

## Feeding India, Draining India: Policy Dilemmas in the Age of Water Stress

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### Abstract

India's agricultural achievements, stemming from the Green Revolution, have been predominantly dependent on groundwater irrigation and subsidized energy, leading to significant water stress and environmental deterioration. Groundwater depletion currently endangers agricultural production, farmer livelihoods, and ecological stability, especially in north-west India, where aquifer recharge is insufficient compared to extraction rates. This article analyzes India's groundwater dilemma by evaluating policy incentives that promote water-intensive crops and investigates government initiatives such as PM-KUSUM, Atal Bhujal Yojana, and NMSA that seek to reconcile production with sustainability. It additionally advocates for new reforms—crop diversification, agrivoltaics, and community water governance—to recalibrate incentives for long-term resilience. The paper emphasizes the necessity for a paradigm shift in agriculture policy by integrating market-based support systems with climate-resilient technology to guarantee food and water security amid escalating climatic threats.

**Keywords** – Groundwater depletion, Agricultural policy, Crop diversification, Water sustainability

### 1. Introduction

India's agricultural advancement in recent decades has predominantly depended on groundwater irrigation, subsidised energy, and a Green Revolution framework that emphasised high-yield, water-intensive rice and wheat cultivation. Currently, India is the foremost global consumer of groundwater for irrigation, and this unsustainable extraction has resulted in significant environmental and socio-economic repercussions.

Research indicates that persistent groundwater extraction has severed the connection between water availability and rainfall in north-west India, signifying a pivotal moment: even increased monsoon precipitation fails to adequately replenish aquifers due to ongoing overexploitation. It is asserted that if current depletion trends continue, cropping intensity might decrease by as much as 68% in groundwater-stressed areas, jeopardising food output and farmers' incomes.

Policy incentives, including subsidised power and minimum support prices (MSP), have inadvertently bolstered the growth of water-intensive cereals, exacerbating depletion.

A significant study in the Indo-Gangetic Plains revealed that transitioning from rice and wheat to millet and sorghum could decrease water usage by 32%, enhance calorie production by 39%, and nearly double farmers' profits, surpassing the benefits of adopting drip irrigation alone (Chakraborti et al., 2023).

In addition to the purely quantitative environmental costs, groundwater depletion has far-reaching consequences: diminishing wells elevate pumping energy expenses, decrease yields, exacerbate agricultural distress, and contribute to suicides, particularly evident in Punjab, where 79% of groundwater blocks are over-exploited.

Furthermore, in the absence of policy intervention, climate change is anticipated to significantly exacerbate depletion rates – potentially tripling losses by 2080 – thereby intensifying concerns related to food and water security.

India faces a multifaceted dilemma: reconciling agricultural production, food security, and farmers' livelihoods with the pressing need to conserve limited groundwater supplies. Solutions necessitate a reevaluation of incentive frameworks, agricultural practices, and governance systems to prevent ecological degradation while maintaining economic stability.

## **2. Government Schemes addressing the Dilemma**

The Government of India has initiated many targeted projects to balance agricultural productivity with the preservation of water resources. These programs seek to enhance agricultural productivity, stabilise farmers' incomes, and concurrently promote sustainable resource utilisation, particularly of groundwater. The subsequent government programs are classified according to their principal objectives: those concentrating on augmenting agricultural output and those dedicated to advancing water sustainability. Collectively, they constitute a multifaceted policy initiative aimed at tackling this pressing national issue.

### **2.1. PM-KUSUM Scheme (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan) –**

Initiated in March 2019, PM-KUSUM offers subsidies—generally approximately 60%—to farmers who install solar irrigation pumps and grid-connected solar power systems, thereby diminishing dependence on diesel and grid electricity, decreasing irrigation expenses, and enhancing water-energy efficiency (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan, 2019)

The initiative promotes solar pumping, which fosters regulated water usage—farmers typically align solar production with irrigation schedules—thereby indirectly supporting groundwater conservation while enhancing yields through increased water access and reduced energy costs (KUSUM plan details).

### **2.2. National Mission for Sustainable Agriculture (NMSA) –**

The National Mission for Sustainable Agriculture (NMSA), as part of India's National Action Plan for Climate Change (NAPCC, 2008), encompasses multiple focused sub-programmes.

- Soil Health Management — Advocates for balanced nutrient application to enhance productivity and diminish water-intensive methods.
- Paramparagat Krishi Vikas Yojana (Organic Farming) - Improves soil moisture retention and resilience.
- Development of Rainfed Areas, Management of On-Farm Water Resources, and Initiatives in Bamboo and Agroforestry (particularly bamboo cultivation on marginal lands)

These treatments seek to enhance productivity, resource efficiency, and resilience, focussing on yield enhancement and water sustainability.

### **2.3. Atal Bhujal Yojana (ABHY) –**

Initiated in December 2019 and endorsed by the World Bank, ABHY emphasises groundwater

governance in seven high-stress states (Gujarat, Haryana, Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Uttar Pradesh) through community engagement, gramme panchayat water budgets, and capacity enhancement (Atal Bhujal Yojana launched December 2019).

This mitigates over-extraction by enabling local users to oversee groundwater, implement recharge strategies, and limit extraction—thus promoting sustainable water utilisation within the community.

**2.4. National Innovations in Climate-Resilient Agriculture (NICRA) –** Initiated in February 2011 by ICAR, NICRA amalgamates:

- Strategic research on drought- and heat-resistant cultivars and water-efficient agricultural practices (e.g., System of Rice Intensification, aerobic paddy);
- Technology demonstrations in over 100 at-risk districts;
- Capacity enhancement via the training of scientists, extension agents, and agricultural producers (National Innovations in Climate Resilient Agriculture initiated in 2011)

The effort promotes water-efficient crop varieties and adaptable practices, hence improving productivity and resilience.

**2.5. Mission Kakatiya (Telangana) –**

Mission Kakatiya, a groundbreaking state-level program (2015–2018), repaired over 27,700 tanks and lakes to enhance surface irrigation, replenish groundwater, and increase irrigated ayacut. In the revitalised regions, paddy yields climbed by between 4–12%, maize by around 7%, and fishing income surged by approximately 30%, while groundwater levels—and agricultural incomes—significantly improved (Mission Kakatiya findings).

### **3. Proposed Policy Initiatives**

While existing government plans have provided the framework for boosting agricultural productivity and water use, broader structural reforms are needed to address the core causes of resource misuse and environmental deterioration. The following proposed policy approaches attempt to align farmer incentives with sustainable practices, boost technological innovation, and increase climate resilience. These initiatives provide a framework for reconciling food security with enduring ecological sustainability.

#### **3.1. Market-Based Price Deficiency or Direct Income Support**

Market-oriented Price Deficiency Payments (PDP) or Direct Income Support (DIS) are feasible alternatives to Minimum Support Price (MSP)-based procurement. The PDP compensates farmers for price discrepancies without altering cropping patterns, whereas the DIS provides reliable, non-market-linked assistance. Research on Madhya Pradesh's Bhavantar Bhugtan Yojana and Telangana's Rythu Bandhu indicates enhanced stability in farmer income and increased resource-use efficiency.

#### **3.2. Crop Diversification Mandates and Rotational Planning**

Enforcing crop variety and rotational planning can diminish water use, augment soil vitality, and elevate

agricultural revenues. Substituting water-intensive rice with millets, pulses, or oilseeds reduces irrigation requirements by as much as 30% while enhancing caloric and nutritional outputs (Chakraborti et al., 2023). Research indicates that diverse rotations enhance resilience to climatic shocks and mitigate groundwater stress.

### 3.3. Agrivoltaics and Decentralized Renewable Energy Integration

Agrivoltaics, the simultaneous use of solar panels and crops on the same land, facilitates dual land utilisation, enhancing energy accessibility while maintaining agricultural productivity. It bolsters agricultural resilience, diminishes evapotranspiration, and ameliorates microclimates. The integration of decentralised solar irrigation systems, such as PM-KUSUM, mitigates groundwater overexploitation and dependence on diesel fuel. Research indicates that agrivoltaic farms can enhance land production by as much as 70% (Barron-Gafford et al., 2019).

### 3.4. Community Water Governance with Water-User Charges

Community-oriented water governance, bolstered by water-user fees, fosters sustainable resource utilisation by encouraging conservation and responsibility. Participatory methodologies, shown by the Atal Bhujal Yojana, enable local stakeholders to collaboratively oversee groundwater resources (World Bank, 2021). Implementing volumetric pricing and localised monitoring can mitigate over-extraction and synchronise water consumption with supply. These methods improve transparency, equality, and the sustainability of groundwater over the long term.

### 3.5. R&D and Diffusion of Climate-Resilient Seed Varieties

The research and development (R&D) of climate-resilient seed varieties, including drought-, heat-, and flood-tolerant crops, is crucial for maintaining productivity amid climate stress. India has introduced more than 100 types through efforts such as NICRA (ICAR, 2023). Research indicates that utilising stress-resilient seeds can mitigate crop losses by 15–25% during harsh weather conditions. Successful spread necessitates the enhancement of seed systems, the education of farmers, and the localised evaluation of varieties.

## 5. References

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