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# Current Status of Irrigation Systems in Tamil Nadu

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**Abstract**

Tamil Nadu's irrigation systems represent one of the most diversified and historically evolved water management structures in India, comprising canals, tanks (system and non-system), open wells and bore wells that together sustain the state's predominantly agrarian economy. Based on data from the Season and Crop Report 2022–23 (Government of Tamil Nadu), the Dynamic Ground Water Resources Assessment Reports (Central Ground Water Board, 2020–2022), and the Sixth Minor Irrigation Census (Ministry of Jal Shakti), the present review highlights the structural composition, emerging trends and sustainability concerns of Tamil Nadu's irrigation sector. The gross irrigated area during 2022–23 was around 29.20 lakh hectares, of which approximately 63% was irrigated by wells and bore wells, 23.4% by canals and 13.7% by tanks. Groundwater has become the principal source of irrigation, with an annual recharge estimated at 21.51 billion cubic metres (BCM) and extraction at 14.42 BCM—reflecting a stage of extraction of about 73.9%. Nearly 31% of the state's groundwater assessment units are classified as over-exploited, showing serious stress in several delta and peri-urban regions.

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The Sixth Minor Irrigation Census (2017–18) reported a marginal increase in the total number of minor irrigation schemes (+2.05%), primarily due to growth in groundwater structures, while surface water systems showed a declining trend. These figures underscore a significant shift from traditional tank and canal irrigation toward groundwater dependence. The World Bank-supported Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP) has initiated modernization of irrigation infrastructure, tank rehabilitation and micro-irrigation expansion to address these challenges. However, persistent issues such as declining tank capacity, groundwater depletion and inefficient surface water conveyance continue to threaten sustainability. The paper concludes that future irrigation development in Tamil Nadu must emphasize conjunctive water use planning, revitalization of tank systems, promotion of water-saving technologies, stronger groundwater governance and real-time monitoring frameworks to ensure resilient and equitable irrigation management.

***Keywords:*** Irrigation systems; Groundwater; Tank irrigation; Canal irrigation; TNIAMP; Water management.

## 1. Introduction

Tamil Nadu, situated in the southern peninsula of India, is among the most water-stressed states in the country, with nearly 95% of its surface and groundwater resources already harnessed for various uses. Agriculture continues to be the largest water-consuming sector, accounting for about 80% of total water use in the state [1]. The irrigation landscape of Tamil Nadu is supported by a combination of canals, tanks (system and non-system), open wells, and bore wells, with groundwater emerging as the dominant source [2]. According to the Season and Crop Report (2022–23), the gross irrigated area stood at approximately 29.20 lakh hectares, of which 63% was irrigated by wells and bore wells, 23.4% by canals, and 13.7% by tanks.

The state's irrigation system is anchored by major river basins such as the Cauvery, Vaigai, Tamiraparani and Palar, complemented by over 39,000 tanks and numerous minor irrigation structures. However, rapid urbanization, industrial expansion and climate variability have exacerbated stress on both surface and groundwater systems. The Central Ground Water Board (2022) estimates Tamil Nadu's annual groundwater recharge at 21.51 billion cubic metres (BCM) and extraction at 14.42 BCM, indicating a 73.9% stage of extraction, with nearly one-third of the state's assessment units categorized as "over-exploited." Declining tank storage capacity, increasing well density, and seasonal variability in rainfall have further intensified water insecurity.

In this context, this review provides an evidence-based analysis of the current status of Tamil Nadu's irrigation systems, drawing from official datasets and recent modernization initiatives such as the Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP). This paper explores evolution, current status, challenges and modernization of irrigation systems in Tamil Nadu, with a focus on both historical practices and contemporary management.

## 2. Historical Background of Irrigation in Tamil Nadu

Tamil Nadu possesses one of the oldest and most intricate irrigation legacies in India, dating back over 1,500 years. The foundations of the state's irrigation system were laid during the Chola, Pandya and Pallava dynasties,

which pioneered large-scale tank irrigation systems designed to harvest and store monsoon rainfall for agricultural use. These tanks, numbering over 39,000 across the state, played a vital role in ensuring water availability for cultivation even during dry seasons and in maintaining groundwater recharge. The Chola kings, in particular, developed an extensive network of interconnected tanks, channels and sluices that served as models of decentralized and community-managed irrigation systems.

Canal irrigation also has deep historical roots in Tamil Nadu, especially in the Cauvery delta, where perennial river flows were harnessed through a system of anicuts (weirs) and canals to irrigate vast stretches of paddy fields [3]. The Grand Anicut (Kallanai), constructed across the Cauvery River during the 2nd century by King Karikala Cholan, remains one of the oldest functional water regulation structures in the world and continues to play a pivotal role in delta irrigation. Other river-based systems along the Vaigai, Tamiraparani, Palar and Bhavani further expanded irrigation coverage across different regions of the state.Following India's independence, irrigation development in Tamil Nadu underwent a major transformation with the introduction of electric and diesel pump sets, facilitating rapid groundwater extraction through open wells and later bore wells. This technological shift in the 1960s and 1970s led to significant increases in the irrigated area under private ownership but also gradually reduced the dependence on traditional surface irrigation systems [4]. Over time, groundwater became the dominant irrigation source, accounting for nearly two-thirds of the irrigated area in the state by the early 2000s. While this transition boosted agricultural productivity, it also brought challenges such as groundwater depletion, reduced tank maintenance and declining surface storage capacity.

Thus, the evolution of irrigation in Tamil Nadu reflects a shift from community-managed surface systems to individual-based groundwater dependence, highlighting both the ingenuity of ancient water management practices and the need for sustainable modernization in the present era.

**3. Current Irrigation Sources in Tamil Nadu**

The irrigation system of Tamil Nadu is characterized by a diverse combination of surface water and groundwater sources, reflecting the state's varied agro-climatic and hydrological conditions. Over the decades, there has been a significant transformation in irrigation patterns—from a traditional reliance on tanks and canals to a growing dependence on groundwater extraction through wells and borewells. This trend has been driven by technological advances, rural electrification and the increasing need for assured irrigation in the face of erratic monsoons.

According to recent data from the Tamil Nadu Water Resources Department (WRD), the Agricultural Census (2020), and the Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP), groundwater has become the dominant irrigation source, accounting for more than half of the net irrigated area. Canals and tanks, which historically formed the backbone of the state's irrigation systems, have seen a relative decline in their contribution due to siltation, encroachment, and inadequate maintenance. However, they continue to play an essential role in supporting irrigation in deltaic and rainfed regions.

From the table 1, groundwater contributes the largest share of irrigation coverage, highlighting the growing dependence on subsurface water resources. This shift has important implications for water sustainability, as many blocks in Tamil Nadu are now classified as over-exploited or critical by the Central Ground Water Board (CGWB). To address this imbalance, initiatives such as TNIAMP and micro-irrigation programs are being implemented to promote conjunctive water use, tank rehabilitation, and efficient water management practices aimed at improving irrigation sustainability across the state.

**Table 1:** Distribution of Irrigation Sources in Tamil Nadu

| Source | Share of Net Irrigated Area (%) |
|---|---|
| Groundwater (wells & borewells) | 55 |
| Canals (including system tanks) | 23 |
| Tanks (non-system) | 18 |
| Other (rainfed/other surface) | 4 |

**4. Major projects and modernization efforts**

The most significant initiative in the past decade has been the Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP), funded by the World Bank. According to the World Bank Implementation Status Report [5], TNIAMP spans 47 sub-basins and emphasizes tank rehabilitation, promotion of micro-irrigation, strengthening of Water User Associations (WUAs) and the adoption of advanced agricultural practices.

- Pradhan Mantri Krishi Sinchai Yojana (PMKSY): Supporting the promotion of drip and sprinkler irrigation across Tamil Nadu.
- Tank rehabilitation programs: Implemented with the support of NABARD and state funds.
- Chief Minister’s Water Resources Conservation Mission (2020): Focused on desilting tanks, canals, and village ponds to improve water storage and availability

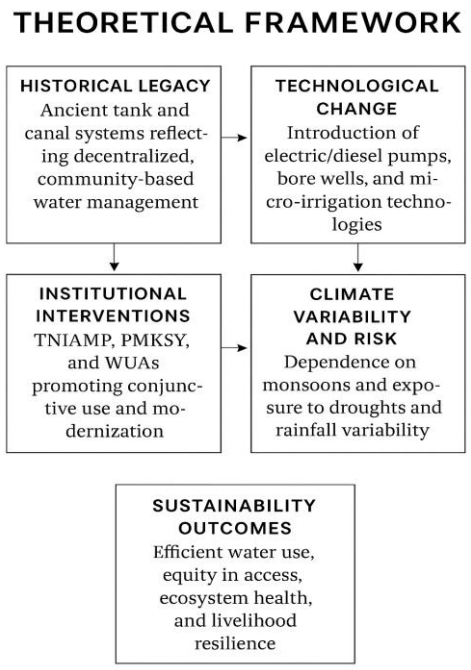


**Figure 1:** Theoretical framework of the study

## 5. Strengths and Vulnerabilities

### *5.1 Groundwater dependence*

The Dynamic Ground Water Resources Report [6] shows that more than 70 percent of Tamil Nadu's assessment blocks are categorized as over-exploited, critical, or semi-critical. This indicates unsustainable withdrawal trends. Dependence on groundwater provides flexibility but at the cost of long-term aquifer depletion.

### *5.2 Tanks as community assets*

Tanks remain vital for small and marginal farmers, especially in semi-arid districts. Studies [7, 8 & 9] highlight their multiple roles in irrigation, groundwater recharge, and ecosystem services. However, lack of maintenance and encroachment have reduced their command area.

### *5.3 Canal system inefficiencies*

Large canal systems (e.g., Cauvery, Vaigai, Parambikulam–Aliyar) suffer from sedimentation, poor maintenance, and inequitable distribution. The World Bank ISR [5] notes that modernization efforts have reduced conveyance losses in pilot areas, but full efficiency gains require integrated water management.

### *5.4 Climate risks*

Tamil Nadu depends heavily on northeast monsoon rainfall (October–December), which is highly variable.

Erratic rainfall reduces reservoir inflows, affecting canal releases. Climate models predict increased variability, making irrigation modernization and conjunctive use more urgent [10].

## 6. Institutional Responses and Policy Measures

Key interventions in recent years include:

- **Conjunctive use planning** – promoted under TNIAMP and by the Water Resources Department to balance surface and groundwater use [5].
- **Tank and canal rehabilitation** – NABARD's RIDF and TNIAMP investments focus on desilting and restoration [2].
- **Micro-irrigation subsidy programs** – PMKSY provides up to 55–75% subsidy for drip and sprinkler systems [11].
- **Water User Associations (WUAs)** – institutional strengthening under TNIAMP has helped participatory irrigation management[5].
- **Groundwater monitoring** – CGWB has established monitoring wells and promotes recharge programs, but enforcement of regulation remains weak [6].

## 7. Priority Research and Data Gaps

- **Aquifer-level mapping:** The state lacks detailed aquifer mapping at firka/block level to inform groundwater governance.
- **Canal system performance:** Quantitative estimates of conveyance losses and rehabilitation benefits are scarce.
- **Equity studies:** Micro-irrigation subsidies may disproportionately benefit medium/large farmers; studies on equity impacts are limited.
- **Tank rejuvenation impacts:** Longitudinal studies on socio-economic and hydrological benefits are needed.

## 8. Recommendations

- **Scale up conjunctive use** – integrate surface and groundwater planning at basin/sub-basin level.
- **Tank rehabilitation** – prioritize tanks in semi-arid and smallholder-dominated districts for cost-effective water security.
- **Expand micro-irrigation** – link subsidies with water-use audits to improve efficiency.
- **Groundwater governance** – strengthen monitoring networks, introduce community-based regulation, incentivize recharge.
- **Invest in data systems** – real-time monitoring and impact evaluation to guide policy.

## 9. Challenges and Policy Responses

**Table 2:** Challenges and policy responses

| Challenge | Current Policy Responses |
|---|---|
| **Groundwater depletion** | **Groundwater levels are declining** due to over-extraction for agriculture and domestic use. The **Central Ground Water Board (CGWB)** continuously monitors aquifer conditions. Policies also include **artificial recharge measures** (like check dams and recharge wells) and **draft regulatory proposals** aimed at controlling unsustainable extraction. |
| **Aging canals and tanks** | Many of Tamil Nadu's irrigation structures are **decades old**, leading to seepage, siltation, and reduced storage. The **TNIAMP project** focuses on **rehabilitating and modernizing canals and tanks**, while **NABARD-supported repairs** provide additional state funding for infrastructure restoration. |
| **Inefficient water use** | Traditional irrigation methods often result in **high water losses**. The **Pradhan Mantri Krishi Sinchai Yojana (PMKSY)** promotes **micro-irrigation technologies**, such as drip and sprinkler systems, and supports **demonstration projects** to encourage adoption among farmers. |
| **Climate variability** | Fluctuating rainfall, droughts, and floods affect water availability and crop productivity. Policy responses include **sub-basin water management plans**, which optimize water allocation, and promoting **crop diversification into climate-resilient varieties** to reduce vulnerability. |

## 10. Conclusion

Tamil Nadu's irrigation systems are at a crossroads. The state has a rich legacy of tanks and canals but is increasingly reliant on groundwater, which is under severe stress. Modernization programs such as the Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP), PMKSY, and state-supported tank rehabilitation initiatives have shown promising results; however, long-term sustainability requires stronger groundwater governance, widespread tank rehabilitation, and institutional strengthening of Water User Associations (WUAs). To address these challenges, policies should focus on scaling up conjunctive use planning to integrate surface and groundwater management at basin and sub-basin levels, prioritizing tank and canal rehabilitation, particularly in semi-arid and smallholder-dominated regions, expanding micro-irrigation technologies while linking subsidies to water-use efficiency audits, strengthening groundwater monitoring and regulation with community-based governance and recharge incentives, and investing in real-time data systems to support informed decision-making, climate-resilient crop planning, and impact evaluation. The integration of these measures with climate-resilient practices and data-driven policy frameworks will be critical to optimize water use, enhance irrigation efficiency, and secure agricultural productivity and rural livelihoods, ensuring a resilient, equitable, and sustainable irrigation system across Tamil Nadu.

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