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

Approaches and Activities for River People Connect

Cauvery Basin

March 2025

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National River Conservation Directorate (NRCD)

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

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

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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.

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Acknowledgment

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Disclaimer

This report is a preliminary version prepared as part of the ongoing Condition Assessment and Management Plan (CAMP) project. The analyses, interpretations and data presented in the report are subject to further validation and revision. Certain datasets or assessments may contain provisional or incomplete information, which will be updated and refined in the final version of the report after comprehensive review and verification.

Team

Praveen C Ramamurthy, cCauvery, IISc Bengaluru
Shekhar M, cCauvery, IISc Bengaluru
Nagesh Kumar Dasika, cCauvery, IISc Bengaluru
Srinivas V V, cCauvery, IISc Bengaluru
Lakshminarayana Rao, cCauvery, IISc Bengaluru
Rajarshi Das Bhowmik, cCauvery, IISc Bengaluru
Bramha Dutt Vishwakarma, cCauvery, IISc Bengaluru
Debsunder Dutta, cCauvery, IISc Bengaluru
R Manjula, cCauvery, NIT Trichy
Nisha Radhakrishnan, cCauvery, NIT Trichy
S Saravanan, cCauvery, NIT Trichy
Aneesh Mathew, cCauvery, NIT Trichy
Laveti Satish, cCauvery, NIT Trichy
Prabu P, cCauvery, NIT Trichy
Vinod Tare, cGanga, IIT Kanpur

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.

Centres for Cauvery River Basin
Management Studies (cCauvery)
IISc Bengaluru (Lead Institute), NIT Tiruchirappalli (Fellow Institute)

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Abbreviations and Acronyms

%	Percent
₹	Indian Rupee
mg	Milligram
ft	Feet
L	Litre
sq.	Square
km	Kilometre
TMC	Thousand Million Cubic Metre
BOD	Biochemical Oxygen Demand
CCCDM	Centre for Climate Change and Disaster Management
CGWB	Central Ground Water Board
CIFRI	Central Inland Fisheries Research Institute
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CRB	Cauvery River Basin
CWC	Central Water Commission
EMPRI	Environmental Management and Policy Research Institute
ESRI	Environmental Systems Research Institute
FPOs	Farmer Producer Organizations
GIS	Geographic Information System
GoI	Government of India
ICAR	Indian Council of Agricultural Research
IWMI	International Water Management Institute
KIADB	Karnataka Industrial Areas Development Board
KRS	Krishna Raja Sagar
KSPCB	Karnataka State Pollution Control Board
LULC	Land Use-Land Cover
MLD	Million Liters per Day
MoEFCC	Ministry of Environment, Forest and Climate Change
NABARD	National Bank for Agriculture and Rural Development
NGO	Non-Governmental Organization
NTFP	Non-Timber Forest Product
TDS	Total Dissolved Solids
TNPCB	Tamil Nadu Pollution Control Board
UNCCD	UN Convention to Combat Desertification
UNEA	United Nations Environment Assembly
USD	United States Dollar
WRIS	Water Resources Information System

Continuation of Abbreviations and Acronyms

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1. Introduction

The Cauvery River Basin (CRB), spanning across the states of Tamil Nadu, Karnataka, Kerala, and Puducherry, represents one of India's most significant and complex river systems, supporting over 65 million people across its 85,220.39 sq. km catchment area. The basin extends from the Western Ghats to the Bay of Bengal, traversing diverse landscapes and ecosystems while serving as the economic and cultural lifeline for millions of inhabitants. However, the relationship between the CRB and its people has become increasingly strained due to rapid urbanisation, industrialisation, climate change, and interstate water disputes.

The concept of "river-people connect" emerges as a critical framework for understanding and addressing the complex interdependencies between riverine ecosystems and human communities. This approach recognises that rivers are not merely water sources but dynamic social-ecological systems that have shaped civilisations, cultures, livelihoods, and identities for millennia.

1.1. Significance and Context of River-People Relationships

1.1.1. Historical and Cultural Foundations

The Cauvery River holds immense cultural and spiritual significance, often referred to as the "Ganga of the South". For centuries, the river has been deeply embedded in the cultural and spiritual fabric of South India, with numerous temples and pilgrimage sites along its banks. The river is personified as Goddess Kaveri, and for indigenous communities like the Kodavas, Cauvery serves as their kula devata or family deity. This reverence has historically fostered a sense of stewardship and sustainable resource management among riparian communities.

The basin's cultural significance extends beyond religious practices to encompass traditional knowledge systems, agricultural practices, and community governance structures that have evolved over thousands of years. These traditional systems represent invaluable repositories of ecological wisdom and sustainable resource management practices that remain relevant for contemporary conservation efforts.

1.1.2. Contemporary Challenges

Despite its cultural importance, the CRB faces unprecedented challenges that have disrupted traditional river-people relationships. The basin has experienced significant ecological degradation, with 87% of tree cover removed over 50 years, transforming an once forest-fed perennial river into a seasonal stream (CCCDM, 2024). Water pollution, over-extraction, industrial discharge, agricultural runoff, and untreated sewage have severely compromised water quality and ecosystem health.

Urbanization has particularly impacted the basin, with major cities like Bengaluru drawing 23.10 TMC of water annually from the Cauvery, and approximately 60% of the city's population depending on the river for water supply (EMPRI, 2017). The growing disconnect between urban populations and river ecosystems has contributed to unsustainable consumption patterns and reduced awareness of environmental consequences.

1.1.3. The Need for Reconnection

The degradation of the Cauvery River has influenced human behaviour toward greater environmental awareness and conservation consciousness. This shift represents an opportunity to rebuild and strengthen river-people connections through innovative approaches that combine traditional knowledge with modern conservation science. Effective river-people connect initiatives can address multiple challenges simultaneously like environmental restoration, community empowerment, cultural preservation, and sustainable development.

1.2. Stakeholder Landscape and Community Dynamics

1.2.1. Diverse Stakeholder Categories

The CRB encompasses a diverse array of stakeholders whose interests, needs, and relationships with the river vary significantly. Primary stakeholders include farmers who depend on the river for irrigation, urban populations relying on it for water supply, fishing communities whose livelihoods are directly tied to river health, and indigenous communities who maintain traditional relationships with the river (Ong'or, 2005).

Secondary stakeholders comprise government agencies at various levels, water utility companies, industrial users, hydroelectric power generators, and environmental organizations. The complexity of stakeholder relationships is further amplified by interstate dynamics, as the basin spans multiple political jurisdictions with often conflicting interests regarding water allocation and management.

1.2.2. Community Participation Models

Successful river-people connect initiatives require meaningful community participation that goes beyond tokenistic consultation to embrace authentic co-creation and shared decision-making. Research on participatory approaches in river basin management emphasizes the importance of inclusive engagement that recognizes diverse forms of knowledge, addresses power imbalances, and creates space for marginalized voices (Verkerk et al., 2017; OECD, 2015).

The literature identifies several key principles for effective community engagement in river conservation, including open access and inclusiveness, transparency in decision-making processes, trust-building through long-term relationships, responsiveness to community needs and concerns, equity and fairness in participation opportunities, and creating enjoyable and meaningful experiences that foster connection (Riverlife, 2024).

1.2.3. Indigenous and Traditional Knowledge Systems

Indigenous communities in the CRB possess invaluable traditional knowledge about sustainable water management, seasonal patterns, ecosystem dynamics, and conservation practices (Ayushi et al., 2023; Kandari et al., 2014). These knowledge systems have enabled communities to maintain productive relationships with river ecosystems for generations, often incorporating sophisticated understanding of watershed dynamics, biodiversity conservation, and adaptive management strategies

However, traditional knowledge systems face significant threats from modernization, urbanization, and the displacement of indigenous communities from their ancestral territories (Ayushi et al., 2023; Wijesuriya, G. ed., 2020). Protecting and integrating traditional knowledge into contemporary river management approaches represents both an ethical imperative and a practical necessity for developing culturally appropriate and ecologically effective conservation strategies.

This introduction establishes the foundation for exploring specific approaches and activities that can strengthen river-people connections in the CRB. The subsequent sections will examine innovative models, successful case studies, and practical frameworks for implementing comprehensive river-people connect initiatives that address the basin's complex environmental, social, and cultural challenges while building resilient and sustainable relationships between communities and their riverine lifeline.

2. Current Nature of People-River Interactions in CRB

2.1. Reliance on the Cauvery River for Livelihood

2.1.1. Agriculture Activities

About 66.21% of the CRB's total land area is used for agriculture, making it the dominant land use within the basin. This agricultural land covers approximately 53,736 sq. km out of the basin's total area (India-WRIS, 2014). The basin supports a wide variety of crops, including rice, sugarcane, pulses, cotton, millets, coffee, and spices, underpinning the livelihoods of millions across Tamil Nadu, Karnataka, Kerala, and Puducherry. The widespread of different LULCs in the CRB is provided in Fig. 1.

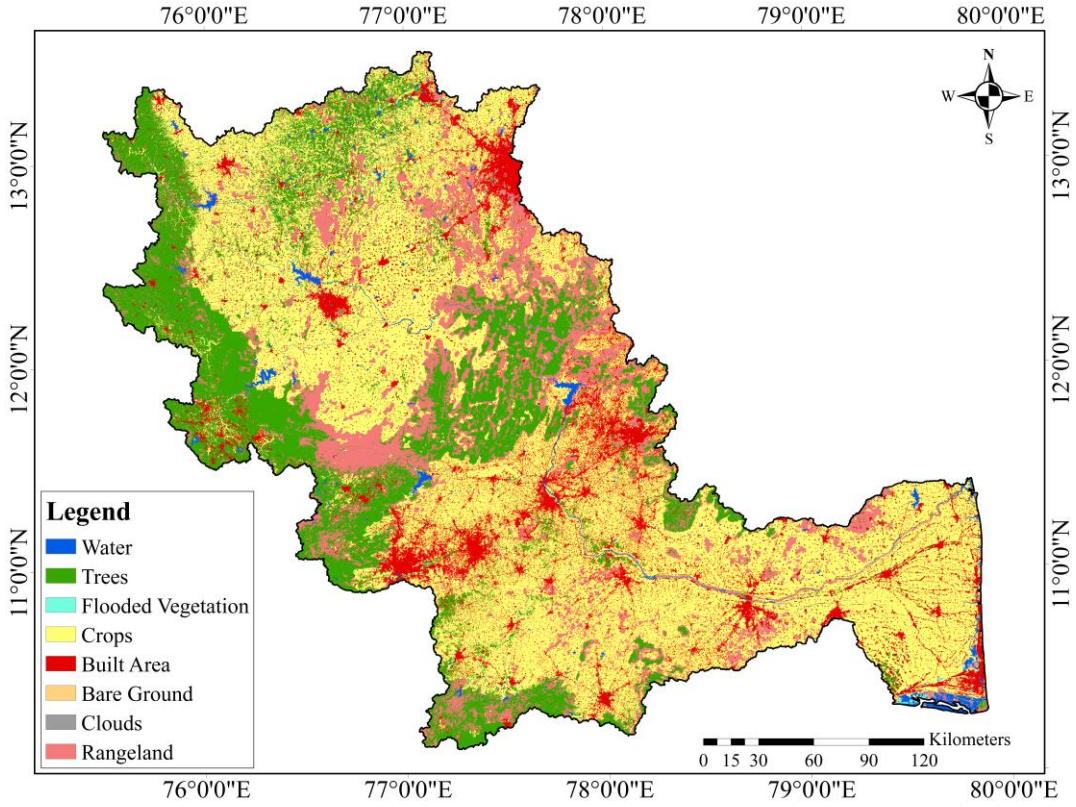

Fig. 1. LULC-2024 showing agricultural area in the CRB (Source: ESRI Sentinel-2)

Irrigation is a critical component of agricultural activity in the CRB. For example, in the Cauvery sub-basin in Tamil Nadu, about 11.6% of the geographical area is under groundwater irrigation (EMPRI, 2017), while surface water irrigation through canals and reservoirs supports the predominant cropping patterns across the basin. Nearly 90% or more of the water from the Cauvery River is allocated for irrigation purposes in Karnataka and Tamil Nadu, mainly for water-intensive crops such as paddy and sugarcane (India-WRIS, 2014). This heavy reliance on river water for irrigation sustains the basin's reputation, such as the "Rice Bowl of Tamil Nadu" in the delta region.

The extensive irrigation infrastructure, featuring major reservoirs such as Krishna Raja Sagar (KRS) and Kabini in Karnataka, and historic canal systems like the Grand Anicut in Tamil Nadu, facilitates multi-season cropping. However, the actual irrigated area varies by region and season. In Karnataka's Mandya district alone, irrigation supports around 1.2 million hectares of agricultural land (EMPRI, 2017). However, irrigation water availability is often uneven and contested, with tail-end farmers experiencing scarcity. This irregularity, along with upstream water uses and climatic variability, pressures farmers to rely increasingly on groundwater extraction through borewells.

Here, the fertile alluvial soils are the product of centuries of sedimentation by the Cauvery and its distributaries. The ingenuity and scale of the historic Grand Anicut (Kallanai) canal system, built during the Chola era and developed over generations, enable multi-season paddy cultivation and have long underpinned agricultural prosperity. Rice-paddy is the predominant crop, occupying approximately two-thirds of the cultivated area, with pulses (black gram, green gram), oilseeds, banana, and sugarcane serving as important rotations for soil fertility and economic diversification (Paramasivan and Pasupathi, 2016).

More than 70% of the population in the delta is reliant on farming, both directly and in ancillary activities, from farm labour to rice processing and local trade. Daily life and seasonal rhythms in these districts are organized around the agricultural calendar, which is, in turn, dependent upon the timely release and adequate flow of Cauvery water. Even a brief delay or reduction in the southwest monsoon or in the upstream release of water (for example, due to the water sharing disputes between Karnataka and Tamil Nadu) can leave tens of thousands of hectares, especially "Kuruvai" (short-term paddy) fields, uncultivated. This pushes farmers to increasingly depend on deep borewell irrigation for groundwater extraction. Studies reveal aquifer levels have been dropping rapidly, with some wells in the delta now drilled to depths of 1,000 ft or more, heightening the risk of saltwater intrusion and permanent groundwater loss (Prayag et al., 2023).

The studies have documented significant groundwater depletion in areas of the Cauvery basin due to increased reliance on deep borewell irrigation for paddy (Navya, 2025) as surface water availability declines in the state of Tamil Nadu (Fig. 2), where the Cauvery extents across a vast geographical expanse and traverse multiple administrative regions spanning three states. Research commissioned by Karnataka's Environmental Management and Policy Research Institute (EMPRI, 2017) highlights that unsustainable water extraction, urbanization, industrial growth, and intensive agriculture have dramatically altered the river landscapes, impacting both water quantity and quality. Aquifer levels across the basin have been falling rapidly, with many

wells in the Karnataka Cauvery basin drilled to depths exceeding 200 meters (over 600 feet), indicating severe stress on groundwater resources.

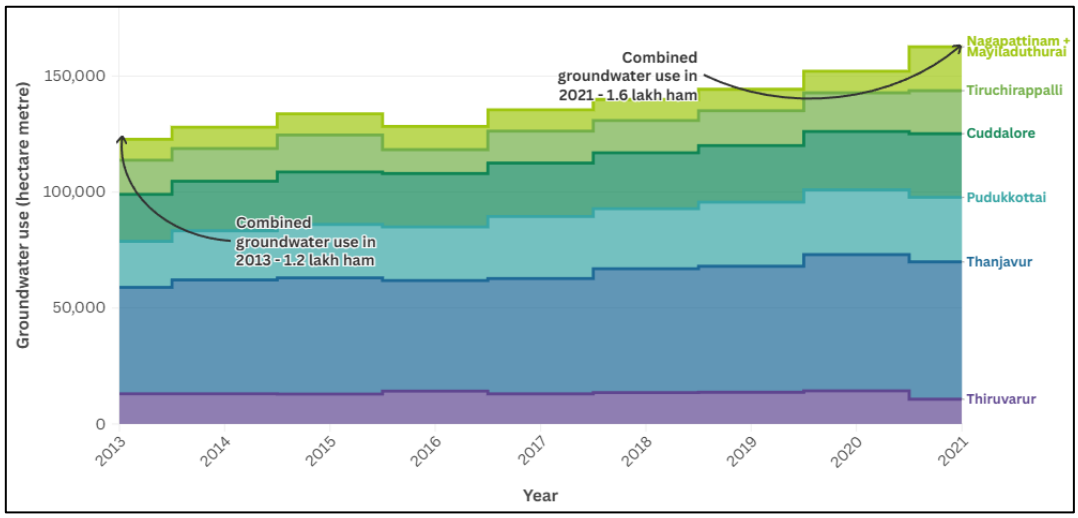

Fig. 2. Increased groundwater extraction in districts of Tamil Nadu in the CRB (Navya, 2025)

Further scientific assessments indicate that groundwater pumping for irrigation is the primary driver of aquifer depletion in this hard-rock region, with saltwater intrusion becoming a significant threat, especially in downstream coastal areas. In the Cauvery delta itself, research conducted by Anna University and the Central Groundwater Board warns that unless the Cauvery River maintains a minimum flow period of 90 days annually, the already deteriorating groundwater quality will worsen due to seawater intrusion and accumulation of pollutants like nitrates and heavy metals. The decrease in river flow directly impacts groundwater recharge, forcing farmers to deepen their borewells, some exceeding depths of 1,000 feet, exacerbating risks of permanent groundwater loss and salinization (CCCDM, 2024; CGWB, 2020).

Tributaries and smaller streams within Karnataka's CRB have also experienced land-use changes due to human activities such as urban expansion, industrial effluent discharge, and waste dumping, all of which contribute to declining river health and reduce surface water availability for farming. The recurrent delays in water release due to interstate disputes between Karnataka and Tamil Nadu further aggravate the crisis, pushing farmers into a desperate dependence on groundwater even as aquifer levels continue to fall (Sneka Lata et al., 2015).

Upstream, the western basin districts of Mandya, Mysuru, and Hassan in Karnataka are also heavily irrigated. Mandya is notably prominent for its sugarcane production, which benefits from the assured flow of the KRS and Kabini reservoirs, although periodic shortages affect tail-end farmers the most. Sugarcane cultivation here is generally highly profitable, with some studies citing benefit-cost ratios over 2.0 during good water years, while paddy and a growing array of horticultural crops (tomato, onions, and more recently, floriculture) are also important to the rural economy. Like their delta counterparts, farmers here are increasingly sensitive to water scarcity and shifting rainfall patterns. During periods of shortage, even lucrative cash crops can become risky investments, forcing rapid shifts in cropping patterns or migration for work (EMPRI, 2017).

Table 1. Geographical area and crop sown area in the different districts in the CRB (NABARD, 2022a, 2022b, 2022c; TNUA, 2017)

Districts	Particulars	Area (ha)	% of Area
Thanjavur	Geographical Area	3,39,657	100.00
	Gross area sown	2,70,799	79.72
	Net area sown	1,91,598	56.41
Erode	Geographical Area	5,72,264	100.00
	Gross area sown	1,99,348	34.83
	Net area sown	1,78,687	31.22
Nagapattinam	Geographical Area	2,71,583	100.00
	Gross area sown	2,68,692	98.94
	Net area sown	1,49,687	55.12
Salem	Geographical Area	5,20,530	100.00
	Gross area sown	3,05,154	58.62
	Net area sown	2,18,448	41.97
Tiruchirappalli	Geographical Area	4,40,383	100.00
	Gross area sown	2,78,157	63.16
	Net area sown	1,62,226	36.84
Mandya	Geographical Area	4,98,244	100.00
	Gross area sown	2,38,761	47.92
	Net area sown	1,89,090	37.95
Chamarajanagar	Geographical Area	5,69,901	100.00
	Gross area sown	1,84,568	32.39
	Net area sown	1,48,584	26.07
Hassan	Geographical Area	6,62,602	100.00
	Gross area sown	4,21,135	63.56
	Net area sown	3,45,441	52.13

The hill district of Kodagu (Coorg) is distinguished by its coffee estates, both smallholdings and larger plantations, where Arabica and Robusta coffee are cultivated under the canopy of native and introduced shade trees. This agroforestry system, which also supports pepper, cardamom, and oranges, is ecologically richer than the monoculture expanses common to other districts and is vital for biodiversity as well as the livelihoods of local populations. Kodagu coffee is both a cultural marker and an economic livelihood, with the region producing some of India's most valued beans for domestic consumption and export.

These studies collectively reveal that the agricultural dependency on the Cauvery River in Karnataka, especially in the Mandya, Mysuru, Hassan regions and upper basin districts is increasingly threatened by water scarcity and environmental stress. The shift from reliable surface irrigation to deep borewell pumping to sustain water-intensive crops like paddy and sugarcane is unsustainable in the long term and threatens the socio-economic stability of farming communities in the region.

Although less extensive in terms of agriculture compared to the delta, Palakkad district in Kerala also depends on Cauvery irrigation and rainfall for rice cultivation. The terrain is more prone to erosion and has been subject to environmental stresses due to reduced water retention

and management challenges. Farmers often rely on short-duration paddy varieties and supplementary irrigation whenever possible.

Over the past several decades, the agricultural system across the basin has undergone a marked shift from traditional, diversified multi-cropping to water-intensive monocultures of rice and sugarcane in the main command areas. Policy incentives, the push for higher yields during the Green Revolution, and market forces have all accelerated this transition. The ecological costs have been significant. Drainage and reclamation of wetlands for paddy expansion have led to wetland loss, while old varieties and dryland crops have been marginalized. Fertilizer and pesticide use has soared to maintain productivity, which has in turn resulted in chemical runoff contaminating water bodies and soils. Reports from the delta show evidence of nitrate and phosphate buildup, which threatens both environmental and human health. In Mandya and Thanjavur, water quality has declined even in groundwater sources, now increasingly burdened with fertilizer residues and, in some areas, rising salinity.

The unsustainable uptake of groundwater, prompted especially by canal unreliability or policy-driven electricity subsidies for pumps, is another core issue. Borewells, once uncommon, now dot the landscape, and are often the only means of irrigating in drought years or when settlements upstream withhold water. This has led to rapidly falling water tables in both the delta and upland regions, threatening long-term agricultural sustainability, especially for small and marginal farmers who may lack the resources or capital to invest in deeper drilling technology.

Climate change, with its impact on rainfall variability and temperature extremes, has exacerbated water stress, periodically rendering even the best-managed fields vulnerable to drought, yield loss, and income instability. In recent years, the frequency of years with substantial proportions of delta land left fallow has increased, with major reversals coming only with favourable rainfall or winning a larger share in inter-state water disputes.

Despite these challenges, the CRB remains remarkably productive. Innovative farmers and some government and non-governmental organization (NGO) programs are promoting a return to more diversified and sustainable approaches as soil health programs, better irrigation management, and renewed interest in indigenous rice varieties and horticulture. Yet, the overall trajectory of growing monoculture and resource pressure persists, and the future of agriculture in the basin will depend critically on successful water stewardship, technological innovation, and policy reforms informed by both local experience and robust research (Ashwini and Kiresur, 2018; Stella et al., 2023).

2.1.2. Industrial Activities

The CRB forms a vital industrial corridor across southern India (Fig. 3), complementing its renowned agricultural landscape. Industrial development within the basin is diverse and regionally concentrated, with each sector closely interacting with the river's water resources, thereby underpinning economic growth while generating significant ecological challenges. Industries such as cotton textiles, cement manufacturing, steel and metallurgical processing, chemical and dyeing units, sugar mills, urban-industrial centres, and associated ancillary activities constitute the backbone of economic activity in hotspots including Krishnagiri,

Tiruppur, Wayanad, Palakkad, Tiruchirappalli, Salem, Idukki, Chikkamangaluru, Bengaluru Urban, and Mysuru. These clusters collectively drive the basin's industrial output, employment, and urbanization trends.

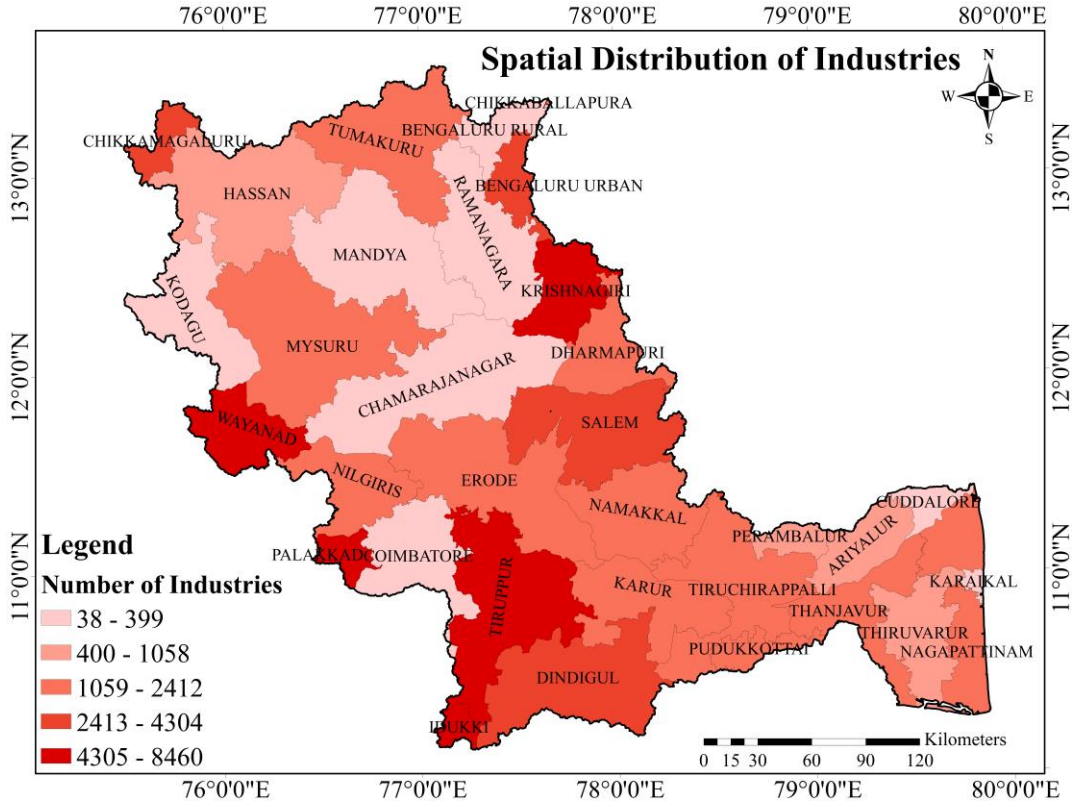

Fig. 3. Spatial distribution of industries in the CRB
(Source: KIADB; MoEFCC, GoI)

2.1.2.1. Water utilised for water-intensive industries

For instance, the cotton textile industry centred in Coimbatore and Mysuru features hundreds of mills engaged in spinning, weaving, dyeing, and finishing, each unit consuming between 50,000 and 150,000 L of Cauvery water daily, particularly in dyeing operations (EMPRI, 2017). The dyeing units in regions like Pallipalayam (Namakkal district) are known for effluent discharge containing colorants, chromium, cadmium, and lead, resulting in BOD peaks above 15 mg/L and COD values above 120 mg/L in nearby water bodies, well beyond Central Pollution Control Board norms.

Cement factories in Coimbatore and Tiruchirappalli, while less water-intensive, rely on the river for cooling, dust management, and raw mix processing. Salem Steel Plant and other metallurgical units utilize up to 0.1–0.2 TMC of Cauvery water annually. Effluent and sediment studies near these facilities have documented accumulations of nickel, chromium, and zinc, posing chronic risks to aquatic biodiversity and groundwater quality (EMPRI, 2017).

Chemical, dyeing, sugar, and distillery industries cluster around Pallipalayam, Komarapalayam, and Mettur. Effluent volumes from these sectors reach over 80 MLD during peak operations, introducing persistent organic pollutants and heavy metals that cause river stretches to be classified as 'critically polluted' in periodic CPCB reports (CPCB, 2022). Sugar

mills contribute to BOD surges during the crushing season, sometimes exceeding 200 mg/L, and distillery spent wash introduces high COD and dark coloration, severely affecting river oxygen levels and aquatic life.

Urban-industrial water demand further compounds stress as Bengaluru, located on the basin's fringe, withdraws approximately 23.10 TMC of Cauvery water annually for domestic and industrial use. Sewage and industrial wastewater from Bengaluru, Mysuru, and other cities routinely flow into tributaries, carrying pathogens, nutrients, and chemical residues that degrade downstream sections.

Industrial dependence on the Cauvery is revealed in water abstracted for manufacturing, cooling, washing, chemical processing, and effluent disposal. These sectors rely on river flow reliability, while often contributing effluents back into the system with inadequate treatment. Competition for water between agriculture, urban areas, and industry is exacerbated during seasonal low-flow periods or interstate allocation disputes.

Environmental monitoring by Anna University, CGWB, EMPRI, TNPCB, and CPCB repeatedly identifies polluted river stretches downstream of industrial hotspots with BOD often exceeding 10 mg/L, heavy metals above IS10500 standards, and groundwater showing electrical conductivity and TDS beyond safe irrigation norms. Aquatic biodiversity surveys reflect declines in sensitive species, while community health studies reveal higher rates of water-linked ailments.

Statistically, over 90% of the basin's surface water is allocated to irrigation, but industry and urban use are growing rapidly. Coimbatore's textile cluster alone uses tens of millions of litters per day; dyeing units in Namakkal–Erode belt collectively discharge over 80 MLD of wastewater. Salem's steel operations and cement factories each consume upwards of tens of thousands of cubic meters of water monthly for process operations (TNPCB).

These impacts are compounded by frequent delays in water release due to interstate disputes, pushing both industrial and agricultural users towards deeper borewell extraction. Groundwater near industrial clusters is frequently contaminated, sometimes forcing farmers to abandon land or dilute with cleaner water.

Multiple research reports and government publications corroborate this scenario:

- EMPRI's "Status of Industrial Pollution in Cauvery River" (2016) details pollution loads and hotspot mapping across Karnataka.
- Anna University's water quality assessments for river and groundwater in Tamil Nadu basin districts document the spatial extent and severity of industrial impacts.
- CPCB's "Identification of Polluted River Stretches in India" regularly lists Cauvery downstream of Salem, Pallipalayam, Komarapalayam, and Mettur among the most polluted stretches by BOD and heavy metals.
- TNPCB annual water quality reports provide sector-wise and zone-wise monitoring data supporting the above findings.

2.1.2.2. Nature and diversity of industrial activities

A. Textiles and Related Processing

The textile and garment sectors are by far the most dominant industrial activity in the CRB. Coimbatore, often called the "Manchester of South India," and its satellite towns form the heart of cotton spinning, weaving, and garment manufacturing. In areas like Erode, Pallipalayam, and Komarapalayam, thousands of power loom units, dyeing, and printing houses cluster together. Textile infrastructure includes ginning mills, fabric processing, dyeing units, knitting, and finishing plants, with significant downstream units for ready-made garment production. These industries rely heavily on river water not only for direct processing but also for dyeing and bleaching, a major reason why settlements grew around the river's distributaries.

B. Leather Tanning and Processing

While smaller compared to textiles, leather tanneries (especially in Erode and sections of Komarapalayam) use both agricultural by-products and imported hides. Water-intensive and chemical-heavy, these units convert raw hides into finished leather, serving both domestic and export markets. The interlinkage with the textile and footwear industries adds a secondary layer of industrial integration.

C. Cement and Building Materials

Major cement manufacturing plants are situated in Coimbatore, Tiruchirappalli, and Ariyalur, exploiting local limestone and sand. Cement factories are central to the growth of the construction industry, and Cauvery water is used in material processing, cooling, and dust suppression. Many clusters are supported by ancillary brick kilns, tile factories, and other building material units that thrive on the alluvial soil of the basin.

D. Iron, Steel, and Metal Industries

The Salem Steel Plant in Tamil Nadu is a flagship metallurgical facility drawing on both local mineral resources and river water. Allied metalworking units fabricate auto parts, industrial machinery, pumps, foundry goods, and precision engineering components, with significant concentrations in Coimbatore, Salem, and Tiruchirappalli. These industries foster a highly skilled and diversified manufacturing ecosystem.

E. Chemicals, Dyes, and Pharmaceuticals

Chemical manufacturing is significant in Coimbatore, Erode, Pallipalayam, and especially the Mettur Dam area, where multi-sector clusters include caustic soda units, synthetic dye and pigment producers, basic pharmaceuticals, and agrochemical blending plants. Their location is dictated by both the availability of water (for processing and effluent dilution) and the transport links needed for raw chemical supply and finished goods distribution.

F. Sugar Mills and Distilleries

Sugar mills operate throughout Mandya, Erode, Thanjavur, and some parts of Salem, taking advantage of the basin's extensive sugarcane belt. Distilleries, ethanol plants, and allied alcohol-based industries are typically co-located with these sugar factories. These units utilize

large amounts of water for crushing, extraction, fermentation, and cooling, and deal with large volumes of organic waste byproducts.

G. Paper and Pulp Processing

Paper mills, found in the Erode belt and parts of Karnataka, process agricultural residues, bamboo, and recycled waste into paper, packaging, and tissues. These industries consume significant water and are important in rural non-farm employment.

H. Food Processing and Agro-Industries

The agribusiness sector is highly diversified: rice mills, oilseed expellers, flour mills, dairy units, and cold storage plants are distributed throughout the basin, especially concentrated in the delta (Thanjavur, Nagapattinam), Mandya and Mysuru districts.

I. Coffee Processing

In Coorg (Kodagu, Karnataka), coffee curing and value-addition units complement one of India's best-known plantation economies. These small to medium units supports both export processing and domestic value chains and are a vital part of the upland basin economy.

J. Urban Service and Engineering Sectors

Peripheral urban-industrial hubs, especially Bengaluru and Mysuru, contain a wide array of IT parks, engineering design centres, automobile assembly plants, electronics manufacturing, biotech units, and specialty foods. While these are less water-intensive than traditional heavy industries, their cumulative water demand and waste output, as well as the workforce migration they attract, have a large direct and indirect impact on the river basin.

2.1.2.3. Hotspot regions for industrial activities

There are several hotspot regions in the CRB for industrial activities, which are advantageous for economic activity for various reasons like water security, clustering of resources, market and transport, and policy support (Table 2).

Table 2: Districts of hotspot regions for several industrial activities in the CRB (KSPCB, 2022; TNPCB, 2024)

Region	Major Industrial Sectors	Key Characteristics
Coimbatore	Textiles, spinning, garmenting, engineering, cement, chemicals, pumps	Dense cluster, skill specialization, large water demand
Erode/Pallipalayam/ Komarapalayam	Textile dyeing, printing, power loom weaving, leather tanning, paper, chemicals	Water-intensive, high-value clusters, dyeing effluents major issue
Salem/Mettur	Steel & alloy, chemical plants, sugar mills, distilleries, cement, power, engineering	Heavy industry concentration, process waste, metal effluents

Tiruchirappalli	Cement plants, heavy engineering, textiles, rice & food processing	Regional trading centre, mixed industry
Mandya/Mysuru	Sugar mills, textiles, distilleries, paper, agro processing	Agro-industrial, dependent on canal irrigation
Bengaluru/Mysuru Urban	Engineering, IT, biotech, food processing, printing	Diversified service/industrial sector, indirect river impact
Thanjavur Delta (Delta towns)	Rice mills, oilseed units, fertilizer blending	Agro-industrial focus, high dependence on seasonal flows
Kodagu/Coorg	Coffee processing, pepper, small agro-industries	Plantation-driven, smaller scale

2.1.3. Fish and Fishery Activities

The fish and fishery activities in the CRB are fundamental to the region's ecological balance, socio-economic fabric, and cultural heritage. The river system sustains a highly diverse array of freshwater and estuarine fish species, which form the basis for fisheries that support thousands of fishers and their families. These fisheries, in turn, contribute substantially to local food security, nutrition, employment, and traditional community identities.

Ecologically, the CRB is home to approximately 146 fish species, with about 90 freshwater species inhabiting the river and its tributaries, and 56 species adapted to the estuarine and deltaic environments near the river's confluence with the Bay of Bengal. The biodiversity includes ecologically and economically important native fish such as the Indian major carps, Catla (Labeo catla), Rohu (Labeo rohita), and Mrigal (Cirrhinus cirrhosis), which have traditionally been the backbone of inland fisheries. The basin also hosts unique species like the critically endangered hump-backed mahseer (Tor remadevii), a symbol of the river's ecological heritage. Alongside native species, the spread of invasive fish like Nile tilapia (Oreochromis niloticus) and African catfish (Clarias gariepinus), particularly in lower stretches, has altered species composition and poses challenges to native biodiversity and fishery sustainability.

From an economic viewpoint, the basin's fisheries generate an estimated annual catch of around 6,000 tonnes from roughly 800 kilometres of river length. The majority of the fish catch, approximately 86%, comes from riverine fisheries, with the rest sourced from reservoirs and other inland water bodies. This harvest is valued at an estimated ₹913 million (about USD 13 million) at the point of first sale, indicating the fisheries' significant contribution to rural economies. Fishery-related activities provide employment, both direct and ancillary, to thousands of individuals. Many fishers are organized into cooperative societies, which help coordinate sustainable harvesting, marketing, and access to government support (Pownkumar et al., 2022).

Fishery activities take place across various ecological and social hotspots throughout the basin. The upper stretches, including sites around Kanave, Harangi, and the KRS reservoir, are critical

habitats for endemic and endangered fish species and support subsistence and commercial fisheries. The middle reaches near Hogenakkal exhibit the highest recorded fish diversity, with up to 76 species observed, representing a key ecological zone. Lower river reaches near Mayanur and T. Narasipura are traditional fishing grounds with active communities engaged in riverine and reservoir-based fishing. Additionally, reservoirs distributed along the basin support reservoir fisheries that contribute supplementary livelihoods.

The fisheries sector also holds deep cultural significance, as fishing practices and fish species feature prominently in local traditions, festivals, and dietary norms. Women participate actively in fishing-related activities, including fish processing and marketing, underscoring the inclusive nature of fishery-based economies. Fish constitutes a vital source of protein and essential micronutrients for many communities within the basin, supporting nutrition and health outcomes, particularly in rural and tribal populations.

Despite this vital importance, the fish and fishery activities face multiple challenges. Hydrological alterations due to dam construction and water flow regulation fragment habitats and alter spawning cycles. Pollution from industrial, urban, and agricultural sources degrades water quality, leading to fish kills, reduced diversity, and contamination concerns. Overfishing and unregulated fishing methods further strain fish stocks. Invasive species outcompete or prey upon native fish, threatening biodiversity and the resilience of traditional fisheries. Sedimentation and habitat degradation compromise nursery grounds and aquatic vegetation critical for fish survival.

To address these threats, there have been concerted efforts involving community-based management approaches, establishment of fish sanctuaries, implementation of closed fishing seasons and size limits, and promotion of eco-friendly fishing practices. Scientific research has emphasized conserving key species like the hump-backed mahseer and restoring ecological flows.

2.1.3.1. Significant fisheries in CRB and hotspots

Scientific surveys conducted by the ICAR-Central Inland Fisheries Research Institute (CIFRI) and other researchers have comprehensively documented the fish biodiversity in the Cauvery River system, revealing a rich and diverse aquatic fauna composed of approximately 146 fish species (Pownkumar et al., 2022). This total includes about 90 species that inhabit freshwater environments, i.e., rivers, tributaries, and reservoirs, and an additional 56 species that thrive in the estuarine zones where the river meets the Bay of Bengal.

One of the most biologically rich sites in the basin is Hogenakkal, situated at the ecological transition between the Western Ghats and the plains of Tamil Nadu. This location supports an especially high fish species diversity, with surveys recording as many as 76 different fish species. Such diversity reflects the unique confluence of hill stream habitats meeting flat riverine environments, providing a variety of ecological niches. Some of the significant fish varieties are mentioned in Table 3.

Table 3. Significant fish varieties in the CRB (Roshith et al., 2022)

Category	Scientific Name	Common Name
Major Fishes	*Labeo catla*	Catla
	Labeo rohita	Rohu
	Cirrhinus cirrhosis	Mrigal
	Oreochromis niloticus	Nile Tilapia
	Mastacembelus armatus	Spiny Eel
	Channa Striata	Murrel
Minor Fishes	*Pangasius pangasius*	Pangas
	Xenentodon cancila	Freshwater Gar
	Glossogobius giuris	Goby
	Lates calcarifer	Sea Bass
	Mylopharyngodon piceus	Black Carp
Declining Native Species	*Tor sp.*	Mahseer
	Hypselobarbus carnaticus	Carnatic Carp
	Mastacembelus armatus	Spiny Eel
	Channa striata	Murrel

The upper Cauvery River also harbours many endemics and ecologically significant fish species. Among these, the critically endangered hump-backed mahseer (*Tor remadevii*) stands out as both an iconic and conservation-sensitive species. This mahseer is famed for its distinctive morphology and is an indicator species for riverine ecosystem health. Alongside the mahseer, the upper river supports native Indian major carps such as Catla (*Labeo catla*), Rohu (*Labeo rohita*), and Mrigal (*Cirrhinus cirrhosis*), as well as various catfish species that are integral to the fishery and ecological networks (Sibina et al., 2024).

However, the fish fauna of the Cauvery River has been increasingly altered by the spread of exotic and invasive species. Notably, the Nile tilapia (*Oreochromis niloticus*) and the African catfish (*Clarias gariepinus*) have expanded their populations prominently in the lower stretches of the river. These invasive species are highly adaptable and compete aggressively with native fishes for food and habitat. Their dominance in certain areas is regarded as a key sign of ecological stress and habitat modification, often linked to the impacts of damming, water pollution, altered flow regimes, and habitat fragmentation. Such environmental changes favour opportunistic exotics, sometimes leading to declines or local extinctions of native species (Pownkumar et al., 2022).

The expanding presence of these invasive fish has significant ecological implications. They disrupt traditional fish communities by preying upon or outcompeting native species, thereby reducing biodiversity. This shift also affects local fisheries, as many native fish species are preferred for food and cultural reasons, meaning economic and social impacts for fishing communities (ICAR - CIFRI).

2.2. Role of Cauvery River as Part of Cultural Practices

The Cauvery River plays a profound and multifaceted role in shaping the cultural landscape of southern India, particularly in Karnataka and Tamil Nadu. Far beyond its identity as a water resource, the river is woven tightly into regional mythology, spiritual practices, festivals, social

organization, and artistic expression, making it a living axis of tradition and identity for millions (Fig. 4).

Fig. 4. Hotspot of cultural, spiritual, and recreational significance in the CRB: (a) Aadi Perukku festival in Tamil Nadu on the banks of the Cauvery, (b) Srigangapatna temple in Karnataka, (c) Talakaveri in Karnataka, and (d) Shivanasamudra water falls in Karnataka

Throughout history, the Cauvery has been regarded as the "Ganges of the South," revered for its life-giving and purifying qualities. In Hindu tradition, the river is one of the seven holiest rivers of India. Its mythological origins trace back to stories of Sage Agastya, who released the river's waters from his pot to nourish the southern lands, and to Goddess Kaveri, often seen as an incarnation of Parvati and worshipped as the nurturing mother who sustains agriculture, prosperity, and spiritual well-being (Wisdom Library).

2.2.1. Rituals, Festivals, and Everyday Practice

Annual and periodic festivals centred on the Cauvery are integral to cultural rhythms. The Kaveri Pushkaram festival, held every 12 years, brings thousands of pilgrims to bathe in the river's waters, seeking spiritual cleansing and blessings. In Tamil Nadu, the Aadi Perukku (celebrated in July/August) marks the onset of the monsoon and commemorates the river's vital role in irrigating fields and sustaining life (Fig. 4a). Processions, music, dance, and collective rituals highlight the river's presence in both religious and agrarian cycles. In Coorg (Kodagu), the Cauvery Sankramana and Theerthodbhava ceremonies at Talakaveri see devotees gather to witness the miraculous springing forth of holy water believed to embody the goddess herself. The water collected during these rites is used in household rituals throughout the year and features in key life events such as weddings.

2.2.2. Temples, Pilgrimages, and Sacred Geography

The river's banks are studded with sacred sites and temples. Notable among these is Talakaveri (the mythic source), Srirangam (the largest functioning Hindu temple complex), Srirangapatna (with Ranganathaswamy temple), Mayiladuthurai, and Thanjavur, each linked to centuries-old shrines, annual rituals, and vibrant festivals (Fig. 4b, c). These cultural landscapes are mapped by clusters of Siva/Vishnu temples, Agraharams (Brahmin quarters), and artisan settlements, often tracing back to Chola-era land grants and temple patronage that nourished the arts and public events (Venkatachary and Kawathekar, 2022).

These destinations are vital pilgrimage centres, drawing communities for special days and ongoing worship. Water from the Cauvery is treated as sacred, used in purificatory rituals, ancestor ceremonies, and daily worship. The presence of the river is commemorated in classical dance (Bharatanatyam), Carnatic music compositions, and local crafts, perpetuating its legacy in artistic forms (Venkatachary and Kawathekar, 2022).

Socially, the Cauvery continues to knit together communities, farmers, fisherfolk, artisans, and tribal groups, whose ways of life are attuned to its seasonal rhythms. Rituals of offering, thanksgiving, and propitiation unite people across caste, occupation, and region. Special traditions like the Kodava Taliyatakki Bolcha ceremony use household offerings to honour the goddess and underscore agricultural stewardship.

Crucially, the river is also a marker of collective ecological consciousness. Its role in sustaining ancient kingdoms like the Chola and Chera is memorialized in local knowledge systems. Water management practices, temple rituals, community festivals, and oral histories all reflect ongoing cultural values of conservation, respect, and reciprocal relationship with nature (Vilas, 2018).

2.3. Role of the Cauvery River for Religious Purposes

The Cauvery River holds a profoundly significant role in religious practices across southern India, deeply embedded in Hindu mythology, spiritual observances, and centuries-old cultural customs. It is revered as one of the seven holy rivers of India and is often referred to as the "Ganga of the South." The river is personified and worshipped as Goddess Kaveri or Kaveri Amma, believed to possess purifying powers that absolve sins and sanctify devotees.

According to Hindu tradition and texts such as the Mahabharata, Ramayana, and various Puranas, the river originated from divine acts involving Sage Agastya, who released its waters from his kamandalu (water pot), and the goddess Lopamudra, an incarnation of Parvati, symbolizing purification, fertility, and spiritual nourishing of the region. This sacred origin story emphasizes the river's role as a maternal life-giver sustaining both land and people.

The river basin encompasses numerous significant pilgrimage sites along its course, including Talakaveri (the mythic source in Karnataka), Srirangam (home to the world's largest functioning Hindu temple complex), Srirangapatna, Mayiladuthurai, Thanjavur, and Poompuhar near the river's mouth. These sacred locations are celebrated for their ancient temples where pilgrimages, ritual ablutions, and pujas take place, continuously reinforcing the river's sanctity and the devotion of communities along its banks.

Central religious festivals highlight the river's spiritual prominence:

- Kaveri Pushkaram, occurring every 12 years, is a major event attracting thousands of pilgrims who bathe in the Cauvery's waters to cleanse their sins and seek blessings.
- Aadi Perukku, celebrated during the monsoon onset, venerates the river's vital contribution to agricultural fertility with offerings and prayers performed on its banks.
- In Kodagu (Coorg), the Cauvery Sankramana and Theerthodbhava ceremonies mark the river's symbolic emergence, where devotees gather to collect sacred waters used in important life rituals like weddings and other rites.

Moreover, the river is integrally tied to social and cultural identity through agrarian practices, ancestor worship, and community festivals. The immersion of ashes in the Cauvery near Poompuhar symbolizes both spiritual renewal and the continuation of life cycles. Fishing communities and local artisans rely on the river not only economically but also culturally, with women playing active roles in fish processing and markets.

The Cauvery is also a profound cultural muse reflected in classical Carnatic music, Bharatanatyam dance, regional poetry, and folklore, where it is regularly celebrated for its spiritual beauty and life-giving attributes. Historical kingdoms such as the Cholas and Hoysalas built monumental temples and irrigation infrastructure, including the ancient Kallanai dam, linking religious devotion with sustainable water management, a legacy still visible today.

Historically, the Cauvery valley gave rise to great medieval South Indian empires that developed elaborate hydraulic infrastructures and religious centres in devotion to the river. The ancient Kallanai dam exemplifies this blend of practical water management and spiritual dedication, sustaining agriculture for over two millennia.

In contemporary times, the religious and cultural salience of the Cauvery continues to influence social and political life, particularly evident in interstate water-sharing disputes where the river's sacred status intertwines with regional identity and governance. Conservation efforts today often invoke these cultural narratives, seeking to reconcile development pressures with the need to protect the Cauvery's ecological and spiritual heritage.

In essence, the role of the Cauvery River in religious life is multifaceted; it is a mother goddess, a purifier, a source of life, a cultural muse, and a unifying symbol for communities. Sustainable future management of this lifeline requires integrating its scientific, economic, and sacred values to honour the profound legacy the river carries for generations.

2.4. Cauvery River for Tourism/Leisure/Recreation

The CRB is a prominent destination for tourism, leisure, and recreation, offering a rich mix of natural beauty, cultural heritage, adventurous activities, and tranquil escapes that attract visitors from across India and beyond. The river's course through Karnataka, Tamil Nadu, and Kerala is dotted with diverse attractions ranging from scenic waterfalls, wildlife sanctuaries, historical monuments, and pilgrimage sites to adventure camps and nature resorts.

Tourism along the Cauvery centres on both its natural environment and cultural landmarks. Popular sightseeing spots include the majestic Shivanasamudra Falls, known for its powerful cascades and hydroelectric significance; Hogenakkal Falls, famous for boat rides and the

"Niagara of India" experience; and the Ranganathittu Bird Sanctuary near Srirangapatna, a haven for birdwatchers hosting numerous migratory and resident bird species around the water tourism hotspots (Table 4).

Table 4. List of water tourist sites in the CRB (India-WRIS, 2021)

S. No	Site Name	Type	District
1	Kodikkarai Beach	Beach	Nagapattinam
2	Velankanni Beach	Beach	Nagapattinam
3	Ooty	Hill Station	The Nilgiris
4	Veeranam Lake	Lake	Cuddalore
5	Kodaikanal Lake	Lake	Dindigul
6	Yercaud Lake	Lake	Salem
7	Velankanni Madha Church	Pilgrimage (church)	Nagapattinam
8	Nagore Dargha	Pilgrimage (Masjid)	Nagapattinam
9	Pichavaram Forest	Reserved Forest	Cuddalore
10	Poompuhar	Tourist spot	Nagapattinam
11	Kovai Kutrallam Falls	Waterfall	Coimbatore
12	Agaya gangai Falls/ Kolli Falls	Waterfall	Namakkal
13	Catherine Fall	Waterfall	The Nilgiris
14	Srirangapatnam Fort	Fort	Mandya
15	Madikeri Fort	Fort	Kodagu
16	Shettihalli Submerged Church	Pilgrimage (church)	Hassan
17	Omkareshwara Temple	Pilgrimage (Temple)	Kodagu
18	Laksmi Kantha Swamy temple	Pilgrimage (Temple)	Mysuru
19	Hogenakkal Falls	Waterfall	Chamarajanagar
20	Iruppu Falls	Waterfall	Kodagu
21	Abbey Falls	Waterfall	Kodagu
22	Brindavan Garden	Tourist spot	Mandya

The historic island town of Srirangapatna, surrounded by the Cauvery, offers a glimpse into rich heritage with sites such as the Ranganathaswamy Temple and Tipu Sultan's Summer Palace. Adventure and leisure activities abound in spots like Bheemeshwari, known as the Cauvery Fishing Camp, which offers river rafting, trekking, angling, kayaking, coracle rides, and wildlife watching within lush forests adjoining the river. Dubare Elephant Camp provides a unique experience for visitors to interact with elephants, enjoy nature walks, and explore riparian biodiversity. These camps are popular among families, adventure seekers, and nature enthusiasts wanting to engage with the basin's ecology actively.

The upper reaches near Talakaveri, the mythic origin of the river, offer spiritual tourism with temple visits and panoramic trekking combined with serene river views. Similarly, the Kaveri Nisargadhama near Kushalnagar is a lush garden and eco-park on the riverbank, ideal for picnics, nature walks, and relaxation amid rich flora and fauna.

The Cauvery's recreational appeal is further enhanced by fishing opportunities for anglers, wildlife photography for bird and animal watchers, and cycling or heritage tours in towns like Mysuru and Pondicherry, bordered by the river. The banks provide peaceful retreats for meditation, photography, and riverbank strolls, drawing both local and international tourists.

Cultural tourism thrives along the river due to its sacred significance. The river's revered status links closely with temple towns where religious tourism blends with architectural grandeur, arts, and traditional crafts.

Overall, the tourism matrix along the Cauvery integrates:

- Nature-based tourism like waterfalls, wildlife sanctuaries, fishing camps, forests, trekking trails.
- Adventure tourism: rafting, kayaking, elephant rides, coracle boating.
- Cultural and heritage tourism: temple towns, historical sites, festivals, pilgrimage circuits.
- Leisure and eco-tourism: riverbank parks, garden retreats, bird watching, nature camps

This rich diversity of attractions, activities, and cultural experiences underlines the Cauvery River's importance not just as a lifeline for agriculture and industry but as a vibrant corridor for tourism, leisure, and recreation, benefiting multiple stakeholders while spotlighting the need for sustainable management of its natural and cultural heritage. These aspects make the CRB a multifaceted tourism hotspot, fostering regional economies while promoting conservation awareness

2.5. Role of Tribals

The tribal communities of the CRB play a critically important role in the region's ecological sustainability, cultural heritage, and socio-economic landscape. Located primarily in the upper catchment areas and the forested zones of the Western Ghats within the basin, these indigenous groups have intricately linked their livelihoods, traditions, and environmental knowledge systems to the Cauvery River and its surrounding ecosystem.

Economically, tribes in the Cauvery Basin predominantly depend on subsistence farming, non-timber forest product (NTFP) collection, animal husbandry, and seasonal labour in plantation

agriculture such as coffee, cardamom, and pepper harvesting. This forest dependence is significant, with estimates suggesting that about 60-80% of tribal households rely substantially on NTFPs for food, medicine, and supplemental income. However, these communities face persistent challenges, including landlessness, poverty, low literacy, and limited access to formal education and healthcare services, which constrain their developmental opportunities.

Their traditional ecological knowledge is a vital asset for biodiversity conservation and sustainable natural resource management in the basin. Tribes maintain rich ethnobotanical and ethno-medicinal knowledge, practicing forest and water resource use that embodies principles of ecological balance and respect for nature. These sustainable practices contribute to maintaining forest cover, enhancing water percolation, and reducing soil erosion in the upper watershed, thus playing a critical role in preserving the Cauvery's health and flow regimes.

Culturally, tribal groups enrich the basin's diversity through unique rituals, oral traditions, customs, and livelihoods tied directly to the river and forest landscapes. Their engagement in cooperative water governance, community self-help groups, and participatory forest management is growing, though awareness and structured institutional inclusion remain limited. Women within tribal communities are also key actors in household livelihood management and the transmission of traditional knowledge.

The tribes' stewardship has implications beyond ecological conservation, contributing socio-culturally by underlining the intrinsic values of the river and surrounding environment. Supporting tribal welfare through improved education, healthcare, land rights, economic diversification, and political representation is essential for the holistic rejuvenation of the basin's environment and society. Also, the specific tribal groups and their livelihood and land use activities, as well as the socio-economic indicators of various tribes in the CRB, are detailed below.

2.5.1. Specific Tribal Groups

The CRB, especially in the upper catchment areas of the Western Ghats within Karnataka, Tamil Nadu, and Kerala, is home to several indigenous tribal groups. Prominent among them are:

- **Kodavas (Codavas or Kodagas or Coorgs)**
  Primarily inhabiting the Kodagu region, closely linked with the Cauvery's origin at Talakaveri. Known for coffee cultivation and unique cultural and martial traditions.
- **Soliga (Solega, Sholaga and Shōlaga)**
  Found in the forests around BR Hills, with a deep tradition of forest gathering and shifting cultivation.
- **Jenu Kuruba**
  Another forest-dependent tribe in the Nilgiri Biosphere adjoining the CRB.
- **Paniya (Paniyar, Panyer, and Paniyan)**
  Tribal groups residing in the Nilgiri and Wayanad regions (partly feeding tributaries of Cauvery), skilled in traditional knowledge of the forest.
- **Kotas and Todas**
  Although mainly in Nilgiris, some populations interact with the CRB forests.

- **Urali**
  Small communities found in forest fringes, involved in agriculture and forest product collection.

2.5.2. Livelihoods and Land Use

Tribal livelihoods in the basin are largely subsistence-based, closely tied to the natural forest-river ecosystem:

- **Agriculture**
  Mostly rainfed or small terraced farms cultivating millets, pulses, spices, coffee, and cardamom in upland zones. Shifting cultivation and home gardens supplement food security.
- **Non-Timber Forest Products**
  Collection of honey, medicinal plants, wild fruits, tubers, and bamboo is common; NTFPs often provide 40-60% of household income in some communities.
- **Animal Husbandry**
  Rearing small ruminants and poultry adapted to forested terrain.
- **Seasonal/Wage Labor**
  Participation in coffee, tea, and cardamom plantations as labourers during peak seasons.
- **Fishing and Water Use**
  Small-scale fishing in rivers and reservoirs supplements protein intake and income.

Land ownership patterns among tribes are generally fragmented and limited. Many communities possess few formal rights, and land alienation pressures persist due to external development and forest conservation policies.

2.5.3. Socio-Economic Indicators

- **Poverty**
  Tribal households in the CRB often experience poverty rates exceeding regional averages, with limited access to formal jobs.
- **Education**
  Literacy rates are below state averages; school attendance is improving with government schemes, but dropout rates remain a concern.
- **Healthcare**
  Access to quality healthcare is constrained by remoteness; traditional medicinal knowledge complements formal health services.
- **Infrastructure**
  Basic amenities like roads, electricity, and safe drinking water are less accessible in many tribal hamlets.
- **Social Inclusion**
  Tribes face marginalization in governance and resource decision-making, though efforts to enhance their participation through self-help groups and Panchayat representation exist.

2.6. River-People (Dis) Connect

The relationship between the Cauvery River and the people living along its basin reveals a complex picture of connection and disconnection shaped by environmental degradation, displacement, pollution, and socio-economic pressures. Here, a comprehensive report with an in-depth analysis is presented for the "River-People (Dis)connect" in the CRB in terms of displacement, environmental damages, pollution, and their social consequences, drawing on research studies, government reports, and expert assessments.

2.6.1. Environmental and Pollution Impacts Affecting River-People Connection

The Cauvery River, once pristine and a vital life source, is increasingly threatened by pollution and environmental degradation that undermine both ecological health and human well-being. Human activities such as industrial effluents discharge, untreated sewage, agricultural runoff, and urban expansion have severely degraded water quality.

- **Water Pollution**
  Industrial zones along the river, notably near Mettur Dam, Pallipalayam, and Bengaluru, release toxic effluents containing heavy metals like lead, cadmium, chromium, and arsenic, alongside dyes, chemicals, and organic pollutants that exceed permissible water quality standards. Sewage discharge directly from towns such as T. Narasipura and Srirangapatna further contaminates the river with pathogens and organic waste, drastically reducing dissolved oxygen levels essential for aquatic life (Earth5R, 2025).
- **Impact on Aquatic Life**
  Biodiversity suffers from this pollution, with drastic declines in native fish species such as Indian major carps and the endangered mahseer. Pollution and habitat disruption have caused fish kills and reduced fish catches, directly impacting fisherfolk livelihoods and the river's ecological balance (Dyig River).
- **Groundwater Contamination**
  Pollutants percolate from the river into groundwater aquifers, resulting in elevated concentrations of nitrates and heavy metals in drinking water sources. This contamination threatens public health, especially for marginalized communities relying on river water for domestic use (Sneka Lata et al., 2015).
- **Riverbank Encroachment and Altered Land Use**
  Expansion of settlements, industrial infrastructure, sand mining, and waste dumping have led to riverbank erosion and loss of wetlands and natural vegetation crucial for maintaining river health and flood regulation (EMPRI, 2017).

2.6.2. Displacement and Social Disconnection

Large infrastructural projects such as dams (notably the KRS dam) and irrigation canals have altered the natural flow of the Cauvery, leading to ecological changes that disrupt traditional livelihoods and sometimes cause displacement.

- **Displacement Effects**
  Construction of reservoirs and associated infrastructure has led to resettlement of communities, disrupting social networks and cultural ties to the river. Loss of

agricultural land due to flooding and changing water regimes has forced migration and economic instability among farmer and fisher populations (Ekka et al.,2022).

- **Flooding and Erosion**
  Unregulated water releases from dams have caused sudden surges and floods downstream, damaging crops and homes, further aggravating vulnerability and displacement risks, especially in low-lying villages (Susheela et al., 2014).
- **Water Conflicts**
  The ongoing interstate water dispute between Karnataka and Tamil Nadu generates political and social tensions, affecting equitable access to water and creating hardship among farming and fishing communities who depend on consistent water supply for their livelihoods (Climate Diplomacy, 2025; Kaur, 2025; Irfan and Jacob, 2016).

2.6.3. Socio-Economic and Public Health Impacts

- **Livelihood Loss**
  Declining fish stocks and polluted water directly reduce the incomes of fisherfolk, who have reported lower catches and health concerns from exposure to toxic water. Farmers face crop failures due to irregular and contaminated irrigation water. Many rural communities lack access to clean water, increasing the disease burden, especially waterborne illnesses (Dyig River; Earth5R).

- **Public Health**
  The community health impact includes skin diseases, gastrointestinal infections, and chronic illnesses linked to heavy metals and chemical exposure from polluted Cauvery waters. Lack of sanitation and waste management exacerbates these conditions.
- **Social Inequality**
  Marginalized and poverty-stricken groups bear the brunt of pollution and water scarcity, with urban slums along the river often lacking sanitation and safe water infrastructure. This spatial and social disconnection further entrenches inequality and exclusion within the river basin (Earth5R).

2.6.4. Causes of River-People Disconnection

The growing disconnects between river and people in the CRB is rooted in a combination of governance failures, unchecked development, changing agricultural practices, and hydrological interventions. The impact of river-disconnect on different domains, from governance fragmentation to hydrological alterations, is mentioned below.

- **Fragmented Governance**
  Multiple authorities (state pollution boards, local municipalities, water resource departments) managing different aspects of the river with poor coordination have hindered integrated river management and pollution control.
- **Industrial and Urban Expansion**
  Unplanned growth with inadequate sewage treatment and industrial effluent controls overwhelms natural absorption and filtration capacity.
- **Agricultural Practices**

Intensive fertilizer and pesticide runoff add to nutrient loading and chemical contamination.

- **Hydrological Alterations**
  Dams and water diversions disrupt natural flow regimes vital for ecosystem function and traditional livelihoods (Ekka et al., 2022).

The growing disconnect between river and people in the Cauvery Basin is rooted in a combination of governance failures, unchecked development, changing agricultural practices, and hydrological interventions. Fragmented governance, where state pollution control boards, local municipalities, and water resource departments operate with little coordination, has prevented unified action against pollution and enabled conflicting interests to dominate river management. As industrial and urban centres expand rapidly, inadequate infrastructure for treating sewage and industrial waste has resulted in the uncontrolled release of pollutants into the river, exceeding its natural capacity for self-purification and degrading water quality.

Intensive agricultural practices have further strained the relationship, with heavy use of fertilizers and pesticides creating runoff that loads rivers with excess nutrients and toxic chemicals. These processes, unchecked by comprehensive watershed policies, impair both aquatic ecosystems and downstream livelihoods. Hydrological alterations from dam construction and water diversions are compounding these pressures, which disrupt the river's natural flow regimes. These changes fragment habitats, undermine the resilience of traditional livelihoods such as fishing and farming, and reduce the ability of local communities to maintain their historical connections to the river. These factors have eroded the ecological, social, and cultural ties between the Cauvery and the people who depend on its health and vitality, illustrating how policy gaps, environmental stressors, and competing water demands can transform a once life-giving river into a contested and diminished resource.

3. Efforts by NGOs, Local Governments, and Other Organizations in Influencing River-People Connect

Restoring and strengthening the relationship between the Cauvery River and the millions who depend on its waters has become a central focus for a wide array of actors across the basin. As rapid industrialisation, population growth, and ecological pressures threaten both the health of the river and the communities it supports, a new wave of action has emerged from civil society, local administrations, and grassroots organizations. These collective efforts aim not only to rehabilitate the river's natural systems but also to re-engage local populations as active stewards and beneficiaries of this vital resource.

This section explores in detail how diverse organizations, including influential NGOs, forward-thinking local government bodies, and dynamic community groups, are innovating solutions that reconnect people to the Cauvery. By highlighting the objectives, methods, and impacts of their interventions, the report illuminates how multi-stakeholder partnerships, participatory river management, and community-led conservation are shaping a renewed and sustainable river-people relationship throughout the basin.

3.1. Major NGO-Led Initiatives

(A) Cauvery Calling by Isha Foundation

Launched in 2019, this 12-year movement seeks to empower farmers to plant 2.42 billion trees across approximately 8.3 million hectares of the Cauvery basin. Globally recognized, including by the United Nations, as a blueprint for tropical river revitalization, the campaign promotes tree-based agriculture, interplanting fruit and timber trees among crops. This agroforestry transition benefits farmers by boosting income reportedly by 3 to 8 times, improving soil health, sequestering carbon, restoring groundwater levels, and mitigating drought impacts (Conscious planet, 2025).

Community mobilization efforts involve volunteers termed “Nadi Veeras” and “Mara Mitra,” supported by government-trained “Kayaka Bandhu,” who assist farmers on the ground, establish tree nurseries, and help secure subsidies and training. By 2024, over 213,000 farmers had adopted tree-based farming, resulting in the planting of 109 million trees. This initiative has notably increased green cover, enhanced rural economies, and revived catchment hydrology, while creating livelihoods for women and youth as local “tree ambassadors” (Conscious planet, 2025).

(B) Art of Living’s Cauvery River Rejuvenation Project

In partnership with Karnataka’s Rural Development and Panchayati Raj Department, this project began in Kodagu and expanded to tributaries like the Kaushika and Noyyal. Utilizing scientific mapping and hydrogeology expertise from ISRO, IISc, and others, combined with local engagement through meditation, skill-building, and leadership development, phase one saw the construction of 751 water recharge structures. Village-level activities include catchment protection, stream cleaning, and promotion of sustainable water use. The project has earned endorsements from government officials and political leaders as a model for participatory river management (Art of living foundation, 2018).

(C) Tree Sisters and Other Community-Based NGOs

Tree Sisters, an international organization, partnered with Isha Foundation to mobilize thousands of farmers and rural youth as “tree friends” (Mara Mitra) and “Kayaka Bandhu.” The partnership provides on-the-ground support, connects farmers to government schemes, and assists in nursery establishment. Reports indicate up to 70,000 farmers have increased their incomes significantly through agroforestry, alongside training rural women and youth in leadership and livelihood skills (Three sisters, 2021).

(D) Earth5R Blue Cities Model

This NGO employs a citizen-led river restoration approach integrating data-driven audits, training for youth and residents, and community river clean-ups. Piloted in urban centres like Bengaluru, Mysuru, and Tiruchirappalli, it transforms local volunteers into river stewards while scaling effective models of river health management and waste control.

3.2. State and Local Government Interventions

(A) Water Supply Reforms and Urban Access

The Karnataka government launched the "Sanchari Cauvery," a GPS-tracked, government-operated water tanker service delivering affordable, certified Cauvery water directly to Bengaluru residents. This initiative aims to undercut illegal water supply cartels and bridge shortages. Accompanying innovations like the "Cauvery on Wheels" app and subsidies for connection fees demonstrate evolving government engagement toward equitable water access.

Large infrastructure projects like Cauvery Stage V and VI aim to expand water distribution to marginalized and peri-urban Bengaluru neighbourhoods. These projects incorporate citizen feedback mechanisms to foster trust and responsiveness in water governance amidst rapid urban expansion.

(B) Watershed, Recharge, and Conservation Efforts

Local governments collaborate with NGOs and village panchayats to build check dams, recharge wells, and revitalize tributaries. These efforts utilize a mix of public funds, technical knowledge, and local social capital to promote participatory water resource management and empower rural communities in sustainable watershed stewardship.

3.3. Community-Based and Farmer Organizations

(A) Farmer Producer Organizations (FPOs)

Programs such as Cauvery Calling emphasize FPOs predominantly run by small and marginal farmers (over 75% membership), featuring equitable governance structures. These collectives provide platforms for farmers to access resources, share knowledge, and participate actively in basin sustainability.

(B) Youth and Women's Empowerment

Women and youth increasingly serve as "Mara Mitra" tree nursery managers and conservation leaders, fostering rural entrepreneurship and local employment opportunities while promoting social equity and intergenerational engagement.

(C) Participatory River Health Audits

Several grassroots groups conduct regular monitoring of river health, pollution levels, and advocate for river rights, connecting scientific data with community advocacy to hold stakeholders accountable and optimize local river management.

3.4. Policy Influence and Ecosystem Outcomes

(A) Policy Integration

The government's nationwide river rejuvenation strategy announced in 2022 draws significant inspiration from successful NGO-led models like Rally for Rivers and Cauvery Calling. These grassroots campaigns focused on large-scale tree planting along riverbanks and promoting

agroforestry practices on agricultural lands as key solutions to restore the ecological health and perennial flow of India's rivers.

The Rally for Rivers movement, launched by Sadhguru in 2017, produced a comprehensive draft policy recommending systematic plantation of native tree species on both sides of rivers, extending into farmland areas with multi-tier tree-based agriculture. This proposal received broad support from multiple state governments and was incorporated into the national river rejuvenation framework. The policy emphasizes ecological restoration through afforestation combined with sustainable farming techniques.

Building on this, the Cauvery Calling campaign operationalized these concepts by mobilizing over 2,39,000 farmers to transition to tree-based agriculture, planting more than 124 million trees to date in the CRB (Conscious planet, 2025). The initiative has gained international recognition, including accreditation by the UN Convention to Combat Desertification (UNCCD) and observer status with the United Nations Environment Assembly (UNEA).

Aligned with these efforts, the Government of India allocated approximately Rs. 19,000 crores (around USD 2.5 billion) in 2022 to revitalize 13 major rivers based on the draft policy recommendations of Rally for Rivers, thereby providing substantial financial backing and policy support to implement large-scale ecological restoration (Ministry of Jal Shakthi, 2022).

These integrated approaches aim not only at restoring river ecosystems but also at improving rural livelihoods, enhancing groundwater recharge, and mitigating climate change impacts. The success of these models hinges on broad-based community mobilization, multi-stakeholder collaborations involving governments and civil society, scientific validation of interventions, and a long-term vision spanning decades.

Overall, the policy and financial commitments made by the government reflect the influence and effectiveness of NGO-led initiatives like Rally for Rivers and Cauvery Calling in shaping a scalable, inclusive, and sustainable model for river restoration across India. This synergy of grassroots action and formal frameworks offers a hopeful blueprint for reviving India's vital river systems for future generations.

(B) Sustainable Livelihoods and River Revival

Collective multi-stakeholder efforts in the CRB have led to measurable improvements in ecosystem services, which in turn have generated significant socio-economic benefits for local communities. These efforts include the construction of recharge structures, check dams, and restoration of surface water bodies, resulting in increased groundwater levels and enhanced aquifer health. Monitoring has recorded improvement in groundwater inflows by billions of Liters, underscoring the hydrological benefits of these interventions.

Agroforestry initiatives such as the Cauvery Calling program have been pivotal in expanding green cover in the basin. With participation from over 200,000 farmers and the planting of more than 100 million trees, these programs have effectively reversed decades of deforestation and supported the ecological restoration of critical river catchments (Tree sisters, 2021).

Moreover, promotion of tree-based agriculture and organic farming techniques has improved soil quality, enhanced soil organic matter, water retention, and nutrient cycling, while reducing

soil erosion. These soil health improvements contribute directly to sustainable agricultural productivity and environmental resilience.

On the socio-economic front, transitioning to agroforestry and sustainable land use has enabled farmer incomes to increase by 3 to 8 times on average, significantly reducing rural poverty. The diversification of livelihoods through such environmentally sound practices has also led to decreased distress-driven migration from rural Cauvery areas, as farmers achieve greater economic stability and food security.

Finally, improved water availability, stabilized soils, and diversified cropping systems have enhanced agricultural stability in the basin. These gains foster better resilience to climate variability and mitigate risks related to water scarcity and soil degradation, securing the livelihoods of farming communities dependent on the river's health.

4. Conclusion and Recommendations

What Works for Policy Implementation

The restoration of the CRB demonstrates the effectiveness of community-driven, multi-stakeholder approaches that integrate ecological restoration with socio-economic development. Initiatives such as Cauvery Calling, river rejuvenation programs, and grassroots monitoring show that empowering farmers through agroforestry and improved watershed management delivers multiple co-benefits, including enhanced green cover, groundwater recharge, soil health, farm incomes, and agricultural stability.

Community-led agroforestry emerges as a central strategy, as financial incentives, technical support, and institutional backing encourage long-term adoption of tree-based farming. By aligning environmental restoration with livelihood enhancement, these practices create durable incentives for farmer participation and are scalable across diverse regions of the basin.

Strong multi-stakeholder partnerships involving NGOs, government agencies, research institutions, and local communities play a critical role in scaling restoration efforts. Such collaborations enable knowledge sharing, resource mobilization, and capacity building, strengthening institutional legitimacy and social capital.

Participatory governance further enhances effectiveness by ensuring inclusive engagement of women, youth, and marginalized groups through platforms such as Farmer Producer Organizations and local conservation committees. This fosters local ownership, accountability, and sustained stewardship.

Finally, formal policy integration supported by sustained public financing and data-driven scientific monitoring underpins long-term success. Embedding grassroots initiatives within government programs and using evidence-based monitoring systems ensures continuity, adaptive management, and basin-scale impact.

Obligations for policy interventions

Despite notable restoration gains, fragmented governance remains a major constraint. Overlapping mandates across water, agriculture, forestry, industry, and urban planning agencies result in inconsistent policies and weak coordination, undermining integrated river

basin management and pollution control. Addressing this requires institutional reforms that enable coherent, basin-scale governance.

Urban and industrial pollution continues to pose a serious challenge. Rapid urbanization and industrial growth have outpaced sewage and effluent treatment capacity, leading to persistent pollutant inflows that offset restoration gains. Ecological interventions must therefore be complemented by substantial investments in waste treatment infrastructure and stronger regulatory enforcement.

Equity gaps further limit restoration effectiveness. Marginalized communities, including indigenous groups within the basin, remain insufficiently integrated into program design and implementation. This restricts equitable benefit sharing and overlooks valuable traditional ecological knowledge, reducing both social justice and ecological outcomes.

Sustainability is also threatened by reliance on volunteer-driven models and uncertain funding streams. Dependence on short-term or discretionary financing risks program discontinuity, particularly under shifting political or economic conditions. Long-term success requires stable, institutionalized funding mechanisms.

Finally, misalignment between agricultural policies and environmental objectives persists. Continued dependence on chemical-intensive, monoculture farming outside agroforestry zones exacerbates soil and water degradation. Basin-wide policy reforms are needed to incentivize diversified, organic, and resource-efficient farming practices that reinforce restoration efforts.

Recommendations to Scale Up the Policy Actions

To scale effective restoration strategies, governments should institutionalize community-based agroforestry and watershed programs within formal policy frameworks. Embedding these initiatives in official schemes ensures predictable financing, standardized technical support, and wider geographic and social reach.

Strengthening interagency coordination is equally critical. Establishing empowered river basin authorities with clear mandates across water quality, forestry, agriculture, urban infrastructure, and pollution control can overcome governance fragmentation, streamline decision-making, and enhance policy coherence at the basin scale.

Inclusive outreach must be expanded to fully integrate marginalized and indigenous communities into restoration planning and benefit sharing. Culturally appropriate engagement, secure land and resource rights, and transparent benefit-sharing mechanisms are essential to promote equity while leveraging traditional ecological knowledge.

Sustained investments in urban and industrial waste management are necessary to safeguard restoration gains. Upgrading sewage treatment, regulating industrial effluents, and promoting green urban infrastructure will reduce persistent pollution pressures on river systems.

Agricultural policy realignment is also required. Aligning subsidies and extension services with conservation objectives can accelerate the adoption of organic farming, crop diversification, and reduced chemical inputs across the basin, mitigating soil and water degradation.

Finally, robust monitoring and adaptive governance must be institutionalized. Participatory, science-based monitoring, integrating citizen science and independent audits, can strengthen accountability, enable continuous learning, and support timely policy adjustments in response to changing environmental conditions.

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