

## Water Management in Marathwada: Challenges and Solutions

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### Introduction

**W**ater scarcity in the Marathwada region of Maharashtra, India, has been a persistent issue, affecting agriculture, industry, and daily life. This research paper examines the various aspects of water management in Marathwada, including the challenges, existing practices, and potential strategies for sustainable water management. Through comprehensive data analysis and review of current policies, this paper aims to provide insights into the effective management of water resources in the region.

Marathwada, a region in the state of Maharashtra, India, comprises eight districts: Aurangabad, Jalna, Beed, Latur, Osmanabad, Nanded, Parbhani, and Hingoli. The region is predominantly agrarian, with a significant portion of the population dependent on agriculture for their livelihood. However, Marathwada has been facing acute water scarcity for several decades, primarily due to erratic rainfall, over-extraction of groundwater, and inadequate water management practices.

### Objectives

1. To analyze the current state of water resources in Marathwada.
2. To identify the key challenges in water management.
3. To evaluate existing water management practices and policies.
4. To propose sustainable strategies for effective water management.

### Background

#### Geographic and Climatic Context

Marathwada is characterized by a semi-arid climate, with average annual rainfall ranging from 600 mm to

800 mm, which is highly variable and unevenly distributed. The region's topography and soil types also contribute to the challenges in water conservation and management.

#### Rainfall Data

Data from the Indian Meteorological Department (IMD) over the past three decades shows significant variability in rainfall. The coefficient of variation in annual rainfall ranges from 30% to 50%, indicating high inter-annual variability. For example, in 2014, Latur district received only 369 mm of rainfall, while in 2010 it received 827 mm.

#### Soil Types

Marathwada's soil types range from black cotton soil, which has good water retention capacity, to red lateritic soil, which is less fertile and has poor water retention. This variability affects the effectiveness of irrigation practices and water conservation efforts.

#### Socio-Economic Impact

The water crisis in Marathwada has severe socio-economic impacts, including reduced agricultural productivity, migration, and increased indebtedness among farmers. The region's reliance on rain-fed agriculture makes it particularly vulnerable to fluctuations in rainfall.

#### Agricultural Impact

Agriculture in Marathwada is heavily dependent on monsoon rains. According to the Ministry of Agriculture, over 80% of the cultivated area is rain-fed. Crop failures due to inadequate rainfall have led to significant economic losses. In 2015, Marathwada experienced a 40% drop in crop yields compared to the previous year.

#### Migration and Livelihoods

The lack of water has forced many farmers to migrate to urban areas in search of employment. A survey by the National Sample Survey Office (NSSO) in 2017 reported that 15% of households in

Marathwada had at least one member who migrated due to water scarcity.

### Challenges in Water Management

#### Erratic Rainfall and Droughts

Marathwada experiences frequent droughts, with some districts receiving less than 50% of the average rainfall in certain years. This unpredictability severely affects water availability for agriculture and domestic use.

#### Rainfall Variability

Analysis of rainfall data from 1990 to 2020 indicates a declining trend in annual precipitation. The coefficient of variation in rainfall is high, indicating significant inter-annual variability. For instance, in 2015, Aurangabad district received only 373 mm of rainfall, which is less than 50% of the long-term average.

#### Over-Extraction of Groundwater

Over-reliance on groundwater for irrigation has led to a significant decline in groundwater levels. Data from the Central Ground Water Board (CGWB) indicates that several blocks in Marathwada are categorized as "over-exploited" or "critical."

#### Groundwater Depletion

In Beed district, groundwater levels have dropped by more than 2 meters per year over the last decade. The water table in Latur has also witnessed a drastic decline, with bore wells going dry at depths exceeding 300 feet.

#### Inefficient Water Use

Traditional irrigation methods, such as flood irrigation, result in substantial water wastage. There is a lack of adoption of efficient irrigation techniques like drip and sprinkler systems.

#### Water Use Efficiency

Agriculture accounts for over 80% of water use in Marathwada. The water use efficiency in the region is low, with water productivity ( $\text{kg}/\text{m}^3$ ) being below the national average. For example, sugarcane, a major crop in the region, consumes over 2000 liters of water per kilogram of produce.

#### Inadequate Infrastructure

The region suffers from poor infrastructure for water storage and distribution. Many existing dams and reservoirs are not utilized to their full potential due to siltation and lack of maintenance.

### Infrastructure Deficiencies

Several major irrigation projects, such as the Jayakwadi Dam, face issues related to sedimentation, reducing their storage capacity. Additionally, the canal networks are often poorly maintained, leading to significant water losses during conveyance.

### Existing Water Management Practices

#### Government Initiatives

The Maharashtra government has implemented several schemes, such as the Jalyukt Shivar Abhiyan, aimed at improving water availability through watershed development, construction of check dams, and desilting of water bodies.

#### Jalyukt Shivar Abhiyan

Launched in 2015, the Jalyukt Shivar Abhiyan aims to make 5,000 villages drought-free. The program includes measures like deepening and widening of streams, constructing check dams, and repairing existing water bodies. As of 2022, the initiative has covered over 16,000 villages, creating an additional water storage capacity of 24 TMC (thousand million cubic feet).

#### Scheme Impact

A 2020 evaluation report by the Water Resources Department of Maharashtra indicated that the program increased water storage capacity by 34%, improved groundwater levels by 1.5 meters on average, and benefited over 10 million people.

#### Community-Based Approaches

Some communities in Marathwada have adopted innovative practices like rainwater harvesting, participatory watershed management, and the revival of traditional water bodies. These initiatives have shown promise in enhancing local water security.

#### Case Study: Hiware Bazar

Hiware Bazar, a village in Ahmednagar district, implemented watershed development and water conservation practices, transforming from a drought-prone area to a water-surplus village. The community's efforts included constructing check dams, contour trenches, and percolation tanks, resulting in a significant rise in groundwater levels.

#### Technological Interventions

The use of technology, such as remote sensing and Geographic Information Systems (GIS), has been

instrumental in mapping water resources and planning water management interventions.

### **GIS and Remote Sensing**

GIS and remote sensing technologies are used for creating detailed hydrological maps, monitoring groundwater levels, and identifying potential sites for water conservation structures. These tools have been pivotal in the planning and execution of the Jalyukt Shivar Abhiyan.

### **Proposed Strategies for Sustainable Water Management**

#### **Integrated Water Resources Management (IWRM)**

Implementing IWRM principles can help in the coordinated development and management of water, land, and related resources. This approach emphasizes the involvement of all stakeholders, including government agencies, local communities, and private sector entities.

#### **IWRM Framework**

IWRM involves the integration of various water management aspects, such as surface and groundwater management, water quality management, and ecosystem protection. In Marathwada, an IWRM framework can help balance water needs across different sectors and ensure sustainable use.

#### **Promotion of Efficient Irrigation Techniques**

Encouraging the adoption of drip and sprinkler irrigation systems can significantly reduce water consumption in agriculture. Subsidies and financial incentives can be provided to farmers for installing these systems.

#### **Benefits of Efficient Irrigation**

Drip irrigation can save up to 50% of water compared to traditional methods, while also improving crop yields. In regions where drip irrigation has been implemented, such as parts of Aurangabad, there has been a noticeable increase in water use efficiency and agricultural productivity.

#### **Groundwater Recharge and Rainwater Harvesting**

Large-scale implementation of groundwater recharge structures and rainwater harvesting systems can help in augmenting groundwater levels. Urban areas should also adopt rooftop rainwater harvesting to reduce dependency on external water sources.

### **Techniques for Groundwater Recharge**

Techniques such as the construction of recharge wells, percolation tanks, and recharge shafts can significantly enhance groundwater levels. For instance, in Nanded district, the construction of 200 recharge wells has led to a rise in the groundwater table by up to 3 meters in certain areas.

### **Infrastructure Development and Maintenance**

Investing in the repair and maintenance of existing water infrastructure, such as dams and canals, is crucial. Constructing new storage facilities and improving water distribution networks will enhance water availability and reduce losses.

### **Modernizing Irrigation Infrastructure**

Modernization of irrigation infrastructure includes lining canals to prevent seepage, automating water distribution to reduce wastage, and constructing new storage facilities to capture monsoon runoff. These measures can improve water use efficiency and ensure equitable distribution.

### **Policy and Governance Reforms**

Strengthening water governance through clear policies, effective regulation, and robust monitoring mechanisms is essential. Establishing water user associations and promoting community participation in water management can lead to better outcomes.

### **Strengthening Institutions**

Forming local water user associations (WUAs) can empower communities to manage their water resources effectively. These associations can oversee the operation and maintenance of irrigation systems, ensuring fair distribution and resolving conflicts.

### **Data and Analysis**

#### **Rainfall Patterns**

Analysis of rainfall data over the past three decades shows a declining trend in annual precipitation. The coefficient of variation in rainfall is high, indicating significant inter-annual variability.

#### **Groundwater Levels**

Data from the Central Ground Water Board indicates that groundwater levels in Marathwada have been declining at an alarming rate. In several blocks, the water table has dropped by more than 2 meters per year.

#### **Agricultural Productivity**

Crop yield data from the Ministry of Agriculture shows a direct correlation between water availability

and agricultural productivity. Years with below-average rainfall correspond to significant drops in crop yields, particularly for water-intensive crops like sugarcane and cotton.

### Socio-Economic Indicators

Data from the National Crime Records Bureau (NCRB) indicates that Marathwada has one of the highest rates of farmer suicides in India. In 2019, over 900 farmer suicides were reported in the region, with water scarcity being a significant contributing factor.

### Recommendations

#### 1. Adopt a Multi-Pronged Approach:

Combining technological, infrastructural, and community-based solutions for comprehensive water management.

#### 2. Enhance Data Collection and Monitoring:

Establish a robust system for real-time data collection on rainfall, groundwater levels, and water usage to inform policy and management decisions.

#### 3. Promote Education and Awareness:

Conduct awareness campaigns to educate farmers and communities about water conservation practices and efficient water use.

#### 4. Encourage Public-Private Partnerships:

Leverage the expertise and resources of the private sector in water management projects and initiatives.

### Detailed Recommendations

#### 1. Integrated Water Resources Management (IWRM):

- Establish a regional water management authority to coordinate efforts across different sectors and stakeholders.
- Develop a comprehensive water management plan that includes surface water, groundwater, and rainwater harvesting strategies.
- Promote the adoption of IWRM principles through capacity-building programs and workshops.

#### 2. Efficient Irrigation Techniques:

- Provide financial incentives and subsidies for farmers to adopt drip and sprinkler irrigation systems.

- Conduct training programs to educate farmers on the benefits and operation of efficient irrigation systems.
- Promote the cultivation of less water-intensive crops and crop diversification to reduce water demand.

#### 3. Groundwater Recharge and Rainwater Harvesting:

- Implement large-scale groundwater recharge projects, including the construction of recharge wells, percolation tanks, and recharge shafts.
- Encourage urban areas to adopt rooftop rainwater harvesting systems through building regulations and incentives.
- Promote community-led rainwater harvesting initiatives and provide technical and financial support for their implementation.

#### 4. Infrastructure Development and Maintenance:

- Invest in the modernization of irrigation infrastructure, including the lining of canals, construction of new storage facilities, and automation of water distribution systems.
- Ensure regular maintenance and desilting of existing dams, reservoirs, and canals to enhance their efficiency and storage capacity.
- Develop and implement a comprehensive plan for the repair and maintenance of rural water supply systems.

#### 5. Policy and Governance Reforms:

- Strengthen water governance through clear policies, effective regulation, and robust monitoring mechanisms.
- Establish and support water user associations (WUAs) to empower communities to manage their water resources effectively.
- Promote community participation in water management through capacity-building programs and awareness campaigns.

### Conclusion

The water crisis in Marathwada requires urgent and sustained efforts to address the multifaceted challenges. Through a combination of integrated water resources management, technological interventions, infrastructure development, and community participation, it is possible to achieve sustainable water management in

the region. Collaborative efforts by government, communities, and the private sector are essential to ensure water security and improve the socio-economic well-being of the people in Marathwada.

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