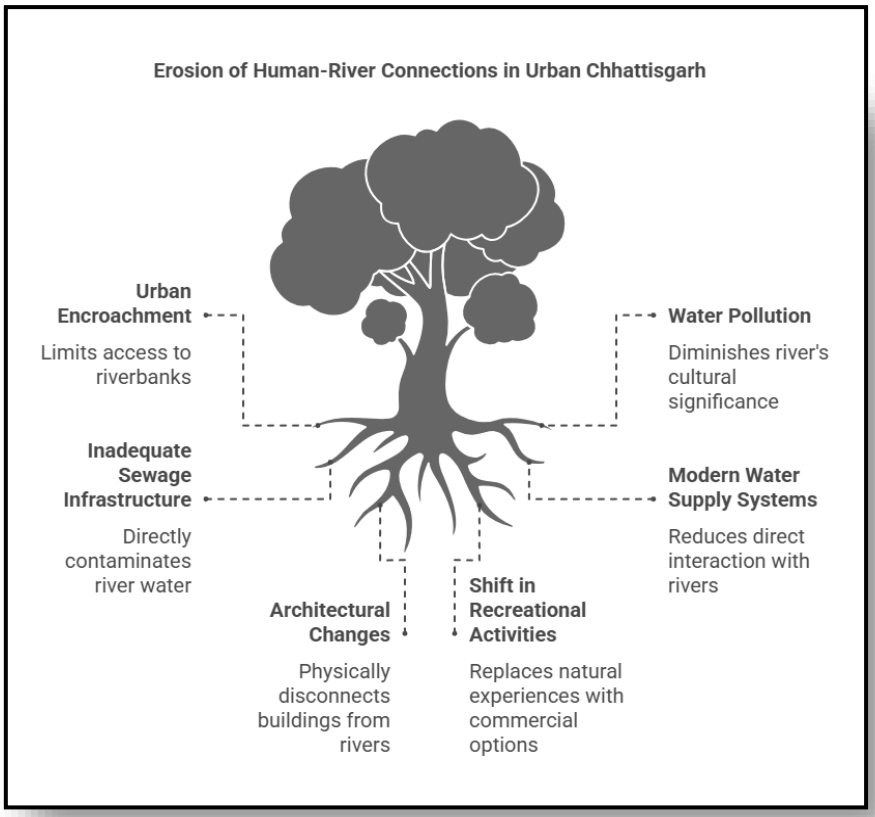

Fig. 34 Erosion of Human-River connections due to urbanization and changing lifestyles.

3.2.5 Agricultural Transformation and Water Management Policies

Agricultural modernization and changing water management approaches have significantly altered traditional farming communities' relationships with the Mahanadi through technological, policy, and practice changes.

The development of extensive irrigation infrastructure, including canal networks and groundwater extraction systems, has reduced direct dependence on river flows for agriculture. While improving water security and productivity, this infrastructural mediation creates distance between farmers and natural river cycles. When water arrives through canals or pumps rather than direct river interaction, farmers' observational knowledge of river conditions often diminishes, replaced by technical management of irrigation systems.

Traditional farming communities in the Mahanadi basin practiced diverse cropping patterns specifically adapted to river fluctuations and seasonal conditions. These systems have increasingly given way to irrigation-dependent, market-oriented monocultures, particularly expanded rice cultivation. This transition reduces agricultural biodiversity while creating more rigid water demand patterns less adapted to natural flow variability. When farming systems require consistent water delivery regardless of natural conditions, they create expectations of river control rather than adaptation to river variability.

The shift toward chemical-intensive agriculture has contributed to water pollution through runoff while simultaneously reducing farmers' need to understand subtle ecosystem indicators. Traditional farming systems relied on detailed observation of soil conditions, indicator species, and water characteristics to guide agricultural decisions. Chemical agriculture often substitutes standardized application schedules for this observational knowledge, reducing the practical value of ecological literacy developed through river interaction.

Water management decision-making has progressively shifted from local community institutions to centralized bureaucratic structures governance. This transition reduces local stakeholder involvement in water allocation decisions while prioritizing technical expertise over experiential knowledge. When farmers engage with water primarily through government agencies rather than direct river relationships, their self-conception often shifts from water stewards to water users or beneficiaries.

3.2.6 Mining and Riverbed Destruction

Fig. 35 Sand minning along the banks of Mahanadi

Illegal and unregulated sand mining has emerged as a major threat to the Mahanadi ecosystem, significantly altering its natural balance and disrupting human-river connections. Despite legal authorization for sand extraction being set at 1.2 million cubic meters annually as of 2022, environmental activists estimate that actual extraction, including illegal mining, exceeds 3.5 million cubic meters. Hotspots such as Banki, Kendrapara, Jagatsinghpur, Sambalpur, Subarnapur, Cuttack, Khurdha, Arang, Simga, Bhatapara, and Champa have experienced severe riverbed destruction, with mechanical dredging creating pits as deep as 15 feet in some areas, such as the village of Mopar in Raipur district. Although mechanized sand mining is officially

banned, investigations in 2022 documented over 60 mechanical dredgers operating in the Mahanadi basin, highlighting weak enforcement despite 342 recorded cases of illegal sand mining in 2021-22.

The impacts of excessive sand extraction are evident in changing river morphology, declining groundwater levels, and the marginalization of traditional sand collectors. In areas like Sihawa, where the Mahanadi originates, locals report that the riverbed has deepened by approximately two meters in the past decade due to relentless mining. Nearby villages such as Khoksa, Bandha, and Tulsi have witnessed a significant drop in groundwater levels, with an average decline of 3.2 meters between 2015 and 2022, according to Central Ground Water Board monitoring. This depletion directly affects water availability for drinking and agriculture, intensifying water scarcity concerns. Further, the groundwater level in the greater Bhubaneswar area has shrunk by about 10 meters or more since 2006. Several villages in Balangir district, including Bangomunda, Bhalumunda, Lathore, Sindhekela, Saintala, Muribahal, Agalpur, Gudvela, Tusra, Chudapali, and Titilagarh, are experiencing acute water scarcity due to the depletion of groundwater levels. Interviews from Angul show how shifting river courses and erosion destroy homes and livelihoods. Additionally, traditional sand collectors, particularly from fishing communities who historically harvested small quantities of sand for local use, have been criminalized while large-scale operators continue extraction with impunity. In Tulsi village in Janjgir-Champa district, 28 traditional sand collectors faced legal action in 2020-21, while commercial miners remained largely unchecked, exacerbating economic disparities and social injustices.

The relentless exploitation of river sand threatens not only the ecological integrity of the Mahanadi but also the cultural and social fabric of the communities that have long depended on it. As sand extraction accelerates, the river's ability to support livelihoods, sustain biodiversity, and maintain its historical role as a sacred and life-giving entity diminishes. Without stricter enforcement, sustainable mining regulations, and community-driven conservation measures, the Mahanadi risks being reduced to an over-exploited resource, severing the deep-rooted human-river connections that have existed for generations.

3.2.7 Agricultural Intensification and Chemical Contamination

The intensification of agriculture in the Mahanadi Basin, driven by commercial rice cultivation and heavy agrochemical use, has severely impacted the river's ecological health and disrupted the lives of river-dependent communities. Districts like Dhamtari, Mahasamund, and Janjgir-Champa have witnessed a dramatic shift from traditional farming to input-intensive agriculture, with excessive reliance on chemical fertilizers and pesticides. Water testing conducted by the Agricultural University in Raipur in 2020 detected organophosphate pesticide residues in 82% of water samples from agricultural zones along the river, with nearly half of these samples exceeding safe limits. This contamination not only endangers aquatic biodiversity but also compromises drinking water quality and public health, with potential long-term consequences for both humans and wildlife.

Beyond chemical pollution, agricultural intensification has triggered widespread soil erosion and sedimentation in the river system. The large-scale replacement of riparian vegetation with commercial farmlands has destabilized riverbanks, accelerating sediment deposition downstream. According to the Central Water Commission, the sediment load in the Mahanadi at Hirakud increased by 38% between 1990 and 2020, disrupting aquatic habitats and reducing

the storage capacity of reservoirs. Meanwhile, the over-extraction of groundwater for irrigation, particularly in Raipur, Durg, and Bilaspur, has pushed many regions to critical levels of depletion.

For local communities, these environmental shifts have intensified water conflicts, diminished agricultural resilience, and led to the loss of traditional farming knowledge. Villages such as Tendumudi, Parsada, and Bhothali have seen growing disputes over water allocation between upstream and downstream users, particularly during dry seasons when water scarcity becomes acute. Small-scale farmers, once reliant on the river for sustainable irrigation, now struggle to compete with large commercial farms that deplete water resources at an unsustainable rate. Furthermore, the adoption of high-yield hybrid rice varieties has led to a sharp decline in indigenous seed diversity, weakening traditional agricultural systems.

Beyond these tangible consequences, the shift toward intensive agriculture has also eroded the cultural and spiritual connections that farming communities once shared with the river. Traditional agricultural practices, which emphasized ecological balance, seasonal water cycles, and soil conservation, have been replaced by extractive farming methods that prioritize short-term yields over long-term sustainability. For generations, farmers viewed the river as a sacred and life-giving force, essential to their livelihoods and rituals. However, as the Mahanadi becomes increasingly contaminated and over-exploited, this deep-rooted relationship is breaking down. The river is no longer seen as a source of sustenance and purity but as a conduit for pollution and depletion. Without urgent interventions to promote sustainable agriculture, strengthen groundwater conservation, and restore riparian ecosystems, the Mahanadi faces irreversible ecological degradation, further alienating the very communities that have depended on it for centuries.

3.3 Current Implications and Challenges due to river-people disconnect

The cumulative impact of these disconnection factors presents significant challenges for sustainable river basin management while creating social and ecological vulnerabilities across the region. These results in ecological consequences, socio-economic impacts, and cultural and psychological effects.

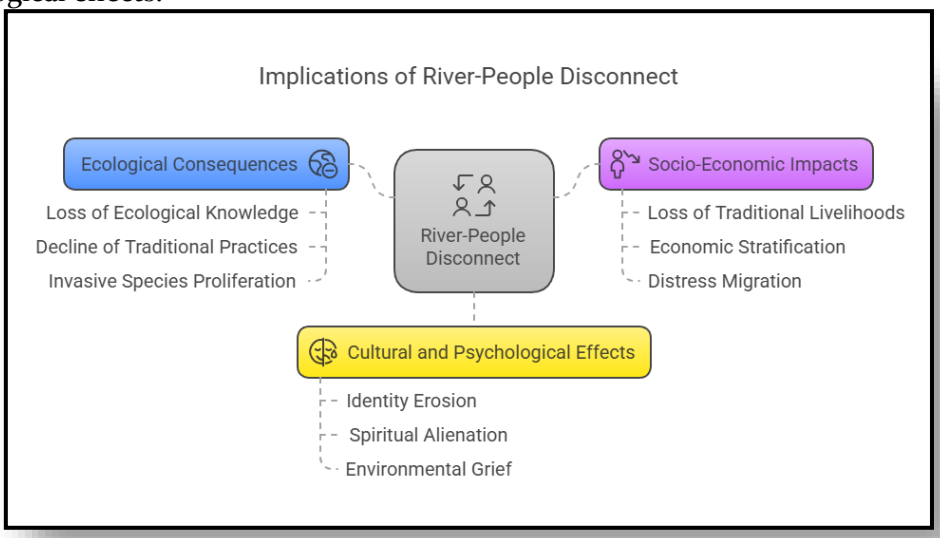

Fig. 36 Current implications and challenges due to river-people disconnect

a) Ecological consequences

The erosion of traditional ecological knowledge represents one of the most profound long-term consequences of the growing disconnect between people and the Mahanadi River. As older generations with direct river experience age without effectively passing down their knowledge, the understanding of river ecosystems, species interactions, flow patterns, and sustainable management practices is rapidly diminishing. This knowledge loss weakens the ability of communities to adapt to environmental changes.

The weakening of people-river relationships has led to significant ecological repercussions. Reduced stewardship is evident in the decline of traditional practices that once protected river ecosystems. Sacred fish sanctuaries (dahars), which historically served as crucial breeding grounds for native fish species, have been abandoned in many areas, removing a vital component of ecological conservation. Additionally, the erosion of detailed local ecological knowledge about riverine species, habitats, and seasonal patterns represents an irreplaceable loss of biodiversity information, limiting informed decision-making for conservation efforts.

b) Socio-Economic Impacts

The disconnect between communities and the Mahanadi River has significantly altered traditional social and economic structures, leading to widespread disruptions in livelihoods, economic inequality, and migration patterns.

One of the most severe consequences has been the **loss of traditional livelihoods**. Fishing communities, riverbank farmers, and boat operators, whose occupations have historically depended on the river, have faced sharp declines in income. A 2017 survey in the middle Mahanadi basin reported that fishing incomes had dropped by over 70% in the previous two decades due to pollution, declining fish stocks, and restricted access to traditional fishing grounds. Similarly, riverbank farmers have struggled with soil degradation, erratic water availability, and encroachment of agricultural land for urban expansion.

Economic stratification has also deepened as access to clean water increasingly correlates with financial power. Those who can afford private wells, borewells, or water deliveries remain water-secure, while poorer communities—despite living near the river—struggle with water scarcity due to pollution and depletion of traditional water sources. This disparity not only affects daily survival but also exacerbates social inequalities.

Another critical challenge is the **devaluation of traditional river-related skills**. Knowledge of fishing techniques, river navigation, and floodplain agriculture, once considered essential, has lost its economic and social value in a rapidly modernizing economy. As these skills become obsolete, the social status of traditional knowledge holders declines, leading to further marginalization of communities with deep historical ties to the river.

These economic hardships and shifts in social structure have fueled **distress migration** from river-dependent communities, particularly among younger generations seeking employment in urban centers. Many families that once relied on the Mahanadi for sustenance now face uncertain futures in cities, where they often take on low-paying, unstable jobs. This migration not only affects individual families but also disrupts the continuity of traditional knowledge and weakens the cultural fabric of river communities.

c) Cultural and Psychological Effects

Beyond economic challenges, the weakening connection between people and the river has deep cultural and psychological consequences.

One major impact is identity erosion of **inhabitants**. Communities that once defined themselves through their relationship with the river—whether as fishers, farmers, or boatmen—are increasingly shifting to identities disconnected from natural systems. As younger generations grow up with little direct interaction with the river, the deep-rooted cultural bonds that once shaped local traditions and values are fading.

This disconnection has also led to **spiritual alienation**. Many communities that consider the Mahanadi sacred now struggle with the cognitive dissonance of worshiping a river that is heavily polluted. The once-revered waters, associated with purity and divinity, are now linked to contamination and decay, forcing a painful separation between religious beliefs and environmental realities. This alienation has weakened the traditional reverence for the river, making conservation efforts even more challenging.

The loss of the river as a **communal space** has further diminished social cohesion. Riverbanks that once served as gathering points for festivals, community meetings, and recreational activities have been lost to privatization, encroachment, or pollution. Without these shared spaces, community bonds weaken, leading to a decline in collective action and a sense of belonging.

Finally, the degradation of the river has resulted in **environmental grief**, particularly among elders who have witnessed the decline of a once-thriving ecosystem. Many older community members experience a profound sense of loss as they recall a time when the river was central to life, clean and abundant with fish. Psychologists have noted that this grief resembles responses to personal loss, as people struggle to reconcile their deep emotional and cultural connections with the stark reality of environmental destruction.

4. Efforts by NGOs, local governments, or other groups/organizations in influencing river-people connect

The Mahanadi River basin in Chhattisgarh and Odisha represents a critical case study in human-river relationships that have undergone profound transformation over recent decades. As documented in the preceding analysis of river-people disconnection, traditional relationships characterized by cultural reverence, sustainable resource utilization, and ecological stewardship have been severely disrupted by large-scale development interventions, industrialization, and changing socio-economic patterns. This section examines the efforts made by various stakeholders—including non-governmental organizations, community collectives, government agencies, and academic institutions—to address this disconnection and rebuild meaningful relationships between communities and the Mahanadi River.

These efforts represent critical experiments in reconciling development imperatives with ecological sustainability and cultural continuity. Their successes, limitations, and challenges offer valuable insights for developing scalable approaches to river-people reconnection not only in the Mahanadi basin but in river systems worldwide facing similar transitions.

4.1 Civil Society and NGO Initiatives

The Mahanadi River basin in Chhattisgarh and Odisha has witnessed significant interventions by non-governmental organizations over the past two decades. These organizations have recognized the critical disconnect between communities and the river system that once formed the backbone of their cultural and economic existence.

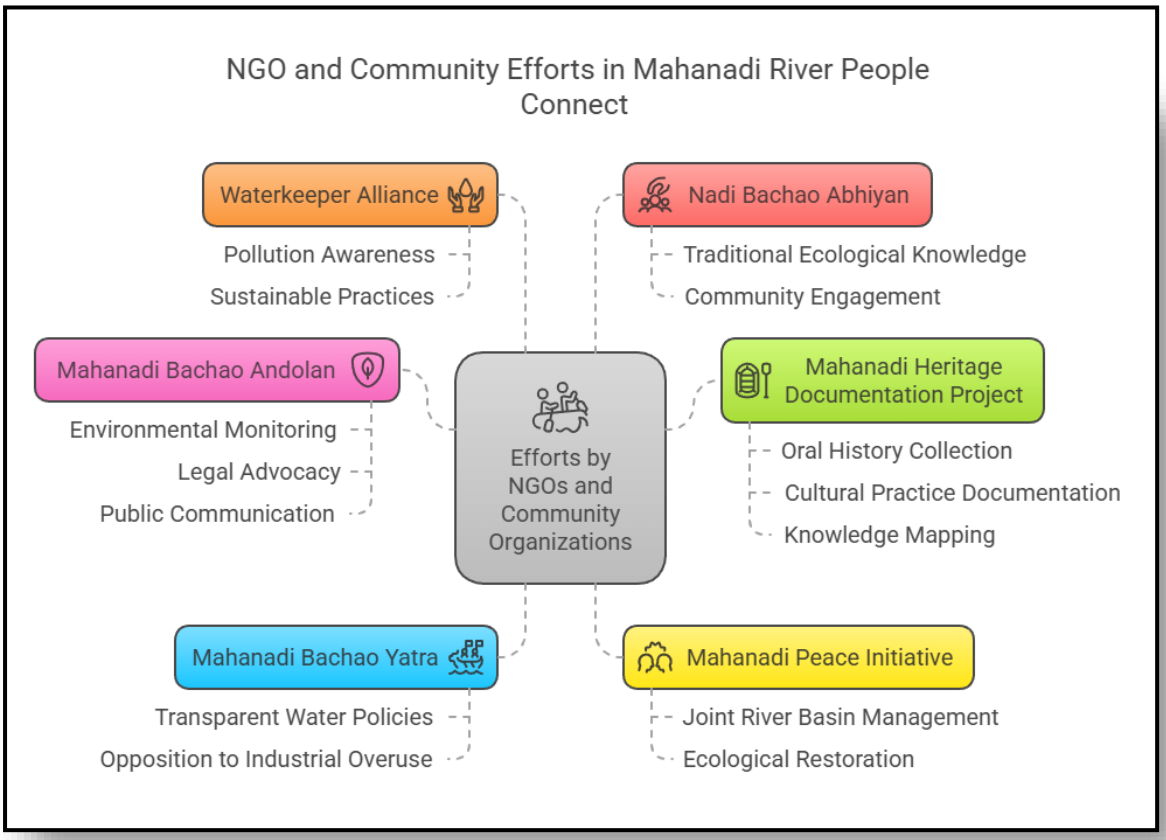

Fig. 37 Eforts by NGOs, local governments, or other groups/organizations in influencing river-people connect

4.1.1 Mahanadi Bachao Andolan

The Mahanadi Bachao Andolan (MBA), initiated in 2016, represents one of the most significant grassroots efforts to reconnect communities with the Mahanadi River through citizen-led environmental monitoring and advocacy. This coalition, comprising 24 civil society organizations and community groups across Chhattisgarh and Odissa, has developed an extensive monitoring network covering 32 strategic points along the river's main channel and key tributaries within the state. The "Mahanadi Bachao Andolan," has approached river-people reconnection through legal advocacy and awareness campaigns. Their work has focused on challenging industrial pollution and ensuring the implementation of minimum ecological flow requirements. Through legal interventions at the National Green Tribunal, they successfully mandated industrial units in Korba and Raigarh to institute stricter effluent treatment protocols (Verma et al., 2022).

The MBA's effectiveness stems from its multi-dimensional approach that goes beyond mere data collection:

a) **Public Communication Strategy**: Technical findings are translated into accessible formats through visual storytelling, local language publications, and community meetings, helping riverside residents understand the condition of their river.
b) **Media Engagement**: Strategic partnerships with regional and national media have amplified river health issues, with coverage in outlets like Navbharat and The Hindu bringing broader attention to localized pollution events.
c) **Legal Advocacy**: The MBA has filed eight Public Interest Litigations between 2017-2023 concerning specific pollution sources.

The initiative faces significant challenges, including threats to volunteers monitoring industrial discharge points, data contestation by polluting industries, and the struggle to maintain consistent monitoring protocols across diverse community groups. Nevertheless, it has succeeded in reframing river pollution from a technical issue managed exclusively by government agencies to a public concern requiring community accountability.

4.1.2 Mahanadi Bachao Yatra

The 'Mahanadi Bachao Yatra' was organized by people's organizations from Chhattisgarh and Odisha to address the politicization of Mahanadi waters. This initiative aimed to protect the river's natural conditions and environmental flows while opposing industrial water overuse and pollution. The campaign emphasized transparent water-use policies, comprehensive studies before constructing dams, and halting illegal industrial water use and pollution (India Water Portal, 2016).

4.1.3 Mahanadi Peace Initiative

Led by Ranjan Panda, the Mahanadi Peace Initiative sought to resolve inter-state disputes between Chhattisgarh and Odisha through dialogue and cooperation. It focused on treating the Mahanadi as a single ecological entity and building awareness about challenges such as reduced water flow due to dams, pollution, climate change impacts, and loss of livelihoods for farmers and fisherfolk. The initiative advocated for joint river basin management plans, ecological restoration, drought-proofing, clean drinking water access, irrigation coverage, and sanitation facilities (Waterkeeper Alliance, 2016).

4.1.4 Waterkeeper Alliance

The Mahanadi River Waterkeeper program has worked to connect basin communities to the challenges facing the river. It focuses on raising awareness about pollution, industrial impacts, urban encroachments, and climate change effects while advocating for sustainable management practices (Waterkeeper Alliance, 2016).

4.1.5 Nadi Bachao Abhiyan (Save the River Movement)

Initiated in 2009, has been instrumental in mobilizing community participation across riverside villages in Raipur, Dhamtari, and Mahasamund districts (Pandey & Sharma, 2018). Their approach combines traditional ecological knowledge with modern conservation strategies, organizing regular "River Parliaments" (Nadi Sansad) where village elders and youth

collaboratively address river-related issues. These events have successfully documented the changing relationships between the river and its people, creating a repository of indigenous knowledge that was rapidly disappearing.

According to Jaiswal (2020), the effectiveness of these initiatives stems from their emphasis on intergenerational knowledge transfer. When elderly residents describe how the river once supported thriving fisheries and clean drinking water, younger generations develop a renewed sense of responsibility. This approach has been particularly successful in villages like Arang and Simga, where "Yuva Jal Nigrani Dal" (Youth Water Monitoring Teams) now conduct regular water quality assessments and document biodiversity changes.

4.1.6 Mahanadi Heritage Documentation Project: Preserving River Knowledge

Initiated by Indian National Trust for Art and Cultural Heritage (INTACH), the Mahanadi Heritage Documentation Project represents a significant academic-community partnership focused on preserving the cultural dimensions of river connections. The project is focussed on documenting traditional ecological knowledge, cultural practices, and oral histories associated with the river across villages in different districts of Chhattisgarh and Odissa.

The project's findings are planned to be returned to communities through locally appropriate formats, including illustrated handbooks in regional languages, documentary films, and traveling exhibitions. While primarily focused on documentation rather than active revitalization, the project has catalyzed community-led cultural revival initiatives in several villages.

4.1.7 Community-Managed Fish Sanctuaries

An innovative approach to combining traditional management practices with contemporary conservation needs has emerged through the establishment of community-managed fish sanctuaries in several stretches of the Mahanadi and its tributaries. Villages have established protected stretches where fishing is seasonally prohibited, particularly during breeding periods.

The approach faces challenges, particularly conflicts with commercial fishing operators and encroachment by industrial activities. However, its success has led the State Fisheries Department to recognize community-managed sanctuaries within its policy framework in 2022, creating opportunities for expansion to additional river stretches.

4.2 Local Government Initiatives

The Chhattisgarh and Odissa state government has implemented several programs aimed at river-people reconnection, though with varying degrees of success. These programs encompass urban restructuring to improve Mahanadi River and its tributaries, sustainable development initiatives, strict environmental management, and policy initiatives. The "Mahanadi Mahotsav," an annual river festival initiated in 2017, represents an attempt to revive cultural connections with the river through art, music, and traditional boat races.

More substantive has been the "Chhattisgarh Jalvayu Parivartan Karya Yojana" (Chhattisgarh State Action Plan on Climate Change), which includes specific provisions for river basin management and community participation. Under this plan, "Nadi Basin Prabandhan Samitis" (River Basin Management Committees) have been formed in 12 districts along the Mahanadi,

with mandated representation from fishing communities, farmers, and women's self-help groups (State Climate Change Cell, 2022). These committees have been given authority to monitor local industries for compliance with environmental regulations, though implementation remains uneven across districts.

Organizations like Water Initiatives Odisha (WIO), Gram Swaraj, and Vasundhara have mobilized campaigns for water literacy, sand mining regulation, and equitable allocation. WIO's documentation of displacement due to Hirakud has fed into judicial activism. District administrations in Bargarh and Cuttack have initiated wetland rejuvenation and tank restoration projects to reduce river pressure. Odisha State Disaster Management Authority (OSDMA) has involved communities in flood early warning and embankment maintenance. Academic institutions like OUAT have piloted citizen-science river monitoring models. Panchayat-level water governance through Jala Suraksha Samitis has begun to bridge community-state cooperation gaps.

4.2.1 Mahanadi Riverfront Development: Balancing Access and Ecology

Urban areas along the Mahanadi have witnessed significant alienation from the river, with infrastructure often turning its back on waterways and treating them primarily as drainage channels.

The "Nadi Kinara Vikas Pariyojana" (Urban Bodies River Front Development initiative) launched in 2019 has transformed riverbanks in Raipur and Bilaspur, creating recreational spaces and improving public access to the river (Urban Development Department, 2023). These attempts represent an attempt to reconnect urban populations with the river while addressing ecological concerns.

The project's design, developed through a consultative process involving multiple stakeholders, attempts to balance recreational access with ecological restoration. However, as Mishra (2022) points out, these developments have primarily served urban populations and tourists rather than addressing the deeper ecological relationship between the river and its traditional dependents.

The Mahanadi Riverfront Development Project, particularly around Cuttack (Jobra–Kendrapara stretch) and Sambalpur (Hirakud downstream), is being executed under an Integrated Urban Infrastructure model that blends open public spaces, parks, cycling paths, and ghats with erosion control and ecological buffers. The Odisha Riverfront Development Authority (proposed) aims to oversee multi-agency coordination involving urban bodies, water resource departments, and tourism boards, ensuring river health is not compromised for infrastructure gain.

4.2.2 Wetland Restoration Initiatives

The Chhattisgarh State Wetland Authority has identified and begun restoring 18 critical wetlands connected to the Mahanadi system through their "Jal-Jeevan Samvardhan" program, working with local communities to establish co-management protocols (Chhattisgarh Environment Conservation Board, 2022). The Odisha Wetland Authority, in collaboration with the Forest & Environment Department and NGOs, has launched programs to rejuvenate degraded wetlands such as the Mangalajodi and Bhusandpur regions of Chilika Lake and

floodplain wetlands near Naraj and Satkosia. These efforts include removal of invasive species like Ipomoea and Eichhornia, desilting of water bodies, construction of inlets and spillways for hydrological connectivity, and community-based protection measures. This approach recognizes the importance of lateral connectivity between the river and its floodplain wetlands, which traditional communities had maintained through customary practices before modernization disrupted these relationships.

5. Conclusions and Policy Recommendations for Scale-Up

The diverse efforts to reconnect communities with the Mahanadi River in Chhattisgarh and Odisha demonstrate both significant potential and persistent challenges. Analysis of these initiatives yields important insights about effective approaches and potential pathways for scaling successful strategies through policy interventions. These aspects are discussed in the subsequent section.

5.1 Key Success Factors in River-People Reconnection Efforts

Across the various initiatives examined, several common factors appear to contribute to effectiveness in rebuilding meaningful connections between communities and the river:

a) **Multi-dimensional Approach**: The most successful initiatives address multiple aspects of disconnection simultaneously—ecological, cultural, economic, and governance-related—rather than focusing on single dimensions.

b) **Recognition of Diverse Relationships**: Effective approaches recognize that different communities relate to the river in distinct ways based on livelihood patterns, cultural practices, and geographical location, avoiding one-size-fits-all solutions.

c) **Knowledge Integration**: Initiatives that successfully bridge traditional ecological knowledge with scientific approaches create more robust understanding of river systems and more culturally appropriate intervention designs.

d) **Tangible Benefits**: Programs that demonstrate visible improvements in river conditions or deliver concrete economic or quality-of-life benefits maintain stronger community engagement than purely awareness-focused efforts.

e) **Institutional Recognition**: Community-based initiatives that secure formal recognition within governance frameworks show greater sustainability and influence than those operating entirely outside institutional structures.

f) **Youth Engagement**: Initiatives that successfully engage younger generations through schools, digital platforms, or cultural reimagining show greater potential for sustained impact as demographic transitions continue.

g) **River Basin Perspective**: Approaches that help communities understand their local experiences within the broader context of the river basin create more holistic understanding of challenges and potential solutions.

5.2 Policy Recommendations for Scaling Effective Approaches (Successful Community-Based River Initiatives)

Based on successful river-people connection initiatives implemented across various Indian river basins and persistent challenges, the following approaches are recommended for adaptation and implementation in the Mahanadi River Basin:

5.2.1 Community-Based Water Conservation Structures

The revival of traditional water harvesting structures similar to the "johads" approach pioneered by organizations like Jal Mitra in other regions has demonstrated significant success in improving groundwater recharge and restoring seasonal streams. This "Jal-Jungle-Jameen" approach has proven effective in rebuilding water relationships through tangible conservation structures. For the Mahanadi basin, a systematic program to identify, restore, and maintain traditional water harvesting structures should be implemented with community participation as the central component.

5.2.2 Women-Led Water Stewardship Programs

Gender-focused River stewardship programs similar to the Jal Saheli ("Friends of Water") model have shown remarkable success in regions facing industrial pressures of Northen India. Jal Sahelis, formed in 2005 in Madhogarh village of Bundelkhand, is a collective of around 1,000 women working across 200 villages in 7 districts of Uttar Pradesh and Madhya Pradesh. Ranging in age from 18 to 70, they address water scarcity by engaging with panchayats and restoring local water sources.

Their efforts have helped over 100 villages resolve water crises, and in 2022, they released a manifesto advocating environmental conservation. These programs empower women as environmental monitors and advocates while legitimizing their traditional water knowledge. The Mahanadi basin would benefit greatly from a scaled implementation of this approach.

5.2.3 Village River Committees Framework

The Nadi Mitra Mandals (Friends of River Committees) model offers a promising institutional framework for community involvement in river management. For effective implementation in the Mahanadi basin, these committees should be given stronger statutory recognition and clear integration with existing governance structures. The Mahanadi basin would benefit greatly from a scaled implementation of this approach.

5.2.4 Riparian Forest Restoration Programs

Community-based riparian ecosystem restoration initiatives have demonstrated significant ecological and economic benefits in various river systems. A comprehensive riparian restoration program for the Mahanadi would address multiple challenges including erosion, water quality, and biodiversity loss while creating sustainable livelihoods.

5.2.5 Educational Institution Engagement

School River Adoption Programs have proven effective in rebuilding connections between urban youth and river systems in several Indian cities. A basin-wide educational engagement strategy would help address the urban-rural disconnect in river stewardship.

Fig. 38 Policy Recommendations for Mahanadi River Basin

5.2.6 Urban Water Harvesting and Connectivity Initiatives

Urban water harvesting initiatives that emphasize the connection between city water systems and river health have shown success in building awareness and practical action. The Mahanadi basin's rapidly urbanizing areas need the following systematic approaches that rebuild hydrological connectivity:

a) Implement mandatory rainwater harvesting across all urban areas in the basin.

b) Restore urban water bodies with clear educational components about basin connectivity.

c) Develop urban watershed management plans for all major cities in the basin.

d) Launch public awareness campaigns emphasizing urban-river connections.

5.2.7 Citizen Science Monitoring Networks

Participatory monitoring initiatives that integrate traditional ecological knowledge with scientific parameters have proven highly effective in other river basins. These approaches enlisted below not only generate valuable data but also deepen community connections with river ecosystems while creating accountability mechanisms:

a) Establish a basin-wide citizen science monitoring network modelled after successful approaches that combine traditional knowledge with modern parameters.

b) Develop standardized protocols for community volunteers to collect water samples and conduct basic tests for pH, dissolved oxygen, turbidity, and visible pollutants.

c) Create partnerships with academic and research institutions for laboratory analysis of complex parameters like heavy metal contamination and biological oxygen demand.

d) Implement an annual "River Health Report Card" system as an alternative data source that complements official monitoring.

e) Target monitoring efforts particularly in known hotspots such as downstream from industrial clusters and urban centres.

f) Develop mobile applications and user-friendly tools to streamline data collection and reporting.

g) Create formal mechanisms for citizen-generated data to inform regulatory decisions and enforcement actions.

5.2.7.1 Inclusive Governance Mechanisms

River Basin Management Committees with significant community representation have demonstrated potential for more inclusive governance in several Indian contexts. The Mahanadi basin requires a governance framework that effectively balances diverse stakeholder interests.

5.2.7.2 Economic Accountability Frameworks

Pollution compensation frameworks based on the "Polluter Pays" principle have begun to address environmental externalities in several river basins. A comprehensive economic accountability system for the Mahanadi would create stronger incentives for environmental protection.

5.2.7.3 Indigenous and Traditional Rights Recognition

Programs documenting and protecting traditional water use rights have helped address historical marginalization in water allocation decisions in several contexts. The Mahanadi basin, with its significant indigenous population, requires a systematic approach to rights recognition.

These policy recommendations build on proven approaches from across India that reconnect people with river systems through meaningful participation, economic engagement, knowledge integration, and formal recognition of diverse relationships with water. Their implementation in the Mahanadi basin would represent a significant advance toward more sustainable and equitable river management that not only ensures river continuity and pristinely but also restores the river ecological health.

5.3 Policy Recommendations for Scaling Effective Approaches (Initiatives Requiring Local, Interstate and federal Cooperation)

5.3.1 Governance and Institutional Reform

a) **Statutory Recognition of River Basin Authority**: Elevate the existing River Basin Management Committee to a statutory River Basin Authority with clear powers regarding water allocation, pollution control, and ecosystem management, maintaining or expanding community representation.

b) **Ecological Flow Mandates**: Establish legally binding ecological flow requirements for all dams and barrages on the Mahanadi system, ensuring downstream ecosystem needs and community use rights are protected.

c) **Community Co-Management Framework**: Develop a formal framework for community co-management of river stretches, building on the success of community-managed fish sanctuaries by providing legal recognition, technical support, and mediation mechanisms for conflicts with other water users.

d) **Participatory Monitoring Protocol**: Institutionalize community-based monitoring within official environmental surveillance systems through standardized protocols, data sharing platforms, and formal recognition of community-generated data in regulatory processes.

5.3.2 Economic and Livelihood Approaches

a) **River Health Incentive System:** Establish performance-based incentives for panchayats, urban local bodies, and water user associations tied to measurable improvements in river health indicators within their jurisdictions.

b) **Sustainable River Livelihoods Fund:** Create a dedicated funding mechanism for supporting traditional and emerging livelihoods that contribute to river health, including sustainable fishing, riverbank agriculture using ecological methods, and river-based ecotourism.

c) **Green Tax and Subsidy Reform:** Review and reform tax and subsidy structures that currently incentivize river-degrading practices, such as subsidies for chemical fertilizers that contribute to nutrient pollution or preferential water pricing for industries.

d) **River-Friendly Certification**: Establish a certification system for agricultural and fishery products produced using river-friendly practices, creating market incentives for sustainable production methods.

5.3.3 Cultural and Educational Initiatives

a) **Cultural Heritage Protection:** Establish a comprehensive inventory and protection system for tangible and intangible cultural heritage associated with the river, including sacred sites, traditional craft knowledge, and oral traditions.

b) **Digital River Platform:** Create an accessible digital knowledge platform that documents historical and contemporary relationships with the river, making cultural knowledge and citizen science data available to communities throughout the basin.

c) **Intergenerational Knowledge Exchange:** Establish structured programs for knowledge transfer between elders with direct experience of traditional river relationships and younger generations, adapted to contemporary communication forms.

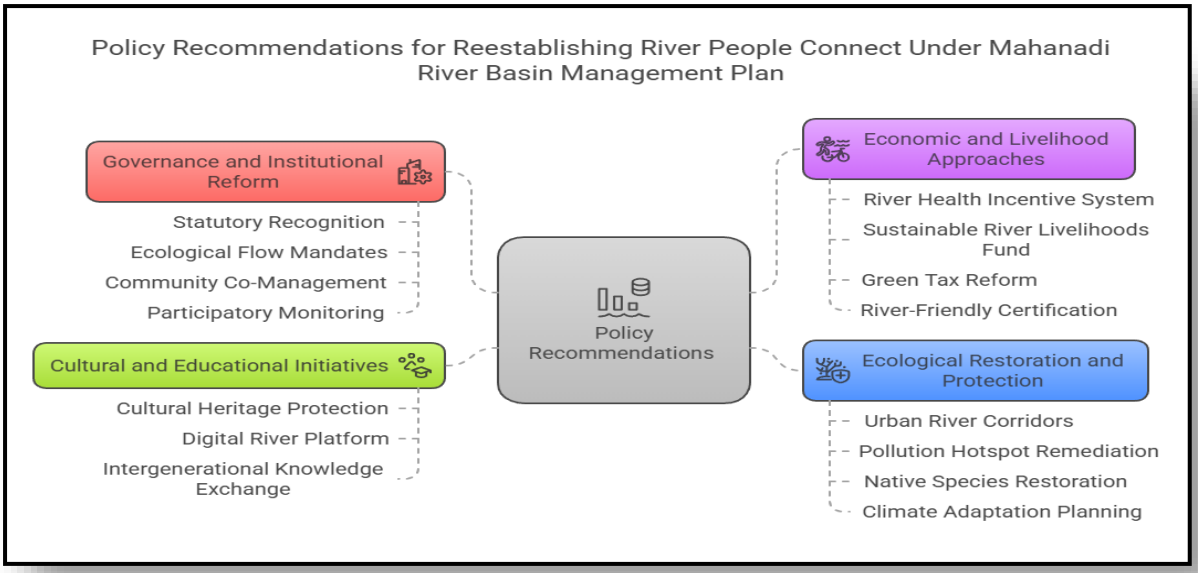

Fig. 39 Policy Recommendations for Scaling Effective Approaches (Initiatives Requiring Local, Interstate and federal Cooperation)

5.3.4 Ecological Restoration and Protection

a) **Urban River Corridors:** Establish protected ecological corridors along urban river stretches with minimum setback requirements, ecological restoration mandates, and limitations on hardscape interventions.

b) **Pollution Hotspot Remediation Program:** Create a targeted program for comprehensive remediation of critical pollution hotspots, combining enhanced enforcement, technical solutions, and community monitoring.

c) **Native Species Restoration:** Expand riparian reforestation programs with explicit focus on native species diversity and traditional use values, creating multiple ecological and community benefits.

d) **Climate Adaptation Planning:** Develop basin-wide climate adaptation strategies that integrate traditional knowledge of river variability with climate science to build resilience in both ecological and social systems.

5.4 Implementation Pathway: Phased Approach

Recognizing the complexity of these recommendations and the constraints of existing institutional capacities, a phased implementation approach is proposed:

5.4.1 Immediate Actions (1-5 years)

a) Formalize and expand community monitoring protocols.
b) Initiate river literacy curriculum development.
c) Establish pollution compensation utilization guidelines.
d) Expand documentation of traditional ecological knowledge.
e) Launch pilot river health incentive systems in selected panchayats.

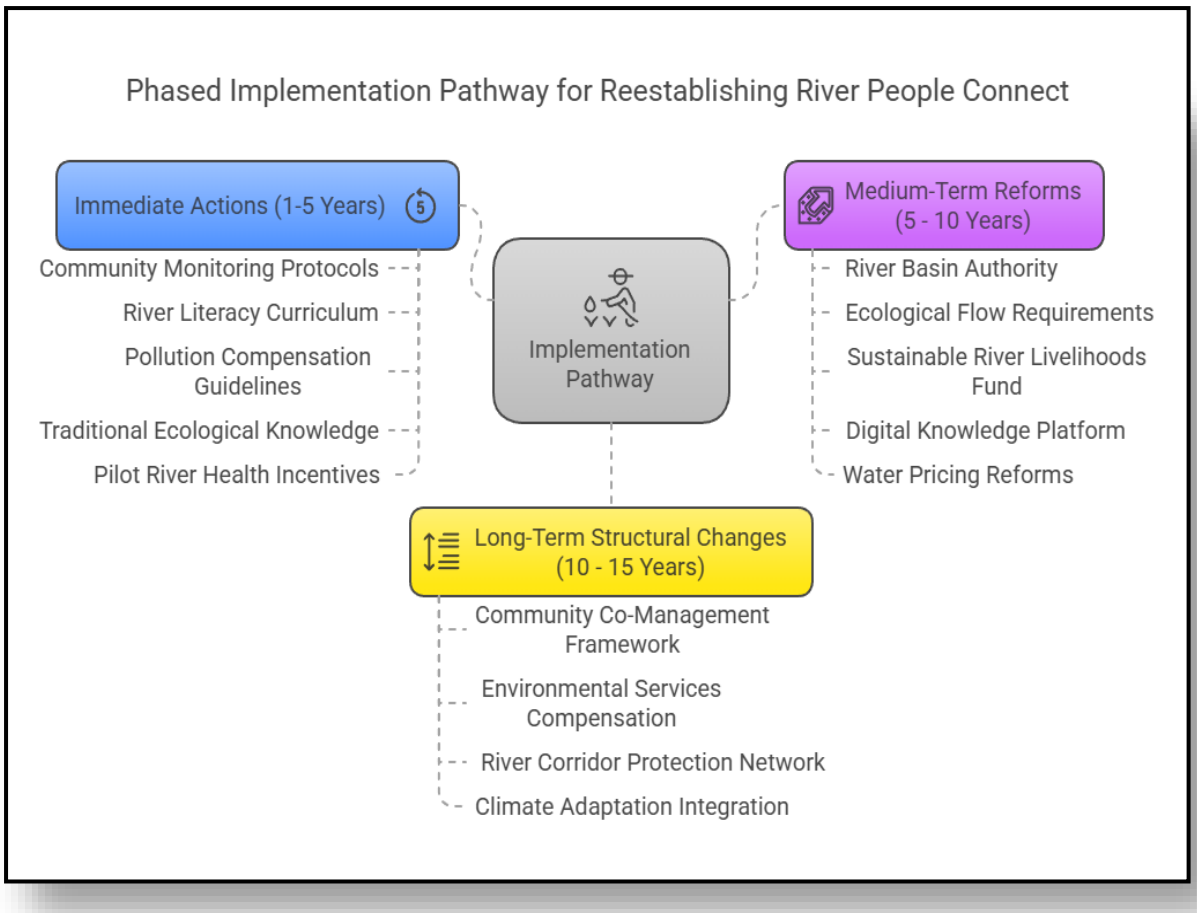

Fig. 40 Phased implementation pathway for reestablishing river-people connect

5.4.2 Medium-Term Reforms (5-10 years)

a) Establish statutory River Basin Authority with community representation.
b) Implement ecological flow requirements.
c) Create Sustainable River Livelihoods Fund.
d) Develop digital knowledge platform.
e) Reform water pricing and incentive structures.

5.4.3 Long-Term Structural Changes (10-15 years)

a) Fully implement community co-management framework.
b) Establish comprehensive environmental services compensation system.
c) Complete river corridor protection network.
d) Integrate climate adaptation measures throughout governance systems.

5.5 Conclusion

The Mahanadi River has historically sustained deep cultural, spiritual, ecological, and economic connections with the people of Odisha and Chhattisgarh. It served not just as a water source but as a vital force shaping agricultural practices, religious rituals, artisanal traditions, and community identities. For centuries, riverside communities developed lifestyles and livelihoods intricately linked to the river's natural rhythms. However, in recent decades, this longstanding relationship has been severely disrupted due to large-scale developmental interventions, including dam construction, industrial expansion, and rapid urbanization. As a result, the Mahanadi is no longer perceived as a sacred and life-giving entity by many, but rather as a utilitarian resource or an environmental burden.

This disconnection reflects broader development models that prioritize economic growth and infrastructure over ecological and cultural continuity. Projects like the Hirakud Dam, Ravishankar Sagar Dam, and Minimata Bango have displaced thousands, uprooting communities from ancestral lands and severing physical and emotional ties with the river. Industrial activities such as coal mining, thermal power generation, and steel production have polluted the river's waters, making them unsafe for domestic use and harming aquatic ecosystems. Urbanization has further encroached upon riverbanks, replacing traditional settlements and livelihoods with concrete infrastructure that isolates communities from the river. Meanwhile, agricultural modernization has distanced farmers from natural hydrological cycles, replacing traditional water knowledge with mechanized irrigation systems and chemical inputs.

These disruptions have had profound consequences. Communities have lost access to fertile floodplains, clean water, and traditional fisheries—forcing many into migration or unfamiliar wage labor. Pollution has led to a decline in fish populations and increased health risks, particularly for low-income families who still rely on the river. Rituals and festivals continue in name, but often lack their original ecological context, becoming more symbolic than lived experiences. The resulting generational gap means many younger people grow up without meaningful interactions with the river, further weakening communal stewardship.

Yet, amidst this disconnection, there are signs of revival. Grassroots movements in Odisha and Chhattisgarh are reasserting the rights of communities to clean water and cultural ties with the Mahanadi. Citizen-led conservation initiatives, participatory water governance models, and renewed cultural practices are emerging as powerful tools for reconnection. These efforts seek to blend traditional knowledge with modern environmental science to address pollution, restore habitats, and empower local voices in decision-making processes.

Rebuilding this connection demands a fundamental shift in how rivers are valued and governed. Recognizing rivers as living systems—rather than mere economic assets—is crucial for sustainability. As climate change exacerbates water challenges, reconnecting people to rivers like the Mahanadi becomes essential for building ecological resilience, preserving cultural heritage, and ensuring long-term water security. The story of the Mahanadi offers both a warning and a way forward—reminding us that sustainable development must include the river as a central, living part of community life.

Acknowledgement

The Centre for Mahanadi River Basin Management and Studies (cMahanadi), NIT Raipur and NIT Rourkela expresses its sincere gratitude to the following agencies and institutions for their invaluable support and contributions in the preparation of the "**River-People Connect**" report for the Mahanadi Basin:

We extend our thanks to the following agencies for providing data and support in the preparation of the report –

- Water Resources Department, Government of Chhattisgarh
- Water Resources Department, Government of Odisha
- Central Water Commission, India
- Central Ground Water Board, India

References

1. Odisha State Action Plan on Climate Change (OSAPCC), 2014–2023 – Forest and Environment Department, Govt. of Odisha
2. Comprehensive Development Plan for Mahanadi Riverfront (Cuttack & Bhubaneswar) – Odisha Urban Infrastructure Development Fund (OUIDF)
3. Odisha Wetland Authority Annual Reports (2018–2023) – Forest & Environment Department, Govt. of Odisha
4. Integrated Coastal Zone Management Project (ICZMP) Reports – Odisha State Project Management Unit
5. Census of India (2011) – Directorate of Census Operations, Odisha
6. National Water Quality Monitoring Programme (NWMP) – Central Pollution Control Board (CPCB)
7. National River Conservation Plan (NRCP) Reports – Ministry of Environment, Forest and Climate Change (MoEFCC)
8. Chilika Development Authority (CDA) Technical Reports (2005–2022)
9. State Environment Report, Odisha (2019) – Odisha State Pollution Control Board
10. Integrated Watershed Management Programme (IWMP) Guidelines – Department of Land Resources, Ministry of Rural Development, Govt. of India
11. Water Allocations and Use in the Mahanadi River Basin A Study of the Agricultural and Industrial Sectors. Published by Forum for Policy Dialogues on Water Conflicts
12. Mahanadi Basin: An Alternative Approach to Inter-state Water Sharing and Management An Approach Paper. Published by Forum for Policy Dialogues on Water Conflicts
13. Groundwater in the Mahanadi River Basin – July 2017. Published by Forum for Policy Dialogues on Water Conflicts
14. Integrated Water Management of the Mahanadi Basin: Water Resources, Water Allocation and Inter-Sectoral Use – July 2017. Published by Forum for Policy Dialogues on Water Conflicts
15. Water Allocations and Use in the Mahanadi River Basin: A Study of the Agricultural and Industrial Sectors – July 2017. Published by Forum for Policy Dialogues on Water Conflicts
16. Mahanadi River Basin: A Situation Analysis – January 2017. Published by Forum for Policy Dialogues on Water Conflicts