June 2023

# Kurukshetra

A JOURNAL ON RURAL DEVELOPMENT

# Water Conservation


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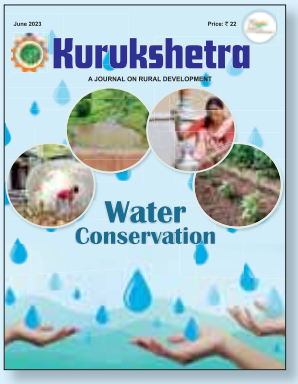


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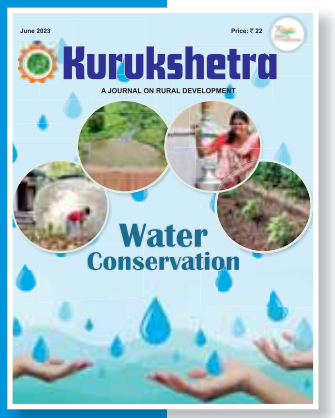


# Editorial

Imagine your life without water for a moment. If you could not find water for your daily uses for the first half of your day, you most likely would not be able to survive. Water conservation is the need of the hour. As we set conservation goals for the years to come, it is essential to recognise the works and efforts done in order to meet the targets of Water Conservation. The Government is consistently striving to effectively deal with the water crisis situation through several schemes and programmes to preserve the natural sources and make people aware to save every drop of water.

As water brings life to earth, the author of the article, '*Water Conservation through Community Planning*' indicated that the conservation programmes would be successful in achieving their goals only if the community and the end-beneficiaries were duly engaged in various stages of the programmes' implementation – from the stage of identifying the need to the prioritisation of conservation activities, implementation, and community monitoring of water works.

The availability of sufficient water for the growing population will be one of the crucial challenges for human development across the globe. In this concern, the author of the article, '*Making Villages Water Sufficient*' provides an insight into the role of local institutions such as, panchayat in achieving water-sufficient villages. The author further explains that how the panchayat secretariat can play a role of 'hyper local platform' or a 'point of contact' by coordinating and closely working with all stakeholders towards making Indian villages water-sufficient, which will ensure water security for sustainable development with equity.

The article, '*Educating People to Save Every Drop of Water*' identifies global water crisis as one of the most significant challenges humanity faces today. In response to this crisis, the United Nations has established a target under its 2030 Agenda for Sustainable Development, which is to ensure that everyone has access to clean water and sanitation. The primary focus is to attain universal access to safe and affordable drinking water that is equitable for all by 2030.

During the Amrit Kaal, India is looking towards water as the future. With this issue, the ultimate objective is for people to appreciate water and all that it offers, and to strive for its continuous conservation. We hope that our readers would be able to know the importance of water conservation through this issue and save more water for the future generations.

# Fostering Water Management for Food Security

**The global food system and its sustainability are facing several challenges due to increasing pressure on natural resources, especially land and water, while in the future the demand for food is set to grow manifold. Indeed, the sustainability of the food system in the future will require much more resource efficient production with prime focus in conservation and management of resources like water. In fact, water management will be one of the most significant factors in the years to come to ensure food security and achieve SDGs. The new India sees efficient water management as key to its future needs to emerge as the world leader.**

**Dr Neelam Patel**
**Dr Tanu Sethi**

Water is an essential input for agricultural production and food security. Worldwide, agriculture sector is the biggest user of water, withdrawing about 70 per cent of all surface and groundwater through irrigation. Globally, rainfed farming produces 60 per cent of the world's food on 80 per cent of the cultivated land. While, irrigated farming produces 40 per cent of world's food production on 20 per cent of the land (FAO, 2021).

In India, agriculture sector uses 80–90 per cent of total water used in the country and, yet, half of the area under agriculture remains rainfed. Irrigation increases the yields of most crops by 100 to 400 per cent. The net-irrigated agriculture in India covers 75456 thousand hectares, while the gross irrigated area is 112229 thousand hectare (DE&S, 2023). The main source of water is the annual precipitation including snowfall in India. It is about 4000 billion cubic meters (BCM) and out of this total available water resource

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is only 1123 BCM i.e., 28.1 per cent (690 BCM, from surface water resources and 433 BCM, is the groundwater resources). As per the latest assessment (2022), the annual extractable ground water resource is 398 BCM. The annual ground water extraction for all uses is 239.16 BCM, out of which 208.49 BCM (87 per cent) has been utilised for agriculture activities (MoJS, 2022a).

With rising population, climate change, changes in land use pattern and water cycle, particularly rainfall pattern, desertification-water management and conservation has become global priorities. India is the home to about 18 per cent of the world's population and has only 4 per cent of its water resources. The per-capita availability of water of less than 1000 $m^3$ and that poses India as one of the most water-stressed countries in the world (NITI, 2018). It is projected that by 2030, the country's water demand will be twice the available supply, that will have implications on millions of people and an eventual ~6 per cent loss in the country's GDP (NITI, 2018). With the increased size of population by 2050, agriculture will need to produce almost 50 per cent more food, livestock fodder and biofuel than in 2012 to satisfy global demand and keep on track to achieve 'zero hunger' (FAO, 2021). The total water demand for all uses is likely to be 1180 BCM by 2050. To address the gap in projected demand and supply, policy makers and scientists are working to bring shift in farming from intensive to resource efficient climate-smart farming.

Under the leadership of the Hon'ble Prime Minister of India, it is iterated that "During the Amrit Kaal, India is looking towards water as the future" and emphasised that "Water conservation is the culture of our society and the centre of our social thinking". Various initiatives are taken by the Government of India for water conservation in producing maximum yield with minimum water. Sahi Fasal campaign, River Development and Ganga Rejuvenation, National Water Mission, Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)- Har Khet Ko Pani (HKKP), Per Drop More Crop, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Repair, Renovation and Restoration (RRR) of Water Bodies Scheme etc. are initiated to encourage water conservation (MoJS, 2022b; MoJS, 2023a).

Hence, harnessing conservation of water resources, crop productivity, water productivity, judicious use of agri-inputs, advanced technologies, climate resilient agriculture practices are necessary for food security and socio-economic sustainability.

## 2. Water Resources in Agriculture: Availability and Projections

The availability of both surface and groundwater varies from one region to another. Water availability in India is shown in **Table. 1**. The major portion of water is drawn for use by the Agriculture sector, followed by other sectors like energy, drinking water etc.

In India, the area under irrigation has continuously increased over the years. The main sources of irrigation in the country are canals, tanks, and wells, including tubewells. The gross irrigated area (GIA) during 2011-12 was 91931 thousand ha and net irrigated area (NIA) was 66009 thousand ha. During 2019-20, the GIA is 112229 thousand ha and NIA is 75456 thousand ha (DES, 2023). Groundwater contributes more than 79 per cent of the total ultimate potential through minor irrigation. At the same time, water scarcity coupled with high demand in farming, small and fragmented land holdings, depleting soil organic carbon, and degradation are challenging the sustainability factor in farming (**Table. 2**).

### Table. 1 Water availability and Sources

| | |
|---|---|
| Average Annual Rainfall (1985-2015) | 105 mm (3880 BCM) |
| Annual Rainfall (2020) | 1283 mm |
| Mean Annual Natural Run-Off | 1999.2 BCM |
| Total Utilisable Water | 1122 BCM |
| Net Ground Water Availability (2013) | 411 BCM |
| Estimated Utilisable Surface Water Potential | 690 BCM |
| Total Replenishable Ground Water Resources (2013) | 432BCM |
| Ultimate Irrigation Potential | 139.9 Mha (From Surface Water= 76 Mha and 64 Mha from Groundwater) |

*Source: Central water commission, Ministry of Jal Shakti, Annual Report 2021-22.*

## Table. 2 Estimated water demand in India for different sectors

| Sector | Water Demand in BCM (Billion Cubic Meter) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Standing Sub-Committee of MOWR | | | NCIWRD | | | | | |
| | 2010 | 2025 | 2050 | 2010 | | 2025 | | 2050 | |
| | | | | Low | High | Low | High | Low | High |
| Irrigation | 688 | 910 | 1072 | 543 | 557 | 561 | 611 | 628 | 807 |
| Drinking Water | 56 | 73 | 102 | 42 | 43 | 55 | 62 | 92 | 111 |
| Industry | 12 | 23 | 63 | 37 | 37 | 67 | 67 | 81 | 81 |
| Energy | 5 | 15 | 130 | 18 | 19 | 31 | 33 | 63 | 70 |
| Other | 52 | 72 | 80 | 54 | 54 | 70 | 70 | 111 | 111 |
| **Total** | **813** | **1093** | **1447** | **694** | **710** | **784** | **843** | **973** | **1180** |

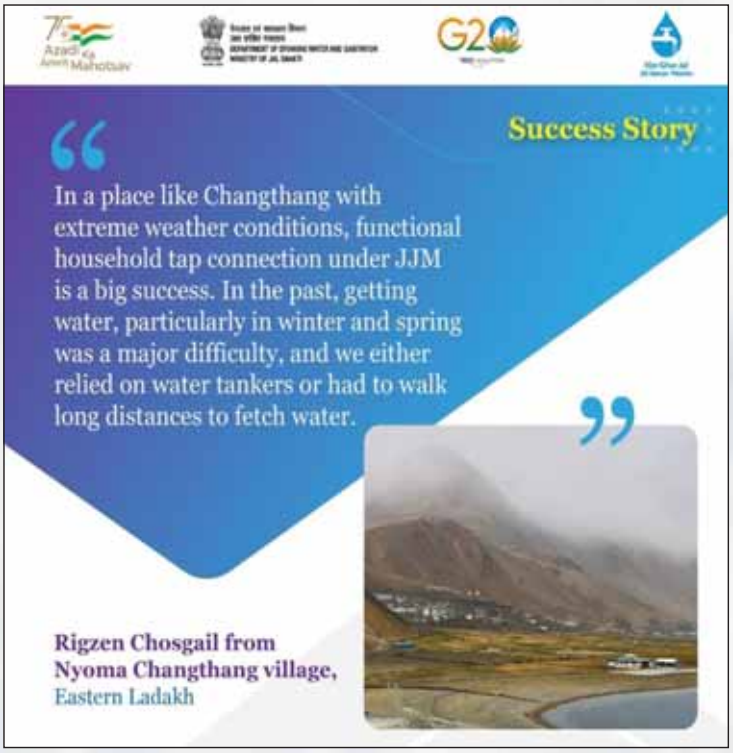
*Source: Basin Planning Directorate, CWC, XI Plan Document (Report of the Standing Sub-Committee on "Assessment of Availability and requirement of Water for Diverse uses-2000"; Note: NCIWRD: National Commission on Integrated Water Resources Development; BCM: Billion Cubic Meters; MOWR: Ministry of Water Resources).*

## 3. Water Conservation Strategies in Agriculture

Agriculture is a key sector in which there is an urgent need to promote water-saving strategies. Noticeably, the main source of replenishable groundwater resources is recharge from rainfall which contributes about 61 per cent of the total annual groundwater recharge. A major part of the country receives annual normal rainfall between 75 to 150 cm. A slew of schemes have been initiated by the Government of India to prevent non-judicious use of water resources, viz.

- **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY):** The PMKSY launched during the year 2015-16 with the vision of extending the coverage of irrigation 'Har Khet ko Pani' and improving water use efficiency, i.e., 'Per Drop More Crop'. The scheme offers an end-to-end solution for irrigation through source creation, distribution, management, field application, and extension activities. The PMKSY has been an amalgamation of schemes, viz. Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Jal Shakti, Department of Water Resources, River Development & Ganga Rejuvenation, Integrated Watershed Management Programme (IWMP) of the Department of Land Resources (DoLR) and the On Farm Water Management (OFWM) of the Department of Agriculture and Cooperation (DAC) (MoA&FW, 2022a). With an outlay of ₹ 93,068 crore for 2021-26 under the PMKSY, it will benefit about 22 lakh farmers (MoJS, 2023).
- **Per Drop More Crop:** Per Drop More Crop (PDMC) scheme was launched in the year 2015-16 as a component under PMKSY and focuses on enhancing water use efficiency, productivity and reduction in inputs costs through Micro Irrigation technologies, i.e., drip and sprinkler irrigation systems. From 2015-16, an area of 69.55 lakh hectare has been covered under Micro irrigation through the PDMC scheme (MoA&FW, 2022b). From 2022-23, PDMC is being implemented under Rashtriya Krishi Vikas Yojana (RKVY). Also, to encourage installation of Drip and Sprinkler Irrigation systems, the Government provides financial assistance or subsidy to small and marginal farmers @55 per cent of the indicative unit cost and @45 per cent to other farmers under the PDMC scheme.

  The irrigation efficiency under micro irrigation is 80-90 per cent and has been adopted in 21 per cent of total irrigated area in the country. Also, a Micro Irrigation Fund of initial corpus ₹ 5000 crore was created with NABARD to facilitate the States in mobilising the resources for expanding coverage of Micro Irrigation by taking up special and innovative projects. In the Union Budget for 2021-22, this corpus was increased to Rs.1000 crores.
- **Sahi Fasal Campaign:** The 'Sahi Fasal' campaign is a component of the National Water Mission initiated by the Ministry of Jal Shakti on 14 November 2019. This campaign envisions raising awareness




amongst the farming community on water efficient farming through selection of agricultural crops that utilises water more efficiently and micro irrigation technology (MoJS, 2023b).

- **Bhartiya Prakratik Krishi Paddhati:** Natural farming is promoted through the Bhartiya Prakratik Krishi Padhati (BPKP) Scheme of Government of India. The scheme aims at minimising the cost of cultivation, recreation of soil ecosystem, resource conservation, enhancing farmers' income, and ensuring environment sustainability. Natural farming is a resource efficient agroecological based farming practice defined as a chemical-free or traditional farming based diversified farming system that integrates crops, trees, and livestock with functional biodiversity (NITI, 2021). It is estimated that Natural Farming requires 50 to 60 per cent less water and electricity and reduces methane emissions (MoA&FW, 2021).

Along with these schemes, measures are underway to mitigate the water footprints of crops through diversification and dietary shifts. The India Economic Survey (2021-22) highlighted that increased paddy cultivation in 44 million hectares that has resulted in overexploitation of groundwater resources, particularly in the northwest and some parts of South India. Few States such as Punjab and Haryana utilises more than 90 per cent of groundwater annually (Ramesh Chand et al., 2022). Identification of cropping pattern based on ideal agroclimatic condition, availability of resources like land and water, market, socio-economic condition of the farmers are essential for water conservation. Concerted efforts were made by the Ministry of Agriculture and Farmers Welfare in promoting states to diversify agricultural/ horticultural crops as per the local need through various ongoing schemes viz National Food Security Mission (NFSM), National Mission on Oilseeds and OilPalm (NMOOP), Rashtriya Krishi Vikas Yojana (RKVY)/ Mission for Integrated Development of Horticulture (MIDH)/ National Mission for Sustainable Agriculture (NMSA)/Rainfed Area Development (RAD), etc. (MoA&FW, 2018).

Through the State Agriculture Department / Indian Council of Agricultural Research (ICAR)/ State Agricultural Universities (SAUs)/Krishi Vigyan Kendras (KVKs), farmers awareness campaigns and capacity building initiatives were undertaken and awareness on land and water pattern, climate smart farming, new agri-technologies, and efficient irrigation techniques were demonstrated at the farmers' fields. The ICAR has identified and documented efficient alternative cropping systems considering agro-ecological, bio-physical and socio-economic factors that have high productivity and income security for farmers. Also, nutritious Millets such as Shree Anna Bajra and Shree Anna Jowar are encouraged for cultivation in water scarce regions of the country.

**Monitoring of SDG Indicator:** At the national level, Water Use Efficiency (WUE) is estimated as the sum of the efficiencies in the major economic sectors - weighted as per the proportion of water withdrawn by each sector over the total withdrawals. The SDG indicator 6.4.1 focuses on 'substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity by 2030'. It measures changes in WUE to address the economic component of SDG target 6.4. together with indicator 6.4.2, it will provide vital information to ensure that water resources support the world's ecosystems and continue to be available for future generations. Worldwide,

WUE has risen by 12 per cent from 2015 to 2019. (https://www.fao.org/sustainable-development-goals/indicators/641/en/)

**Water Efficient Goods:** In India, the Bureau of Water Use Efficiency (BWUE) was set up by the Government of India under Department of Water Resources, RD & GR on 20 October 2022 for promotion, regulation, and control of efficient use of water in irrigation, industrial and domestic sectors. BWUE have published the Indian Standards for the mico-irrrigation and sanitary products towards addressing water efficiency (MoJS, 2022c). In irrigation sector, Ministry of Jal Shakti under CADWM part of PMKSY Scheme has been promoting different water efficient technologies like underground pipeline and micro irrigation (drip irrigation and sprinkler irrigation) to conserve water resources (MoJS, 2022).

## Community Participation

Water conservation methods in agriculture can be disseminated through community participation, women self-help groups, cooperatives, etc. Rainwater harvesting measures, groundwater recharge, use of micro-irrigation technology, climate smart cropping patterns and resource conservation technologies can be made available to all farmers through these community centres.

## Way Forward

Water is a State subject and requires cooperation to harness steps for augmentation, conservation, and efficient management of water resources across States. India being an agrarian economy, ensuring food security and natural resources conservation is needed to guide land and water allocation to ensure sustainable agriculture and socio-economic development. Ecosystem services, and incentives should be considered to encourage efficient use of water. ❑

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# Water Conservation through Community Planning

**The water conservation programmes would be successful in achieving their objectives only if the community and the end-beneficiaries were duly engaged in various stages of the programme's implementation – from the stage of identifying the need to prioritisation of conservation activities, implementation, and community monitoring of water works.**

**Dr. K. K. Tripathy**

Water brings life to earth. Without its availability and sustainable management, the world would not be able to attain Sustainable Development Goal 6 (SDG 6). There is enough water for all citizens, provided they accord the right value to it, and use and manage it efficiently. Delay in addressing management of water resources may severely limit our drives towards attaining other related SDGs relating to poverty reduction, food and nutrition, health, gender equality, energy, sustainable cities, economic growth, environment, etc.

The magnitude of India's population, their prevailing socio-economic conditions, and the quality of their lives demand an all-round development of basic infrastructure in order to achieve the objectives of inclusive growth with equity and social justice. Out of such immediate infrastructure needs, an important component is to arrange an adequate, timely, and affordable water supply for becoming a water-secure nation, and ensuring a healthy and economically productive society. India is home to 18 per cent of the world's population but has only 2.4 per cent of its land resources. The country receives about 1,200 mm of rainfall each year, out of

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which only 6 per cent is stored, indicating that the issue is not lack of rainfall in India but how much the country can conserve and save to meet water needs.

## Need to Conserve Water Resources

The adequate availability of groundwater is important for any country to secure food and water for its future citizens. Increased demand for freshwater uses for multifarious causes, dependency on rain-fed irrigation, varied rainfall patterns, population growth, rapid industrialisation, and urbanisation have led to massive exploitation of water, and reduction in the groundwater levels. Farmers are digging borewells to irrigate their land. Fragmentation of landholdings coupled with a gradual reduction in farm-size necessitates extensive and over-exploitation of groundwater resources. Two-thirds of India's irrigation needs are met from groundwater sources. 80 per cent of India's rural and 50 per cent of its urban drinking water needs are met through groundwater exploitation. It is estimated that over the last four decades, around 84 per cent of the total incremental irrigation has been sourced from groundwater. It is, therefore, a must to understand how to conserve water resources and how to ensure that the conservation methods applied are sustainable. The country now has the responsibility to conserve every drop of water to ensure water security for the future generation. The data on groundwater extraction for irrigation purposes indicates that out of the total extraction of 244.92 billion cubic metres (BCM) of groundwater, 88.85 per cent was used for irrigation.

## Community Participation in Water Conservation

Water is a 'State' subject as per the Constitution of India. Hence, steps to effectively augment, conserve, and manage water resources have remained the primary responsibility of the respective States. Such efforts are supported through various Central Government Schemes with required provisions of technical and financial assistance. Present-day development discourses have increasingly underscored the significance of the community's role in the participation and ownership of various development interventions. To limit the adverse impacts of large-scale water projects, public policy-makers and development practitioners have advocated a gradual shift from state assisted large-scale water resource management projects to community-based and participatory water resource management programmes.

### *Vanarai* – People's Movement for Green India

***Vanarai* – a Pune (Maharashtra) based organisation, dedicates its energy in empowering rural India, primarily, by focusing on natural resource management, fulfilling basic necessities, and capacity building of beneficiary client through a well-calibrated participatory approach. Founded way back in 1986, this organisation always believed in sustainable development and followed an integrated approach towards improving and innovating farming and farm practices to remove difficulties due to adverse climatic conditions. Sustainable rural development approaches involved activities viz. soil conservation, agriculture and livestock development, water conservation, and ecological restoration for ensuring sustainable livelihoods opportunities. With the active participation of community in planning and execution of identified activities, during the last 37 years of its existence, Vanarai has been able to conserve 1,460 crore litres of water benefiting 1.47 lakh acres of cultivable land and more than 10,000 livestock population. It has been able to plant 2.5 crore of trees by encouraging community nurseries and distributing saplings through the community. So far, *Vanarai* has spread its wings of action to 168 villages covering more than 4 lakh beneficiaries. The economic benefits (direct and indirect) to the society have been estimated to be Rs. 250 crore in 2022-23, where 1 lakh families have been socially and economically uplifted due to community-based sustainable drives of the institution. Cumulatively, the organisation has created 1,460 crore litres of recharge and storage capacity through construction of 3,169.8 kms of continuous contour trenches, 10,297 loose boulders, 279 cement nala bunds, 34 kms of nala deepening works and 80 earthen bunds. Its pioneering conservation efforts, so far, have been successful in conserving 2.92 lakh cubic metres of soil. The success factors of the institution are – effective and timely need-based planning, ground data analysis, conduct of socio-economic study with identification of target beneficiaries and scope of targeted intervention, and outcome-oriented scientific methods of activity implementation.**

*Source: Vanarai – People's Movement for Green India [www. vanarai.org]*

Civic participation in the management processes of any public development endeavour results in better outcomes. (See box on page No. 12). A number of states have done commendable work implementing various water conservation initiatives. Some of which are described in **Table 1**.

## Table 1: Water Conservation Programmes Implemented by Select States

| SN | State | Name of Initiative | Programme Activity |
|---|---|---|---|
| 1 | **Andhra Pradesh** | **Neeru-Chettu** | Rejuvenating and revitalising natural resources. De-silting of tanks and feeder channels, etc., are taken up, additional water storage is created.<br>Aimed at collective participation and spread of awareness to make the State 'drought proof' through better Water Conservation. |
| 2 | **Bihar** | **Jal Jeevan Hariyali** | Identification, restoration, and renovation of all public water storage structures – ponds / canal / pines, etc.<br>Construction of check dams and other water harvesting structures in small rivers / drains and water storage areas of hilly areas.<br>The objective is to encourage farmers to participate in water conservation initiatives of the government and to get sensitised on the use of alternative crops, drip irrigation, organic farming, and other new technologies with less dependence on irrigation. |
| 3 | **Gujarat** | **Sujalam Sufalam Jal Sanchay Abhiyan** | Deepening water bodies in the state before monsoon arrives to increase storage of rainwater to be used during times of scarcity.<br>It is a Public Private Partnership programme and government contribution is 60 per cent of the work expenditure. |
| 4 | **Haryana** | **Jal Hi Jeevan Hai** | Encouraging farmers to adopt crop diversification and sow crops which require less water like Maize, Arhar, etc., instead of water guzzling crops such as paddy so as to conserve water. |
| 5 | **Odisha** | **Pani Panchayat** | Ensuring voluntary activity of group of farmers engaged in the collective management (harvesting and distribution) of surface water and groundwater (wells and percolation tanks).<br>Objective is to ensure optimum utilisation of water as well as improving agricultural production. |
| 6 | **Maharashtra** | **Jalyukt Shivar Abhiyaan** | Deepening and widening of water streams, construction of cement and earthen stop dams, works on nullahs and digging of farm ponds. Objective is to make Maharashtra drought-free by making 5,000 villages free of water scarcity each year. |
| 7 | **Rajasthan** | **Mukhya Mantri Jal Swawalamban Abhiyan** | Extending conservation efforts to manage rainfall, runoff, groundwater & in-situ soil moisture.<br>Through convergence of schemes of various departments, works are executed through people's participation by motivating villagers & beneficiaries. |
| 8 | **Telangana** | **Mission Kakatiya** | Reclamation of water tanks by restoring minor irrigation sources. Aims at spreading minor irrigation in the state with community participation for sustainable water security. |

*Source: Author's compilation from various scheme guidelines of the respective States' websites [available online]*

## Water Conservation Initiatives of Union Government

India has about 141 million hectares of net sown area, out of which about 45 per cent (65 million hectares) is presently covered under irrigation of any source. Large-scale dependency on rainfall still persists in India, making cultivation in unirrigated areas a risk-ladened, low-remunerative, and less-productive profession. While assured or protective irrigation encourages farmers to invest more in farming technology and inputs, leading to increase in income and productivity, the vision of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) has been, inter alia, to ensure sustainable access to some means of protective irrigation to all agricultural farms in the country through efficient management of water resources and by propagating the tagline - 'Per Drop More Crop', thus bringing the much desired prosperity along with water security for future generations. Various inbuilt components of the PMKSY that require adequate community planning and participation during the implementation phases are depicted in **Table 2**.

**Table 2: A few PMKSY activities needing Consistent Community Participation**

| SN | PMKSY Components | Programme Activity |
|---|---|---|
| 1 | **Har Khet ko Pani** | Create new water sources through Minor Irrigation (surface and groundwater);<br>Repair, restoration and renovation of water bodies;<br>Construct rain water harvesting structures;<br>Command area development, strengthening and creation of distribution network from source to the farm;<br>Create and rejuvenate traditional water storage systems [like Jal Mandir (Gujarat); Khatri, Kuhl (H.P.); Zabo (Nagaland); Eri, Ooranis (T.N.); Dongs (Assam); Katas, Bandhas (Odisha and M.P.) etc.] at feasible locations. |
| 2 | **Watershed Development** | Create water harvesting structures viz. check dams, nala-bund, farm ponds, tanks, etc.;<br>Ridge area treatment, drainage line treatment, soil and moisture conservation, nursery raising, afforestation, horticulture, pasture development, livelihood activities for the asset-less persons;<br>Effective rainfall management like field bunding, contour bunding/trenching, staggered trenching, land levelling, mulching, etc. |
| 3 | **Per Drop More Crop** | Programme management, preparation of State/District Irrigation Plan, approval of annual action plan, Monitoring, etc.;<br>Promote efficient water conveyance and precision water application devices like drips, sprinklers, pivots, rain-guns in the farm;<br>Construct micro irrigation structures;<br>Secondary storage structures at tail end of canal system to store water when available in abundance (rainy season) or from perennial sources like streams for use during dry periods through effective on-farm water management. |
| 4 | **MGNREGA** | Create water harvesting structures on individual lands of vulnerable sections, creation of new irrigation sources, upgradation/desilting of traditional water bodies, water conservation works, etc.;<br>De-siltation of canal & distribution system, deepening and desiltation of existing water bodies, strengthening of bunds/embankments, etc. |

*Source: Compiled from PMKSY Guidelines [www.pmksy.gov.in]*

The Union Government has also taken other important initiatives to ensure water conservation while appealing to community participation. While Jal Shakti Abhiyan, a mission mode approach, is implemented to improve water availability including, ground water conditions, in the water stressed blocks of 256 districts in India, Atal Bhujal Yojana aims at sustainable management of ground water with community participation in identified over-exploited and water stressed areas of the States of Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Uttar Pradesh. The construction of water harvesting and conservation works is emphasised under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA).

The MGNREGA allows watershed development activities wherein the PRIs are mandated to plan, implement, and monitor Natural Resource Management works, which include watershed development for rain-fed areas, command area development for irrigated areas, afforestation, tree plantations, and horticulture. Some of the watershed development activities permitted for execution under MGNREGA, along with the community engagement profiles, are depicted in **Table 3**.

**Table 3: Community Engagement in MGNREGA Watershed Development Works**

| Type of Watershed Development Works | Engagement of the Community |
|---|---|
| ☛ Contour trenching for water conservation in plantations and grassland development.<br>☛ Loose boulder bunding by erecting dry stone walls across the hill slopes at pre-determined spacing for developing land for cultivation.<br>☛ Spring-shed development in north eastern States to revive springs and protect these against drying up during dry season.<br>☛ Village ponds excavation and renovation of existing ponds to increase water storage space.<br>☛ Bench terracing to use the hill slopes for crop production on sustainable basis.<br>☛ Gabion structures of stone and wire dams across drainage lines to address soil erosion issues. | ☛ Intensive participatory planning exercise is adopted to prepare watershed development plans with active involvement of villagers.<br>☛ Identification of workable watershed boundaries [with around 500-1000 hectares of area] by referring to watershed atlas available with the States concerned.<br>☛ Carrying out Baseline/benchmark Surveys viz. climate, soil types, fertility, rainfall pattern, runoff volume, land-use pattern, vegetation to make the plan outcome-oriented.<br>☛ Active participation of community makes the programme community-driven and community managed/owned.<br>☛ Adoption of Participatory Rural Appraisal which combines various tools like social mapping, resource mapping, seasonal mapping, transact walk, focus group discussions enables community to express and analyse their own situation, clearly delineating location-specific water needs and priorities. |

*Source: Compiled by the author from Samarthya: Technical Training Manual (MGNREGA), Ministry of Rural Development [www.nrega.nic.in]*

The Ministry of Jal Shakti has also taken various other steps for water conservation with active people's participation involving village panchayats, urban local bodies, Resident Welfare Associations, Non-Government Organisations and other stakeholders through, National Water Policy, National Aquifer Mapping and Management (NAQUIM) Programme, Rainfed Area Development Programme (RADP), National Perspective Plan, Catch the Rain and Sahi Fasal Campaigns, etc. Further, the Prime Minister of India has also urged all sarpanches to adopt appropriate measures to transform water conservation into a mass movement.

## Why Community Planning and Participation in Water Conservation?

The community's involvement in planning and execution ensures success in the endeavour by enhancing the economic viability of the implementation of development interventions, their operation and maintenance, the better upkeep of assets due to inherent community belongingness, and also increasing the life span of the system so created. The 73rd Constitutional Amendment empowers Gram Panchayats to plan and manage rural water supply and sanitation systems. The effective planning and implementation of water conservation-related schemes demand active community engagement through Farmer's Group, Panchayati Raj Institutions (PRIs), Self-Help Groups (SHGs), and Cooperatives.

There is a need to ensure a proper capacity building and awareness generation mechanism to ensure successful community engagement in water conservation planning and implementation. Some of the important issues to be taken into consideration at the planning stage are as follows:

(a) How to arrest the rapid depletion of groundwater levels through judicious extraction by the farm and non-farm sectors?

(b) How to control construction activities in rural areas and remove encroachments of the erstwhile water bodies?

(c) How to identify water courses, revive, de-silt rural water bodies, and improve water storage capacities?

(d) What steps to be taken to address issues due to erratic rainfall, droughts, or drought-like conditions?

(e) How to ensure integration of crop-planning, crop-rotation, and crop-diversification planning with the conservation plans of the community?

The community, through PRIs, needs to take up the responsibility of being Programme Implementing Agencies (PIAs) not only to identify, plan, priorities and execute water conservation projects but also to plan and priorities the extraction of water for only identified purposes ensuring appropriate conservation of valuable water resources. The community should ensure the following to ensure the success of water conservation interventions in rural areas:

- Social mobilisation, initiation of need analysis, preparation of the Water Security Plan, Irrigation Plan and Village Action Plan;
- Discuss and deliberate on the sustainability of water schemes – both drinking and irrigation purposes, explore new revenue sources like user fees, operation and maintenance fees, if any, for smooth operation, maintenance, and conservation of water systems;
- Prepare a water reserve audit, water safety plan to ensure recharge, storage, and availability of water and to meet issues relating to quality water usage;
- Ensure convergence with line departments of the district to participate, plan, and execute water conservation projects under the PMKSY, MGNREGA, etc., so as to ensure water recharge and increased water availability in rural areas;
- Demand and support setting up of the technical support cells in consultation with the District/ Block administration to ensure convergence in the

community and near the water project areas;

- Coordinate with District or Block level authorities for promoting timely execution of water projects and fund utilisation;
- Coordinate with District or Block level authorities for adopting technologies and digital medium for monitoring of water schemes;
- Arranging social audit of water schemes from time to time in consultation with district line department officials;
- Arrange training and capacity building programmes on rainfall data capture, water collection, storage, and usage for grass-root workers like health workers, anganwadi workers, science teachers, high school students, panchayat members, retired army officials, etc.;
- Monitor water availability, water sources, and quality of water and get arranged awareness camps.

## Concluding Remarks

India's decentralised planning process encourages the active involvement of the community in planning, implementing, and supervising public service delivery at the local level to ensure that the growth process is inclusive. To ensure effective local governance, the local self-governments are rightly put at the centre of location-specific development planning, implementation, and monitoring. Increased demand for freshwater uses, along with population growth, rapid industrialisation and urbanisation have led to massive exploitation of water and reduction in the groundwater levels, necessitating collective management of water resources.

The present-day development discourse has increasingly advocated the community's role in participation in the planning and execution of various development interventions. Further, civic participation in the management processes of any public development endeavour results in better outcomes of the intervention. Particularly in community-based water management projects, which have become popular in States of India where community participation has facilitated activities leading to the attainment of sustainable development goal parameters.

The water conservation programmes would be successful in achieving their objectives only if the community and the end-beneficiaries were duly engaged in various stages of the programme's implementation – from the stage of identifying the need to prioritisation of conservation activities, implementation, and community monitoring of water works. Thus, communities through PRIs need to take up the required responsibility of being Programme Planning, Implementing, and Monitoring Agencies and identify, plan, prioritise, and execute water conservation projects and plan, strategise and prioritise extraction of water for identified purposes to ensure appropriate conservation of valuable natural resources like water. ❑

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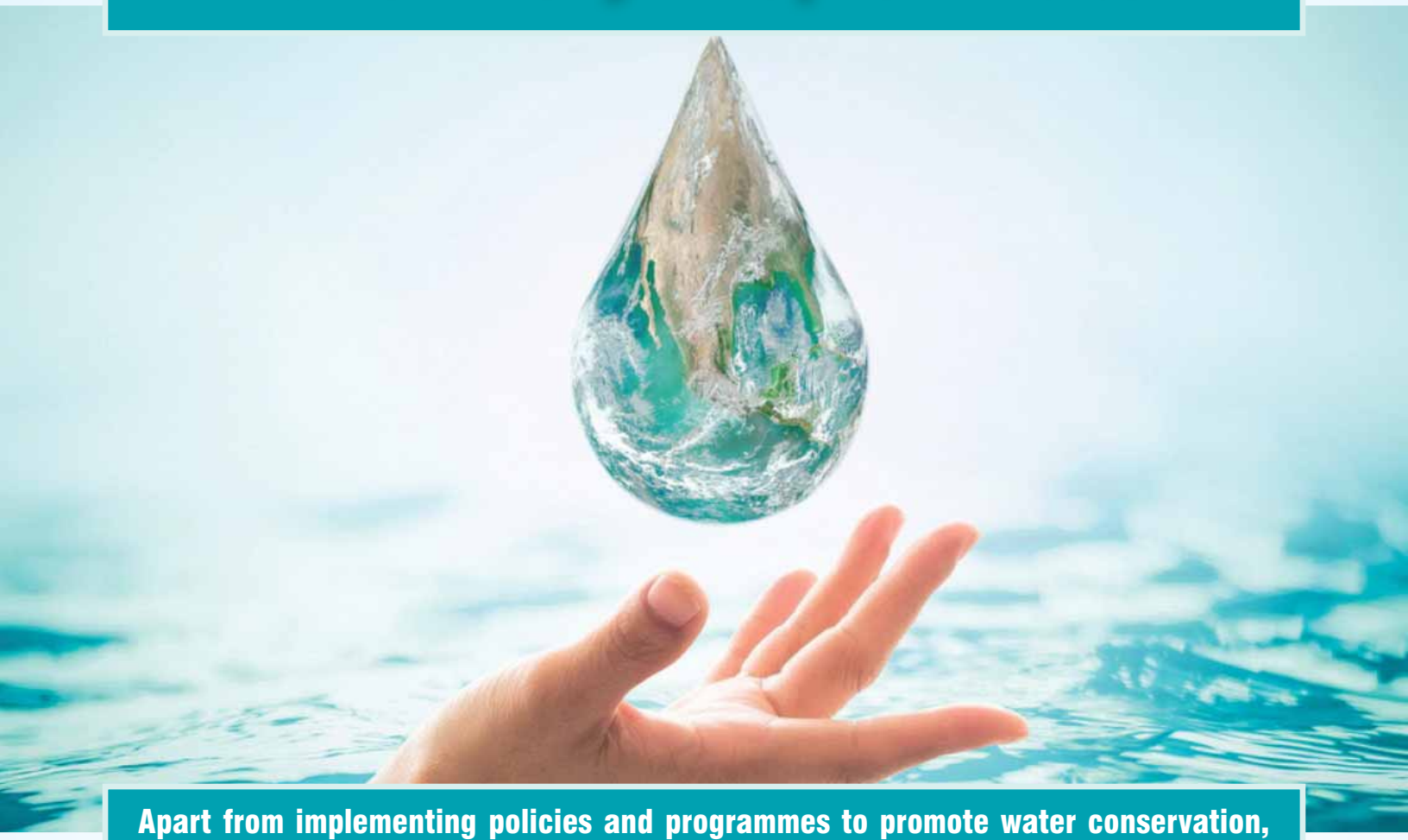
# Educating People to Save Every Drop of Water



**Apart from implementing policies and programmes to promote water conservation, we also need to address the crucial challenge of water scarcity to ensure the success of these efforts taking every citizen along in the fight against the water crisis. This will not only require structured long-term campaigns to build awareness and educate people but also to incentivise and reward them to save every drop of water.**

**Balendu Sharma Dadhich**

One of the most significant challenges humanity faces today is the global water crisis. In response to this crisis, the United Nations has established a target under its 2030 Agenda for Sustainable Development, which is to ensure that everyone has access to clean water and sanitation. The primary objective is to attain universal access to safe and affordable drinking water that is equitable for all by 2030. Despite this goal, the United Nations World Water Development Report 2019 indicates that approximately 4 billion people, which is almost two-thirds of the world's population, suffer from severe water scarcity for at least one month every year.

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India is among the countries where the state of water crisis is very complex and requires urgent attention. Despite having abundant rainfall, India faces frequent droughts, floods, and water scarcity due to inadequate water management practices and rapid urbanisation. The agriculture sector, which accounts for 80 per cent of water resources in India, is responsible for almost 90 per cent of groundwater withdrawals. The lack of awareness and capacity for sustainable water management is a significant factor in the country's water crisis.

Water scarcity is a growing challenge as India has 18 per cent of the world's population and only 4 per cent of global water resources. Achieving water independence requires a concerted effort from various stakeholders, including the government, administration, civic bodies, educational institutions, non-profit organisations, media, and society. Apart from implementing policies and programmes to promote water conservation, we also need to address this crucial challenge to ensure the success of these efforts- taking every citizen along in the fight against the water crisis. This will not only require structured long-term campaigns to build awareness and educate people but also to incentivise and reward them to save every drop of water.

## A Collective Responsibility

An important strategy in this fight is to secure support and active involvement of the people that society looks up to. When the top leadership of the country sends out a message, it is bound to attract people's attention and respect. When Late Atal Bihari Vajpayee was the Prime Minister of India, he had released a formal appeal to the citizens of the country, encouraging them to save every drop of water so that we can leave a better world for our future generations. The appeal was titled 'Water sustains life. It is now our duty to sustain all sources of water. Let us make water conservation a National Mission, let us collectively address the problem of water shortage, which is growing into crisis proportions.' Shri Vajpayee further added that to solve the problem effectively, we need effective partnership between all citizens, various water users, people's organisations and the Government at all levels.

Clearly, a problem such as countrywide water

scarcity is not something that can be solved overnight by one Government order. The water consumption and management ecosystem involves layers of stakeholders playing their roles in various ways at various places. We have a heritage linked with water and there are social issues that relate with water. We have traditions that have a deep connection with water, and we have habits and lifestyles which impact the way water is used and managed. Any change can happen if we look at the issue in its entirety and involve all important stakeholders.

The present union government too is cognizant of the fact, and it is making concerted efforts to meet the massive challenge that India faces. During last February, while inaugurating the 'Jal Jan Abhiyan', a joint nationwide campaign of Brahma Kumaris and the Union Ministry of Jal Shakti, Prime Minister Narendra Modi had underlined the importance of citizens' involvement in dealing with the water crisis in the country. He said people needed to realise the enormity of the problem, and that water resources in the world are limited. He further added that conserving water resources is a collective responsibility. “Due to such a large population, water security is an important concern for India. It is a shared responsibility of all of us,” he said. The Prime Minister urged citizens to start today to combat water pollution and work towards water security as a collective force. He emphasised that “there shall be a tomorrow only if there is water, and for this, we must make joint efforts from today." In the PM's words, “we will have to generate faith in the value of water conservation among the people of the country."

It is worth mentioning that the Prime Minister had even wrote to Sarpanches of 2.6 lakh villages to organise Special Gram Sabhas on water conservation and the importance of water.

The Prime Minister's views regarding citizen awareness are echoed by the Union Minister of Jal Shakti, Shri Gajendra Singh Shekhawat, who recently chaired a workshop for Central Nodal Officers (CNO) and Technical Officers (TO), for effective implementation of Jal Shakti Abhiyan. He asserted that a campaign can become successful only through community participation, especially at the grassroot level. He specifically mentioned the ‘Catch The Rain’ campaign in this regard, asking the CNOs and TOs to make it a success and act as catalysts and facilitators to encourage and energise the district authorities for the successful implementation of the campaign.

**Although the efforts of the Central Government are having a positive impact, it is equally important to educate people about the severity of the water crisis and encourage them to respond positively. We must use all available media and platforms to raise awareness about the importance of conserving water and help people understand its value.**

## National Water Mission's Efforts

The ‘Catch the Rain’ campaign is being run by the National Water Mission (NWM). NWM is one of the 8 missions under the National Action Plan on Climate Change (NAPCC). The main objective of the NWM is 'Conservation of water, minimising wastage, and ensuring its more equitable distribution both across and within States through integrated water resources development and management'. One of the five goals of the NWM is to promote citizen and State actions for water conservation, augmentation, and preservation, and one of the strategies of NWM is to incentivise the organisations or companies through awards for water conservation and efficient use of water. Its Annual NWM Water Awards recognise excellence in water conservation, efficient water use, and sustainable water management practices.

The ‘Catch The Rain’ campaign uses a slogan ‘Catch the rain, where it falls, when it falls" which is nothing but an expression of the desire to collect, save, and manage every drop of water in whichever form it comes to us. The campaign, which is a part of the Government's strategy to address the issue of water scarcity at its roots, aims to encourage States and stakeholders to build appropriate Rainwater Harvesting Structures (RWHS) based on the local climatic conditions and sub-soil strata before the monsoon season. The campaign involves the active role of the local community in the implementation of

several measures to enhance the storage capacity of water bodies. These measures include the construction of check dams, water harvesting pits, rooftop RWHS, and desilt tanks. Additionally, efforts will be made to clear any obstacles in the water channels that transport water from catchment areas to the water bodies and restore stepwells to their original condition.

In addition, the National Water Mission has taken the initiative to organise a lecture series called 'Water Talk' that seeks to foster dialogue and facilitate the exchange of information pertaining to water-related topics. The principal objective of this series is to raise awareness, build the capacity of stakeholders, and encourage active participation in water conservation. The 'Water Talk' series takes place on the third Friday of every month, and features presentations from experts and practitioners in the field. The speakers share their knowledge and practical experience in water management, providing attendees with an intellectual platform to engage in problem-solving, knowledge transfer, brainstorming, and teamwork. The Water Talk programme aims to facilitate cross-learning and the sharing of best practices, which can lead to new developments in the field of water management. The recordings of these water talks can be accessed on the website of the National Water Mission, here- https://nwm.gov.in/water-talk

## Strategies to Educate People

Although the efforts of the Central Government are having a positive impact, it is equally important to educate people about the severity of the water crisis and encourage them to respond positively. We must use all available media and platforms to raise awareness about the importance of conserving water and help people understand its value. It is crucial to encourage people to adopt water-saving practices in their daily lives. Through education and awareness-building campaigns, we can empower individuals to take responsibility for their water consumption and help to ensure that every drop of this precious resource is conserved. To achieve this, we need to reach every household, housing society, colony, Panchayat, and Municipal body and promote water-saving measures, rainwater harvesting, and recycling of water.

People should also be made aware of the work being done by the Union Government and State Governments to save water in the country. Then only they would be able to connect with such efforts and take advantage of them whenever required. Any campaigns conducted to spread awareness around water conservation should also include this aspect in their planning. Water is a state subject in India and mainly the State Governments are responsible for planning, funding, executing and maintaining projects related to water conservation. The Government of India supports the States in their efforts by providing them with technical and financial assistance through various schemes and programmes.

In the past, many mass awareness programmes were launched for the purpose, which included various media campaigns, public exhibits, puppet shows, traditional media, street theatres, and jal yatras on the need for water conservation. Doordarshan, Akashwani and other government media organisations have been regularly utilised to build awareness among the people. Even quiz and science shows and water theme marches have been organised for the purpose. While continuing such good practices, the Union and State Governments can also explore the measures such as:

**Social Media:** In today's age, we can take advantage of Information Technology and social media to directly reach out to people in real time and proactively engage with them. Specialised campaigns can be run on various social media platforms and websites and mobile applications can be developed to disseminate information, run contests, deliver incentives and rewards, recognise the local heroes and answer queries of the people. Some apps are already available such as the 'Know Your Water' app from the Central Water Commission which has the objective to create a platform for sharing authentic information on water issues, spreading awareness, promoting water conservation measures, sensitising people regarding water quality issues and making people aware of Governmental policies on water resources.

**Conventional Media:** Spreading the message about the significance of water conservation can be achieved through conducting awareness campaigns via various mediums like TV, radio, and newspapers. Their vast footprint across the country can be of great importance. We still remember a slogan used in one such campaign on Doordarshan a few decades ago- 'Jal ki boond boond bachaiye' (Save every single drop of water).

**Educational Institutions:** Including water conservation education in school curriculums can help instill a sense of responsibility in children from a young age towards water conservation. Similarly, youth can be encouraged to spread the message across by conducting activities to promote water conservation.

**Engaging Communities:** Community programmes such as seminars, workshops, and interactive sessions can be organised to educate people about water conservation practices and motivate them to adopt these practices. Engagement with local bodies and NGOs can be helpful in making such efforts successful and impactful.

**Incentives and Rewards:** To encourage people to conserve water, incentives like tax rebates or discounts can be offered to households that adopt water-saving practices. This can be done at the local level with funding support from the Union or State Governments. Such incentives can be for stakeholders at various levels including the users of water at the distant end of the curve.

**Involving Private Sector:** Collaborating with private organisations to develop and implement water conservation initiatives can increase awareness and reach a wider audience. Some private organisations are already running programmes aimed at water conservation and awareness building. Many nonprofits too, are making a significant contribution. Names such as Environmentalist Foundation of India, Tarun Bharat Sangh, SARA (Sustainable Alternatives for Rural Accord), Jal Bhagirathi Foundation, Sehgal Foundation, Centre for Aquatic Livelihood Jaljeevika and Watershed Organisation Trust (WOTR) are worth a mention. Startups are another segment of organisations which can be involved in the process.

**Engaging with Eminent Personalities:** Celebrity involvement can be sought to attract public attention and promote water conservation initiatives. Celebrities are often seen as role models and have a large following, that can be leveraged to reach a wider audience and amplify the impact of the message.

## Amplifying Success Stories

An effective way to send the message across could be to amplify the good work done by people to save water and educate people in this regard. This will not only generate interest among the people but will also work as an encouragement to those who are making a positive impact through their efforts. Here are some such success stories that have the potential to inspire others.

Vedant Goel and Yusuf Soni from the Pune-based organisation IneedSai developed an initiative to conserve water by educating children about the importance of water and encouraging them to practice water conservation methods. The initiative involves students emptying their leftover water bottles into a drum before leaving school, which is then used for various purposes such as cleaning toilets, grounds, washing vehicles, and watering plants. The initiative has been successful in saving 40,000 liters of water every day and has been recognised by the title 'Water Dadas'. The founders aim to take their campaign to a national level and encourage more people to conserve water for the future generations.

The Run Blue campaign's India chapter was launched recently in New Delhi, with the aim of creating awareness about the importance of water conservation. The campaign conducted 200 marathons globally, and similar runs will also be organised in Varanasi, Thane, and Mumbai. The goal is to create awareness about water conservation among the local populations.

Larsen & Toubro (L&T) launched an extensive programme to create awareness about water conservation, which included a massive awareness campaign and road rallies organised by WET-IE (Water & Effluent Treatment Independent Company) employees at 286 schools across different states in India. The programme reached out to more than 20,000 school students, and it has been recognised by the India Book of Records as a national record for the 'Largest Water Conservation Awareness Campaign for school students across the nation on a single day.'

The Paani Foundation runs an annual inter-village competition called Water Cup for water conservation work in drought-prone areas of Maharashtra. The programme has seen increasing participation from villages and tries to involve urban people.

Thousands of such campaigns and projects are being conducted across the country in different forms, and they are making serious contributions towards achieving the goal of educating people. By encouraging and recognising them, we can boost such efforts and encourage many others to follow suit. ❑

# Making Villages Water Sufficient

**The availability of sufficient water for the growing population will be one of the crucial challenges for human development across the globe. However, in the emerging discussion on the Localisation of Sustainable Development Goals, rural bodies such as panchayats, in partnership with other stakeholders, can play a decisive role in promoting and achieving sustainable use and conservation of water resources.**

**"Climate-driven food and water insecurity is expected to increase with increased warming".**
**IPCC, March 2023.**

**Partha Pratim Sahu**

The availability of sufficient water is not only a crucial prerequisite for transforming the lives and livelihoods of all segments of society but also for the country's economic growth. India is home to 18 per cent of global human population and 15 per cent of the global livestock population. However, it has only 2 per cent land mass and 4 per cent of global freshwater resources. Over the years, our demand for water resources has increased manifold, not only due to demographic pressure but also for multiple purposes of its use, i.e., drinking water, irrigation, recreation, and infrastructure. Growing demand for water on the one hand and depletion of water due to climate change, competitive extraction on the other hand, efficient and sustainable use of scarce water resources is of utmost importance. Towards this goal, various efforts are being undertaken, including rejuvenation of inactive water bodies, construction of water recharge pits, promotion of rainwater harvesting, treatment of waste water and so on. Under national flagship schemes, such as the Mahatma Gandhi-NREGA, and Jal Jeevan Mission (JJM) many activities are taken up for sustainable and efficient water resource management.

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In the emerging discussion on localisation of Sustainable Development Goals, rural bodies such as panchayats, which are the last mile institutions have been put in the centre of attention and efforts are being made to improve their governance capability and strengthen them to promote equity and inclusiveness, along with social justice and economic development of the community. The 17 UN-SDGs have been remapped into nine broad themes such as: Theme 1- Poverty free and enhanced livelihoods village, Theme 2- Healthy village, Theme 3- Child friendly village, Theme 4- Water sufficient village, Theme 5- Clean and Green village, Theme 6- Self-sufficient infrastructure in village, Theme 7- Socially secured village, Theme 8- Village with Good Governance and Theme 9- Engendered Development in village.

The Ministry of Panchayati Raj (MoPR) has brought out localisation of Sustainable Development Goals in PRIs- Report of the Expert Group Volume 1 and 2, which discuss in detail the framework for localising the implementation of SDGs through capacitating local governments and involving them from planning to monitoring using standardised GP level indicators to measure and track the progress. The Government of India has approved ₹ 5,911 crore under the revamped Rashtriya Gram Swaraj Abhiyan (RGSA), which is aimed at empowering 2,78,000 Panchayati Raj Institutions, or elected rural local governments, to implement a set of social goals that the UN has deemed necessary for sustainable development. A stronger 'whole-of-society' and 'whole-of-government' approach has been followed to ensure an enhanced level of engagement and meaningful participation of different stakeholders such as Panchayati Raj Institutions, line Ministries/ Departments, State Governments and UT Administrations, civil society, communities, higher educational institutions such as IITs and IIMs academia, NGOs/CBOs, international agencies, etc.

## Envisioning Water Sufficient Village

The stated vision under theme 4- 'Water Sufficient Village' is, 'A village with functional house tap connections to all, with targeted standard of quality water supply, good water management and abundant water availability for agriculture and all needs, and conserving its water ecosystem'. It addresses both quantitative and qualitative challenges to water resources. Due to climate change, over the years, we have witnessed uncertainty and erratic rainfall, and water bodies disappearing. Availability of quality water is also a critical issue. In rural areas, the health burden of poor water quality is enormous. Rural masses, especially children are often affected by waterborne diseases and die of diarrhoea. The problem of chemical contamination is also prevalent in India. The major chemical parameters of concern are fluoride and arsenic. Iron is also emerging as a major problem with many habitations showing excess iron in the water samples.

The theme 4- 'Water Sufficient Village' is intricately related to many other SDGs, and understanding these interlinkages is crucial for integrated governance and policy coherence for the implementation of SDGs. For instance, access to water and lack of adequate water in dryland farming lead to low incomes for marginal farmers and landless labourers dependent on agriculture and their likelihood to fall below poverty line will rise (SDG 1-Zero Poverty). Adequate availability of water will increase the agricultural productivity, lead to food production systems (SDG 2-Zero hunger) and so on. The theme water sufficient village is multi-dimensional and directly related to health, education, gender equality, sustainable and efficient use of natural resources, recycling and safe reuse of water, climate change impact mitigation and adaptation measures, and so on. Thus, there is an interplay of various factors that govern access to and utilisation of water resources, and in light of the increasing demand for water, it becomes important to look for holistic and people-centered approaches for water management.

Under Theme 4- Water Sufficient village, 9 sub goals have been set with 25 Modified GP Level Indicator to assess, analyse, and monitor the progress (See Box 1)

## Box 1: Goals proposed under Theme 4- Water Sufficient village

| Sl No. | Goals |
|---|---|
| 1. | Providing access to clean Water to all households and public buildings in the villages by 2024 |
| 2. | Provide access to Sanitation in the villages |
| 3. | Achieve ODF Sustainability |
| 4. | Grey Water management |
| 5. | Per capita availability of water in villages |
| 6. | Construction of rainwater harvesting and recharge works |
| 7. | Safeguarding of water bodies |
| 8. | Constitution of Village Water and Sanitation Committees (VWSCs) in each Gram Panchayats |
| 9. | Water efficient Agricultural practices |

*Source: MoPR (2021)*

Gram Panchyat (GP), in its efforts towards water sufficient village, has to undertake a series of activities: a detailed situation analysis; set the water and sanitation goals and targets for the GP; appropriate technology for water supply and grey water management in the GP based on participatory assessment; ensure adequate, functional clean toilet facilities in schools (separately for boys and girls), anganwadis and other public places; identify and source funds from different relevant schemes and network with all stakeholders who can support water supply, source sustainability, water conservation, watershed management, etc., and reductionfor source contamination, and waste water management programmes; constitute committees and build their capacity for managing new and existing assets; sensitise regularly all households on the key aspects of usage and management of water and sanitation assets; undertake water budgeting annually, and sharing information with villagers for appropriate crop selection, and so on.

A robust and process driven convergence plan is the need of the hour. The said convergence plan must ensure that resources (human, financial, knowledge, administrative) reach the end-point (village, farmer, or family) from different sources in the required quantity, sequence, and time. The Panchayati Raj functionaries and all officials of various line departments must have the basic knowledge of various on-going schemes and ability to develop comprehensive action plans (that allows easy "plug-in" for other departments/ agencies). For instance, to achieve water sufficient village, the GP must explore resources from many schemes and programmes, such as the 15$^{th}$ Finance Commission Funds, Mahatma Gandhi-NREGA, Jal Jeevan Mission (JJM), Swachh Bharat Mission -Grameen (SBM -G), Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), National Rural Drinking Water Programme (NRDWP), and so on. The GP has to closely work with other stakeholders operating in the rural landscape such as SHGs, ASHA and anganwadis women, Swachhta Doots, teachers, youth, Water User Associations (WUAs), NGOs and CBOs, officials and functionaries of Drinking Water and Sanitation, and other line departments.

## Learning from Good Initiatives and Practices

The Mission Amrit Sarovar was launched on 24 April 2022 with the objective of harvesting and conserving water for the future generation. The salient features of

the Mission Amrit Sarovar are as follows- i) Mission Amrit Sarovar is based on 'Whole of Government' approach with the participation from the Ministry of Rural Development, Ministry of Jal Shakti, Ministry of Culture, Ministry of Panchayati Raj, Ministry of Environment, Forest and Climate Change and technical organisations; ii) Under the Mission, every district of the country will construct or rejuvenate at least 75 Amrit Sarovars; iii) Every Amrit Sarovar will have a pondage area of at least 1 acre with a water holding capacity of about 10,000 cubic metre and will be surrounded by trees like Neem, Peepal, and Banyan etc.; iv) These Sarovars will generate livelihoods by using the water for different purposes like irrigation, fisheries, duckery, cultivation of water chestnut, water tourism, and other activities; v) Mission Amrit Sarovar works through the States and Districts with convergence from various schemes such as the Mahatma Gandhi NREGA, 15th Finance Commission Grants, Pradhan Mantri Krishi Sichayi Yojna sub schemes such as Watershed Development Component, Har Khet ko Pani, besides States' own scheme. Similarly, the Jal Shakti Abhiyan: Catch the Rain campaign was started in 2022 to optimise rainwater harvesting and robust conservation. Under this initiatives, a number of water and afforestation related works were carried out. Jal Shakti Kendras in each district of their state were established which will act as knowledge centres and will offer a one stop solution to all water related problems/ issues, and draw up district water conservation plans. Special Gram Sabhas were conducted during the launch of the campaign, and Jal Shapath was administered to the people in the village.

Many such good interventions are in operation in different parts of the country, and need to be documented and attempts should be made to replicate with any necessary customisation. In Telangana state, the Mission Bhagiratha scheme is implemented in all the villages for providing safe and sustainable drinking water to all households. Under this scheme, surface water from the rivers is tapped, treated, and piped to all the households in the village. Similarly, the Mission Kakatiya Scheme was implemented to restore the irrigation tanks to their full capacity and a number of water conservation works (i.e., construction of farm ponds, construction of Percolation Tanks, construction of check dam and other water harvesting structures, de-silting of feeder and filed channels, constructions of different types of bunds, trenches and other soil and moisture conservation works) are taken up in the Mahatma Gandhi-NREGA. The State has also implemented flagship programmes of 'Palle Pragathi' and 'Telanganaku Haritha Haaram' to improve the cleanliness and green cover in the villages.

**Local institutions such as panchayat has a crucial role to play in achieving water sufficient village. Further, all water related issues are to be mainstreamed in Gram Panchayat Development Plan (GPDP). However, the diversity in level of awareness, socio-economic development, education, poverty, practices and rituals and water availability make this goal complex and challenging.**

Kerala has become the first state in the country to prepare a water budget based on local self-government bodies by calculating water availability and consumption. The water budget, which puts forward scientific methods to conserve water, is also aimed at creating awareness among the public about the need for water conservation. The water budget is formulated by a committee comprising representatives of the state water resources department and experts from the Information Technology field, with the help of the Centre for Water Resource Development Management. In the first phase, 15 block panchayats and 94 gram panchayats prepared the water budget. The active participation of local institutions and consultation with the local population are crucial features of this initative.

In the rural areas of Sikkim, the primary sources of water for agricultural and drinking waterneeds are mountain springs. But due to climate change-induced erratic weather patterns, there are frequent and intense water shortages in the State. Under the Jal Dhara Vikas initiative (using resources of Mahatma Gandhi-NREGA), attempts were made to enhance the waterdis charge in the springs and ensure water security in the state.

This was achieved through the participation of the local communities in digging percolation pits and percolation ponds in theforest land, which have been successfully demonstrated as means to increase spring discharge.

## Conclusion

Local institutions such as panchayat has a crucial role to play in achieving water sufficient village. Further, all water related issues are to be mainstreamed in Gram Panchayat Development Plan (GPDP). However, the diversity in level of awareness, socio-economic development, education, poverty, practices and rituals and water availability make this goal complex and challenging. In addition, lack of people's participation, community-led management, training, and capacity development of PR functionaries and officials of various line-departments are also important concerns to be addressed. However, infusing the idea of 'responsible use of water' in the minds of all citizens must be a development priority. Possibly a nation-wide 'water literacy programme' is the need of the hour! The panchayat secretariat can play a role of 'hyper local platform' or a 'point of contact' by coordinating and closely working with all stakeholders towards making Indian villages water sufficient which will ensure water security for sustainable development with equity. ❑

## Reference


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# Water Use Efficiency Ensuring Water Sustainability

**With the growing scarcity of water resources, it is essential to adopt irrigation practices and methods that bring about enhanced water use efficiency to utilise the water so saved for additional irrigation and other beneficial uses. Knowing that each drop of water is precious, the Government of India has accorded high priority to water security. Scientific management of water is increasingly recognised as vital to India's economic growth and ecosystem sustainability.**

**Suneel Kumar Arora**

Water is the lifeblood of ecosystems, vital to human health and well-being, and a precondition for economic prosperity. That is why, it is at the very core of the 2030 Agenda for Sustainable Development. SDG target 6.4 addresses water-use efficiency and water stress, aiming by 2030, to 'substantially increase in water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity'.

India has about 18 per cent of the world's population but only 4 per cent of the world's water resources (NITI Aayog Report, 2017). With an ever increasing population, to support the food requirements of more than 1.35 billion people, irrigation water demand is increasing. Rapid urbanisation and industrialisation are also taking a heavy toll on the overall water demand scenario. As a result, the gap between water demand and availability has been progressively increasing.

## Water Use Efficiency

In general, the term efficiency is used to quantify the relative output obtainable from a given input. Water use efficiency is the ratio between effective water use and actual water withdrawal. In India, a major chunk of water usage is for agricultural purposes, and a small per centage is for drinking and domestic purposes. Hence, even a small percentage saving of water in agricultural usage will have a significant impact on water availability for drinking and domestic purposes. Enhancing water use efficiency in every sector of water use including irrigation, is, thus, crucial and imperative for sustaining life faced with the challenges posed by climate change in the water sector in the present times.

## Water Use Efficiency in Agriculture Sector

India is an agrarian country, being one of the top producers of several crops such as wheat, rice, pulses, sugarcane, and cotton globally. Agriculture is also the source of livelihood for about 58 per cent of India's population. Referring to the use of water in irrigation, efficiency may be defined in various ways, depending on the nature of the inputs and outputs to be considered. Water Use Efficiency (WUE) in irrigation is the per centage of total applied water that is stored in the soil

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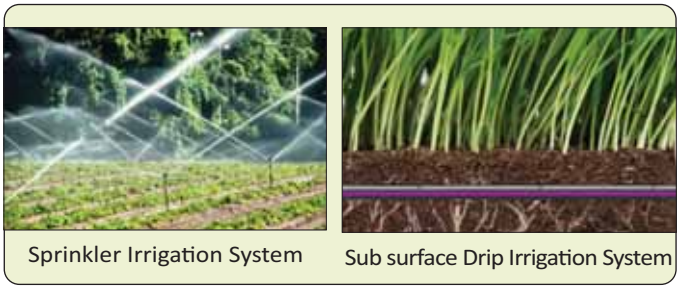
and available for consumptive use by the crops. Some water is lost in conveyance, distribution, and application in the field.

The agriculture sector in India is the largest consumer of water resources, and increasing water use efficiency in this sector is the need of the hour for enhancing per-drop production of more crops as envisaged in the PMKSY. With the growing scarcity of water resources, it is essential to adopt irrigation practices and methods that bring about enhanced water use efficiency to utilise the water so saved for additional irrigation and other beneficial uses. Many factors that affect WUE in the irrigation sector include seepage, percolation, soil depth, texture, evaporation, evapotranspiration, the design of irrigation structures, and their operation and maintenance, and management skills.

## Methods for improving water use efficiency in agriculture

### Micro Irrigation

The Water use efficiency of micro irrigation including drip irrigation, is as high as 80- 95 per cent in comparison to only 30-50 per cent in conventional flood irrigation with several benefits in terms of water saving (30–60 per cent), yield enhancement (40–75 per cent), weed reduction (20–50 per cent).



Sprinkler Irrigation System | Sub surface Drip Irrigation System

### Fertigation studies

Different fruit and vegetable crops showed that there is 25 per cent savings in fertilisers with this technology. The ICAR has standardised drip irrigation and fertigation schedules for 24 crops and crop systems.

### Mulching

Mulching, either through polythene sheets or organic materials spread on top of the soil helps in increasing water use efficiency by controlling evaporation losses from the plant root zone. On average, there is about 10 per cent water saving from the use of mulch materials in agriculture.

### Drought-Tolerant Crops

Growing crops that are appropriate to the region's the climate is another way that farmers are getting more crops per drop. The ICAR has developed several drought-tolerant short duration crop varieties that suit different agro-climatic regions of the country for judicious use of water.

Lady finger | Melons | Tomatoes

## Less Water Intensive Crops

**Other Methods for improving water use efficiency in Agriculture**

- Reduce conveyance losses by lining channels or, preferably, by using closed conduits.
- Reduce direct evaporation during irrigation by avoiding midday sprinkling.
- Minimise foliar interception by under-canopy, rather than by overhead sprinkling.
- Reduce runoff and percolation losses due to overirrigation.
- Reduce evaporation from bare soil by mulching and by keeping the inter-row strips dry.
- Reduce transpiration by weeds, keeping the inter-row strips dry and applying weed control measures where needed.
- Enhancement of crop growth Select the most suitable and marketable crops for the region.
- Use optimal timing for planting and harvesting. Use optimal tillage (avoid excessive cultivation).
- Use appropriate insect, parasite, and disease control.
- Apply manures and green manures where possible and fertilise effectively (preferably by injecting the necessary nutrients into the irrigation water).

- Practice soil conservation for long-term sustainability.
- Avoid progressive salinisation by monitoring water-table elevation and early signs of salt accumulation, and by ensuring appropriate drainage.
- Irrigate at high frequency and in the exact amounts needed to prevent water deficits, taking into account of weather conditions and crop growth stages.

Drip and Trickle Irrigation System

## Initiatives to Increase WUE in the agriculture sector

The Government of India through various ministries and departments have taken many steps and initiated programmes as follows:

## Ministry of Jal Shakti

Knowing that each drop of water is precious, the Government of India has accorded high priority to water security. Scientific management of water is increasingly recognised as vital to India's economic growth and ecosystem sustainability. The Government is proactive about water conservation and its efficient management and has created the Ministry of Jal Shakti in May 2019 to consolidate inter-related functions pertaining to water management.

## Launch of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

The PMKSY is a centrally sponsored scheme (core scheme) launched in 2015. The centre- state share will be 75:25 per cent. In the case of the north-eastern region and hilly states, it will be 90:10. Its objectives are:

- Convergence of investments in irrigation at the field level,
- To expand the cultivable area under assured irrigation (Har Khet Ko Pani),
- To improve on-farm water use efficiency and reduce wastage of water,
- To enhance the adoption of precision-irrigation and other water-saving technologies (Per Drop More Crop).

## Accelerated Irrigation Benefit Programme (AIBP)

The Government of India launched AIBP during 1996-97, to provide Central Loan Assistance (CLA) to major and medium irrigation projects that were in an advanced stage of completion to achieve the targeted potential, ultimately resulting in saving water and improving efficiency. During 2015-16, the AIBP got amalgamated under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). PMKSY- Har Khet Ko Pani and Per Drop More Crop was taken up with mandatory 10 per cent of command to be taken up with micro and drip irrigation network.

## Command Area Development and Water Management (CADWM)

The Government of India in 1974-75 launched the CADWM to bridge the gap between Irrigation Potential Created (IPC) and Irrigation Potential Utilised (IPU). Some of the works proposed under this programme are the Completion of On-Farm Development (OFD) works, levelling, drainage, Warabandi, participatory irrigation management (PIM), etc., which resulted in the overall improvement of water use efficiency. With the launch of the PMKSY during 2015-16, CADWM got included under the Har Khet Ko Pani component of the PMKSY.

## Har Khet Ko Pani

Efficient use of water is one of the mission objectives of the PMKSY, launched in July 2015 which mainly aims at 'Har Khet Ko Pani' (ensuring water to every farm through assured irrigation) and 'Per Drop More Crop' (ensuring more productivity through micro irrigation). The PMKSY provides a convergence of 4 components under 3 Central Government Ministries. The 'Per Drop More Crop' component is under the Ministry of Agriculture, Cooperation & Farmers Welfare.

## National Water Mission

The National Water Mission under the National Action Plan on Climate Change has been unveiled by the Prime Minister of India on 30 June 2008. Five goals have been identified under the National Water Mission. One of the most important goals of the NWM is to improve

the Water Use Efficiency (WUE) by at least 20 per cent. To achieve this goal, research in the area of increasing WUE in agriculture, Industry, and domestic water is one of the important strategies.

To achieve the target of improvement in WUE by 20 per cent, a dedicated organisation has been set up as the Bureau of Water Use Efficiency (BWUE) under the National Water Mission in October 2022 to work on mission mode.

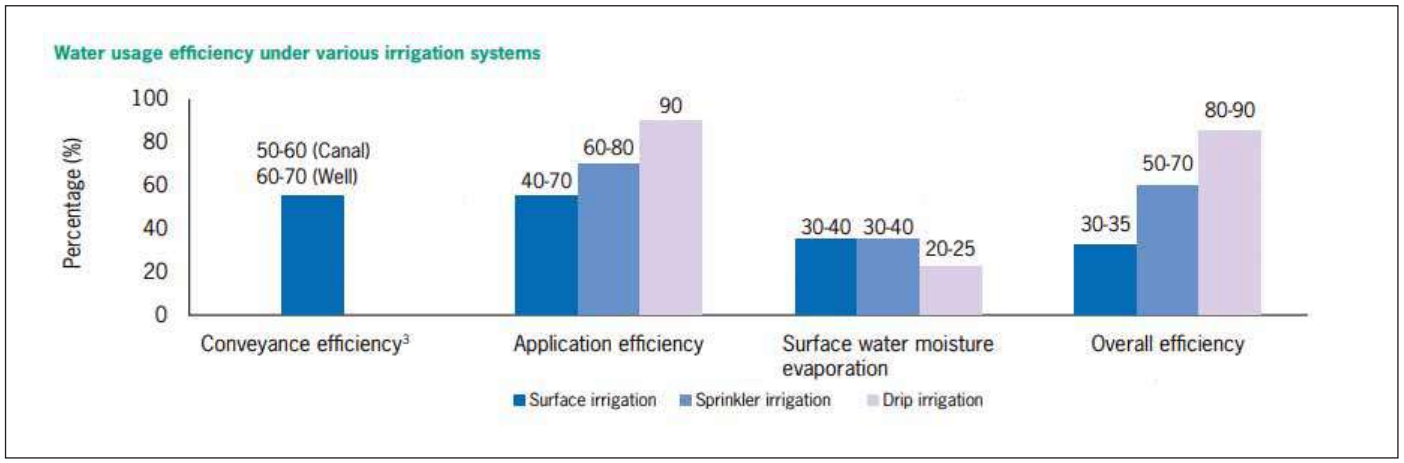
## Bureau of Water Use Efficiency (BWUE)

The Bureau of Water Use Efficiency (BWUE) will be a facilitator for the promotion of improving water use efficiency across various sectors namely irrigation, drinking water supply, power generation, industries, etc., in the country.

## Baseline Studies

As a part of this strategy, the National Water Mission (NWM) has awarded Baseline Studies to four institutes with the objective to evaluate the Water Use Efficiency of the completed major and medium irrigation projects.

**Did you know? Installing Nozzles in water taps is a small yet very effective method to reduce consumption up to 80% annually. This way we can astonishingly contribute to #SaveEvryDrop of while ensuring to #SaveWaterforLiFE**


## Sahi Fasal Campaign

The National Water Mission launched a campaign to increase water use efficiency in the agriculture sector namely 'Sahi Fasal' to nudge farmers in the water-stressed areas to grow crops that are not water intensive, but use water very efficiently, are economically remunerative; are healthy and nutritious; suited to the agro-climatic-hydro characteristics of the area; and are environmentally friendly.

Creating awareness among farmers on appropriate crops, micro irrigation, soil moisture conservation, etc., weaning them away from water-intensive crops like paddy, sugarcane, etc., to crops like corn, maize, etc., which require less water; assisting policymakers to frame policies that make effective pricing of inputs (water and electricity); improving procurement and market for these alternate crops; create appropriate storage for them, etc., ultimately leading to increase in the income of farmers, are the key elements of 'Sahi Fasal'. Under 'Sahi Fasal', a series of workshops were organised in the water-stressed areas of the country with the following tagline-

**'नहीं है जल, तो नहीं फसल । कम जल ले, वो सही फसल'**

## Water Use Efficiency in Industrial Sector

Recent studies reveal that industrial water demand will quadruple between 2005 and 2030, putting further strain on the already over-allocated water resources of the country. Many industrial sectors have already experienced physical, reputational, regulatory, or a combination of these risks owing to the prevalent water issues. Moreover, water scarcity has already caused India's 20 largest thermal utilities to shut down at least once between 2013 and 2016, taking a total financial toll of USD 1.4 billion.

The need is, therefore, for companies to elevate water resources management above the realm of corporate social responsibilities, and, following this appreciation, join hands with communities and the government to manage this shared risk collaboratively and efficiently.

## Initiatives for Increase in WUE in Industrial Sector

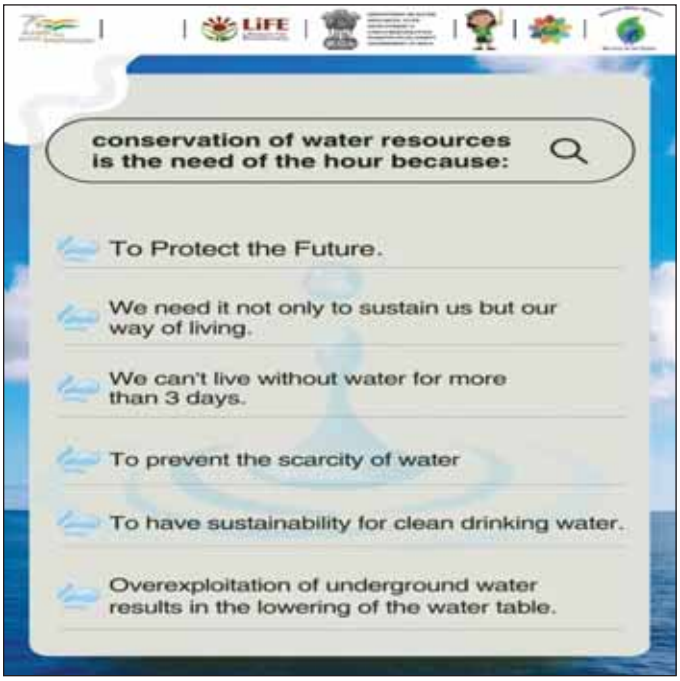
### Benchmarking Studies

To enhance WUE in some of the water-intensive industries namely thermal power plants, textile, pulp and paper, and steel industry, the National Water Mission has awarded a benchmarking study to TERI regarding 'Benchmarking Industrial Water Use to Assist Policy for Enhancing Industrial Water Use Efficiency in India'. The study would focus on two industrial sectors namely thermal power plants and textile industries in phase-I and scoping exercise, the preliminary baseline assessment and comprehensive water audit in pulp & paper, and steel industries in phase-II. TERI has also suggested some opportunities and Interventions for reducing water consumption in various industries.

## Initiative for Increase in WUE in Domestic Sector

### Water Efficient Plumbing Products

The National Water Mission has taken initiatives and recommended to the Bureau of Indian Standards (BIS) that it take steps to issue standards for Water-Efficient Plumbing Products. These standards cover the requirement for standardising the guidelines and specifications of various fixtures and sanitary wares used in plumbing systems to be water efficient to reduce water requirements for effective operations and maintenance of these appliances. A series of Indian Standards have been formulated for various fixtures used in plumbing




systems, which cover the requirements for assessment and star ratings of these fixtures.

## AMRUT Mission of Ministry of Housing and Urban Affairs

The Ministry of Housing and Urban Affairs has taken several steps towards sustainable management of water in urban areas through its national mission, such as the Atal Mission for Rejuvenation and Urban Transformation (AMRUT). Water use efficiency in cities is also improved through centralised control and monitoring of water supply using smart technologies. Some cities have adopted Supervisory Control and Data Acquisition (SCADA) system under AMRUT projects for better management of city infrastructure. 230 water supply projects are being implemented with the SCADA system. SCADA in the water supply system help reduce non-revenue water in our cities.

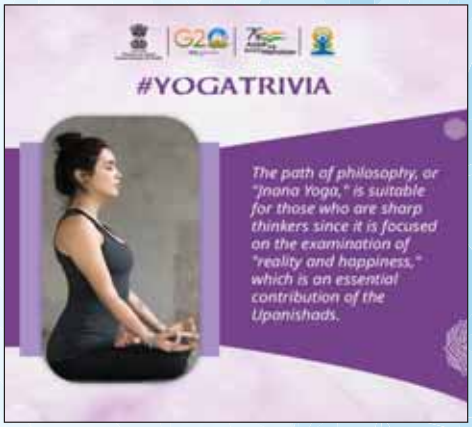
## Conclusion

Enhanced water use efficiency through persistent and concerted efforts of individuals, groups and associations of people, and the Government implementation agencies and institutional mechanisms will go a long way in effectively coping with the challenges posed by climate change and an ever-increasing population on available water resources and will result in optimum and efficient utilisation of precious water, thereby adding to enhanced productivity, prosperity, and sustainability. ❑

# YOGA FOR HEALTH

**The International Day of Yoga is celebrated on 21 June. Yoga is an integral part of Indian cultural and spiritual heritage. It is an ancient science of wisdom for living a healthy life and by adopting it in daily life, one can make life easy and simple. It works efficiently on all the aspects related to human life viz. mental, emotional, spiritual and physical planes of being.**








# Water Conservation and Multiple Use Management

**Increased climate variability has made rainfall patterns erratic that warrants water resources development, conservation and multiple use management, especially in agriculture sector, which is the dominant consumer of water (about 70 per cent). It is of the utmost importance that water resources are conserved and prudently used for integrated agricultural development and to achieve 'more food, more income with less water'.**

**Souvik Ghosh**
**Shreya Anand**

Water is one of the most essential natural resources for sustaining life, food production, and economic and social development. It is primarily used for growing crops, household uses, input to industries, power generation, recreations, and sustaining the earth's ecosystems. Presently, this essential natural resource is under threat. Water is abundant globally but scarce locally. Global climate change can be expected to have a major differential impact on water availability, demand, erosion, salinisation, and flooding. In some areas, water withdrawals are so high relative to supply that surface water supplies are literally shrinking and groundwater reserves are being depleted faster than

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they can be replenished by precipitation. The challenges of growing water scarcity are heightened due to increased demand for food and fibre by the growing population, wasteful use of developed water resources, depletion of groundwater resources, degradation of land in irrigated areas, increase in the pollution level of surface and groundwater, etc.

Efficient use of water resource is essential to the survival of the ever-increasing population of a country. India accounts for about 2.4 per cent of the world's geographical area and 4 per cent of world's renewable water resources, but the country has to support about 18 per cent of the world's human population and 15 per cent of its livestock. The average annual rainfall in the country is 1,170 mm, which is unevenly distributed, and dependent mainly on the southwest monsoon from June to September, accounting for 75 per cent of the country's precipitation. Eventhough India is rich in terms of annual total water resources, uneven topography causes severe regional and temporal water shortages and excess in different states. The highest annual rainfall of 11,690 mm is recorded at Mawsynram near Cherrapunjee, Meghalaya and lowest 209 mm at Jaisalmer of Rajasthan. About 30 per cent of the country receives less than 750 mm rainfall, 42 per cent of the area receives between 750 mm and 1250 mm, and 20 per cent receives rainfall between 1250 mm and 2000 mm annually. Increased climate variability has made rainfall patterns more inconsistent and unpredictable which warrants proper water conservation and multiple use management, especially in agriculture sector, as the consequences of the water stress will be more pronounced in agriculture sector, which is the dominant consumer of water as compared to other sectors.

## Water Availability

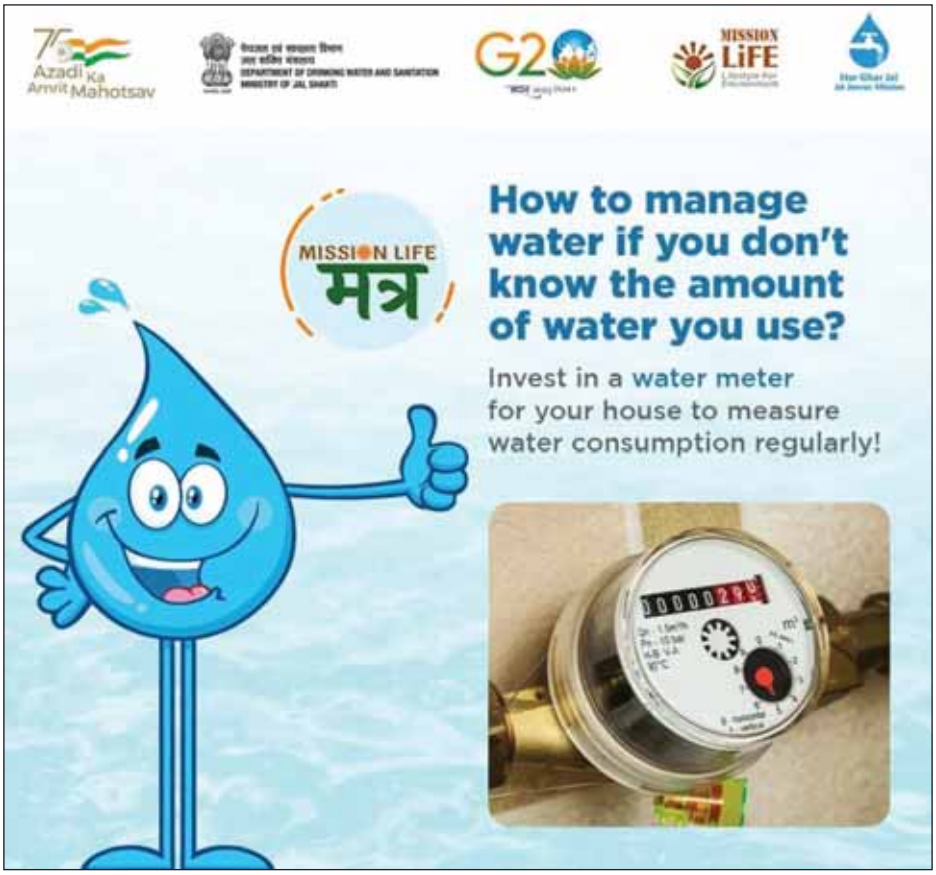
Any region's or country's average yearly water availability is heavily influenced by hydro-meteorological and geological factors. India's total water availability from precipitation is around 3,880 billion cubic meters (BCM) each year. Natural runoff contains 1,999 BCM of water after evaporation. Due to geological and other causes, the available usable water is limited to 1,128 BCM per year, which includes 690 BCM of surface water and 438 BCM of replenishable groundwater. The water potential used is approximately 689 BCM, with 450 BCM of surface water and 239 BCM of groundwater. The country's total requirement for different applications under the high demand scenario for the years 2025 and 2050 has been estimated to be 843 BCM and 1,180 BCM, respectively (DoWR, RD and GR, Ministry of Jal Shakti, 2023). The average annual per capita water availability in the years 2001, 2005 and 2011 was assessed as 1816, 1703, and 1,545 cubic meters, respectively, which is projected to further reduce due to an increase in population, rapid industrialisation, urbanisation, cropping intensity and declining groundwater table. A condition of water stress is defined as having fewer than 1,700 cubic metres of water available annually per person, while a condition of water scarcity is defined as having less than 1,000 cubic metres of water available annually per person. Therefore, the development, conservation, and management of this precious natural resource are crucial.

## Water for Agriculture

Agriculture is by far the biggest user of water, accounting for over 70 per cent of water withdrawals worldwide. However, stiff competition has been developing between different uses and users of water. Globally, the demand for water has grown annually by 2.4 per cent. Gross water demand for all users in India is expected to grow from 750 BCM in 2000 to 1027 BCM by 2025. Water as a source of irrigation has emerged as the mainstay of the food-agricultural economy. Therefore, in the future, available water resource will not be sufficient to fulfill the water needs of all sectors, unless water is conserved and used efficiently. By all possible means, the water conservation will be able to increase the utilisable quantity. Inspite of impressive achievements in foodgrain production with 315.7 million tonnes in 2021-22 (Economic Survey 2022-23, Ministry of Finance and Corporate Affairs), the net sown area in the country remains at about 140 million hectares (Mha) with the net and gross irrigated area of 71.55 Mha and 102.67 Mha, respectively (MoA&FW, 2022). To meet the projected food grain demand of 450 mt by 2050, it is essential to increase crop productivity up to 4 t/ha under irrigated conditions and upto 1.5 t/ha in rainfed area. Therefore, to produce more food with the same amount of water, the productivity of water has to improve through better water resource management.

Because of heavy demand and limited availability, safe and fresh water has now become the costliest input in agriculture. The rising cost of irrigation projects and low rate of returns make the situation even more

difficult. It is therefore of the utmost importance that water resources are conserved and prudently used for integrated agricultural development and to achieve 'more food, more income with less water'. Water resource development and management plays a pivotal role in enhancing agricultural productivity through optimum use of water resources and seeks to allocate water on an equitable basis to satisfy all agricultural uses and demands. Application of better water management practices through intensification of existing agri-food systems with an emphasis on integrated farming system is therefore, the main approach for improving production performance. Understanding the principles of water resource management and integrated farming systems within an effort to optimise, integrate, and disseminate such a combined methodology is needed towards a sustainable agri-food production system.




## Rainwater Conservation

It is often said that the second green revolution will occur in rainfed agriculture, which warrants its rapid growth, efficient management, and sustainability. Rainwater harvesting, conservation and its efficient utilisation through multiple use management play a crucial role in rainfed agriculture and are being taken up on a massive scale through various Government schemes. Large-scale water harvesting will reduce the possibility of flooding and improve groundwater recharge. Rainwater harvesting may be defined as the technique of collecting and storing of rainwater at the surface or in a sub-surface aquifer before it is lost as surface runoff. The various rainwater harvesting practices in vogue can be broadly grouped as in-situ and ex-situ rainwater harvesting.

The in-situ rainwater harvesting is generally carried out through various agronomic and engineering measures, where the rainfall is collected where it falls. Some of the widely adopted techniques are bunding, terracing, contour farming, broad bed furrow systems, micro basins, ridge and tie ridging, mulching, deep ploughing, etc.

In the case of ex-situ rainwater harvesting, the runoff is diverted and stored in anatural or artificial reservoir for later use. This can be achieved through dugout ponds, diversion bunds, tanks, tank cum well system in the plateau region, traditional system of rainwater harvesting like khadins, and haveli. Diversion of perennial surface/subsurface water source is practiced through check-dams, nala-bunding, percolation tanks etc.

A Tank cum Well system has been found to be a potential option for improving water productivity under watershed as well as canal irrigation commands in Odisha through conservation of rainwater and groundwater. The secondary storage reservoir in the outlet command of flow-based minor irrigation systems is also found effective in Odisha to harvest rainwater during monsoon and store excess irrigation water, and utilise the harvested water most effectively during the dry season. These systems have been developed through farmers' participation, which have integrated

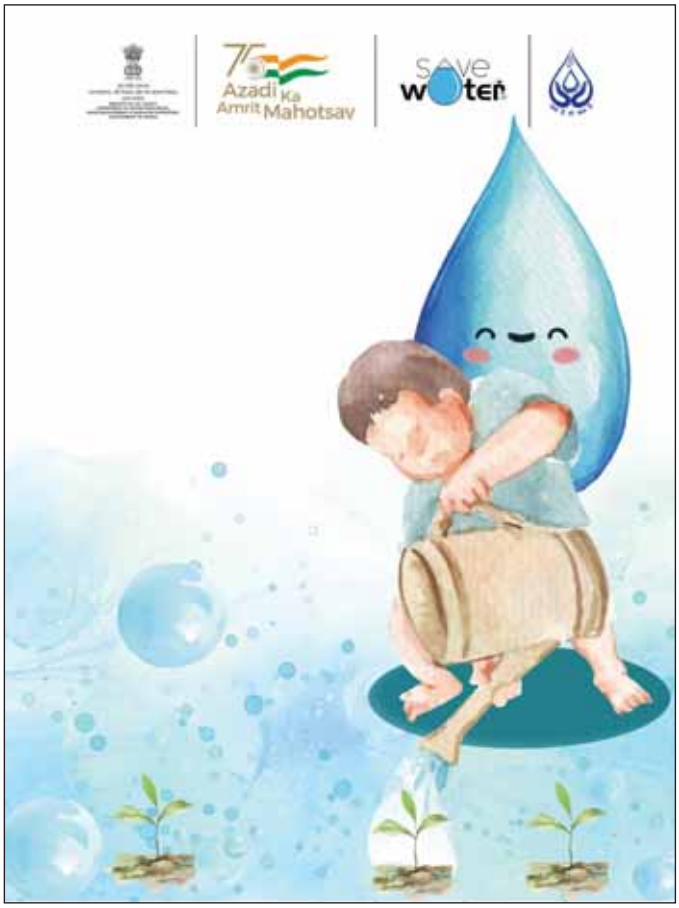
crop, fish, and on-dyke horticultural crop components and established integrated farming systems.

## Traditional Water Conservation Systems

A rainwater harvesting system has three components: catchments, collection system, and utilisation system. Judicious blending of the traditional practices with scientific technologies is required. Indigenous methods of rainwater conservation and harvesting are location specific; a few of those are mentioned below.

*Khadin, Rela,* and *Tal* are popular water conservation practices in Rajasthan. *Khadin* is a system whereby rocky catchment areas are used to collect run-off water in a valley by constructing a bund across the flow. The system combines two adjoining physiographic land units. The arrested water stands in *Khadin* throughout the monsoon period. The collected water is allowed to percolate, after which a crop can be grown. The soils of *Khadin* are extremely fertile because of the frequent deposition of fine sediments. *Rela* a water conservation practice aims to channel water from streams in hills to terraced farms on the edge of adjacent plain. Water enters the upper fields and flows down gradually to the lower reaches. This provides a secure water supply in drought-prone areas. Tal farming is found where runoff rainwater flows into low-lying valleys, forming stagnant pools. During the monsoon, water is lifted and used in adjacent fields. After the monsoon, crops are grown under residual moisture in the Tal bed when water has evaporated and percolated. Another rainwater harvesting structure called *Kundi* is an artificial well, which stores runoff from an artificially prepared catchment surrounding it so that rainwater that falls on the catchment rapidly runs into the well and gets stored. It can be made anywhere if adequate land is available. Water harvesting through *tankas* (dugout lined circular holes of 3-4 metres in diameter) is very common in Rajasthan.

The *Virda* system in Gujarat is like a well in a tank. The system is for procuring potable sweet water in an area where rainwater is scarce and groundwater is saline. *Maldharis* who have invented the technique, locate low-lying areas that accumulate a great quantity of rainwater from very large catchment basins. Some of this water infiltrates into the ground and is stored in a layer above the salty groundwater at a shallow depth. By digging small shallow wells, called *Virdas* into the layer




of accumulated rainwater, they obtain fresh drinking water. The bottom half of a Virda is consolidated by straight tree poles, forming a square frame. Grasses are put between these branches. The branches hold the soil in place while the grasses reduce the velocity of water and erosion around the branches, and also filter out soil particles that would otherwise enter the Virda. The upper half of Virda is circular and bowl shaped, designed to facilitate water removal.In Gujarat, people are motivated to collectively harvest rainwater through *bandharas* (check dams) by using stone and sand filled gunny bags right after the monsoon, which has increased water availability. Gunny bags filled with sand and stones are arranged in rows across the rainfed village streams to arrest water flow.

In the *Haveli* system of Madhya Pradesh, farmers store rainwater in the agricultural fields itself. The fields are embanked, and farmers work out an arrangement amongst themselves to allow rainwater to flow from one field to another. The Collected water seeps into the soil and gives it enough moisture to grow a good crop in the following dry period.

The *Jalkund* (lined small ponds) technique of water harvesting is popular in Maharastra and Assam. Series of tanks connected through field channels isa common feature of water harvesting in Tamil Nadu and western Odisha.

A structure called *Niru Oni* (an outlet for each field) is used to control runoff in Karnataka. The type of outlet depends on the type, size, and location of a certain field. Surface runoff is controlled according to a timetable, that coincides with the growth of a crop and various cultural operations.

In the North West Himalayas, *Khuls* and *Ghuls* are used to divert the waterfrom the source to agricultural fields. *Khatri*, or *Diggi*, an innovative structure to harvest rainwater, is found in the sub-Himalayan regions of Himachal Pradesh. It is a horizontally dug tunnel with steps going down towards the basin. The length is between three to four metres and the entrance is rectangular in shape with a capacity varies between 30,000 and 50,000 litres. The basic principle is to harvest the rainwater falling on the hill. Water filters down through the sandstone rock into khatri. Direct runoff is not allowed into *khatri*. In the arid and semi-arid regions, where streams are more seasonal, the diversion channels are first directed to a storage structure so that the water can be used in the dry period. No lining is done on the walls or bottom, as it recharges from all sides. As water is consumed over a period of time, people use steps to go down into *khatri* to reach the water. Highly location specific structure such as *Kul* (diversion channel) are prevalent in Himachal Pradesh.

The *Zabo* is a water harvesting system in Nagaland, where ponds are constructed in such a manner that surplus water from one pond flows down to another. Water is released from a pond through an opening at its lower end, which is otherwise blocked by a piece of wood. The Bamboo rainwater harvesting for tapping streams exists in Meghalaya. The Rooftop harvesting of rainwater is a practice in Mizoram. Water is harvested as it falls from the rooftop. Though average rainfall is high, the geological formation does not encourage water retention. A method of storing rainwater is by placing horizontal rain gutters made of bamboo along the sides of a sloping roof. The water pours into a pipe that is connected to a tank. In Arunachal Pradesh, the *Apatani* system consists of terraced plots connected by inlet and outlet channels. Indigenous people of north-eastern India have built bamboo pipelines to carry water from natural springs to a convenient point where it can be used for drinking as well as for watering plantations in those areas where channels cannot be built.


## Way Forward

The main objective of the National Water Mission (NWM) is conservation of water, minimising wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management. As a part of Azadi Ka Amrit Mahotsav, the NWM has initiated the process of identifying 75 ancient water conservation structures across India and declare them as Water Heritage Structures (DoWR, RD & GR, Ministry of Jal Shakti, 2023). The Jal Shakti Abhiyan, a flagship campaign of NWM, involves inter-sectoral convergence of all development programmes

like MGNREGA, AMRUT, Repair, Renovation and Restoration Scheme, Watershed Development Scheme, Per Drop More Crop, etc. It offers a major opportunity for leveraging convergence and working towards a greater vision of water conservation. Under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), sustainable water conservation practices are being introduced. It emphasises ensured integrated development of rainfed areas using the waters held approach towards soil and water conservation, regeneration of groundwater, arresting runoff, providing livelihood options, and other natural resource management (NRM) activities. Extension activities are being promoted relating to water harvesting, water management, and crop alignment for farmers and grass-root level field functionaries. One of the key aspects of the Atal Bhujal Yojana is to bring in behavioural changes in the community, from the prevailing attitude of consumption to conservation and smartwater management. The message of water conservation and multiple use management need to be communicated across all levels; creation of awareness and an enabling environment for water conservation at various levels through information, education, and communication is an important activity to face the challeges of water scarcity. ❑

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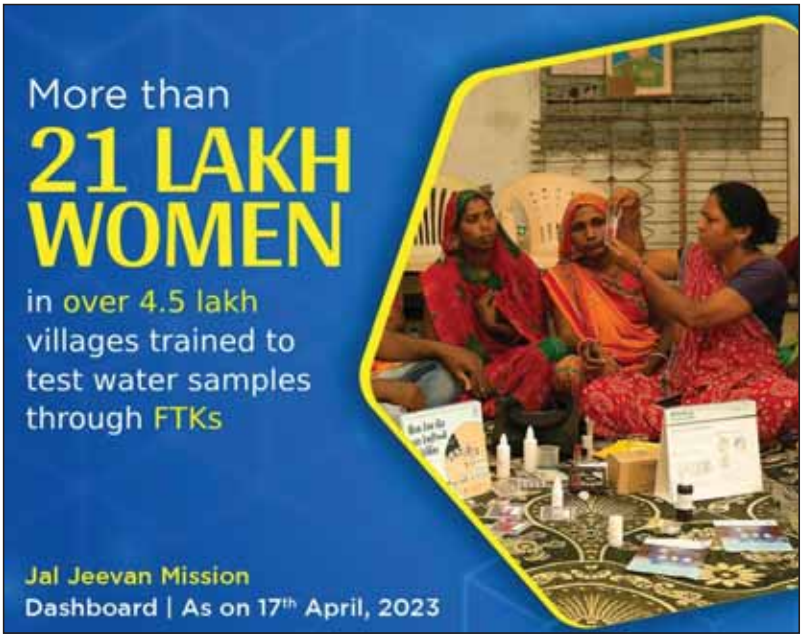

# 2023: Year of International Water Commitments and What it Means for Rural India

**India has been proactive in making commitments and negotiations on global platforms around sustainable and climate resilient water management. The goals and vision, which Government of India intends to achieve with regard to water, have been endorsed by it on several international and national forums this year.**

**Ekansha Khanduja**
**Shreya Wadhawan**
**Saiba Gupta**

The year 2023 is an important year nationally and internationally for the world's water-related goals. In 2017, the United Nations (UN) adopted a resolution declaring 2018-28 as the International Decade for Action on Water for Sustainable Development. The year 2023 is the mid-year to the decade for action on water and also for the Sustainable Development Goals (SDGs). Goal 6 of the SDGs focusses on the availability and sustainable management of water and sanitation for all. In this context, the alignment of SDG 6 and SDG 13, which emphasises urgent action to combat climate change and its impact is very important.

The Sixth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) was launched in 2021, which highlights that the water cycle is more sensitive to global warming, causing an increase in droughts, floods, and cyclones even with one-degree temperature rise. With rising temperatures, the increasing frequency and intensity of extreme weather events will make it challenging to access freshwater, grow food, and produce energy. The same report points out that these issues impact nearly 40 per cent of the global population or approximately 3.5 billion people, and this number is projected to rise dramatically over the coming decades.

As per the United Nations Office for Disaster Risk Reduction estimates in 2019, India had suffered losses of Rs 5.61 lakh crore (USD 79.5 billion) due to extreme climate events in the previous two decades. According to a study by the Council on Energy, Environment and Water (CEEW) in 2020, India experienced an exponential increase in extreme events during the period 1970–2019, with a marked acceleration during

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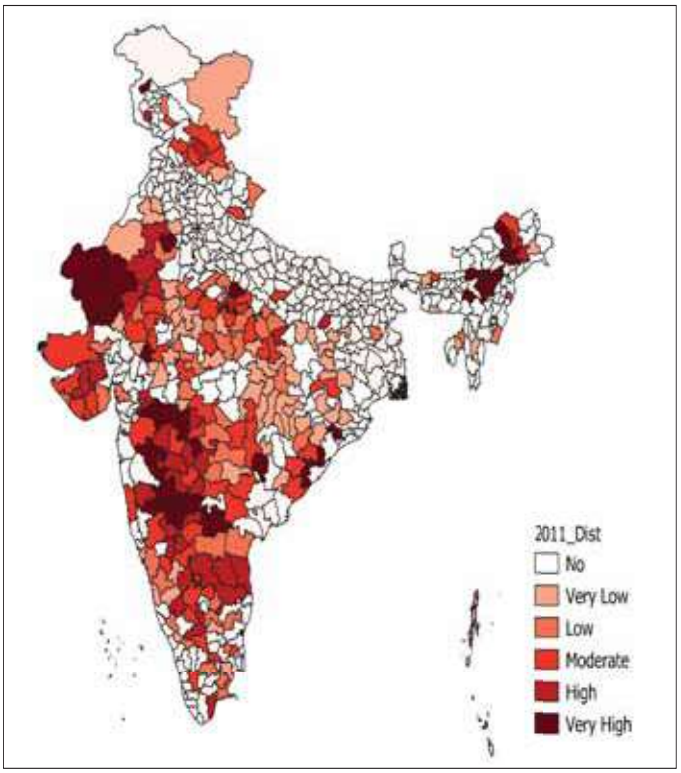
2000–2019. Another study by CEEW in 2021 shows that more than 75 per cent of India's districts are extreme event hotspots, and more than 80 per cent of India's population resides in districts highly vulnerable to extreme hydromet disasters, i.e., floods, cyclones, and droughts. Water scarcity, water quality degradation, infrastructure damage, and an increased spread of waterborne diseases are some of the impacts that occur due to climate change.

## Water Matters for Rural India

Our analysis based on the Census 2011 data finds that 53 per cent of districts in India are rural. Out of these districts, 37 per cent are vulnerable to the impacts of extreme hydromet disasters. These districts are also home to one-third of India's population. Thus, there is an urgent need to ensure water security in rural areas to mitigate the impacts of droughts, floods, and cyclones.

**Figure 1: 37 per cent of Indian rural districts are vulnerable to the impacts of extreme hydromet disasters**




* The districts with density of population less than 400 per sq km are categorised as rural based on the criteria given by https://www.india.gov.in/content/rural-indian

*Source: CEEW | Authors' analysis based on Mohanty and Wadhawan 2021 and Census 2011 data set.*

The Government of India (GOI) has been delivering schemes and policies in the water sector to increase its adaptive capacities to climate change. India has about 18 per cent of the world's population and only 4 per cent of global freshwater resources. Two of the major sectors competing for water in India are agriculture and WASH (water, sanitation, and hygiene). While the latter accounts for a much smaller share of water demand with respect to agriculture (80 per cent), it is important from the point of view of public health. Considering that occurrence of climate extremes will further exacerbate in the future, climate-proofing of WASH infrastructure and services are crucial for building the resilience of communities.

The adverse impact of climate variability and change on hydrology has also increased the dependence on groundwater for meeting sectoral water demands. As per CGWB analysis in 2022, about 30 per cent of the assessment units in the country were semi-critical, critical, or over-exploited, i.e., they are annually extracting more than 70 per cent of how much groundwater can be extracted. Considering more than 80 per cent of the rural water supply schemes in India are based on groundwater based sources, non regulation of groundwater use in such areas can be a matter of concern in the future.

The year 2023 began with India announcing the formation of its 'Water Vision' as a part of Prime Minister's Vision India @2047 plan. The goals and vision, which Government of India intends to achieve with regard to water have been endorsed by it on several international and national forums this year. We discuss some of them in the subsequent section, which are intended to ensure equitable, sustainable and climate resilient development, and management of surface water and groundwater resources.

## Major International Commitments and Outcomes

### Group of Twenty (G20)

The G20 was formed in 1999 and India is leading the G20 presidency for the first time this year. A dedicated global water dialogue is being held as a part of the Environment and Climate Sustainability Working Group (ECSWG). The focus is on prioritising water action towards achieving sustainable water resources management in alignment with the SDG6 by 2030.

During the second G20 ECSWG meeting held in March 2023, the Ministry of Jal Shakti (MoJS) emphasised on the importance of climate-sensitive development for ensuring water security, while highlighting India's two flagship missions - Jal Jeevan Mission and Swachh Bharat Mission. The intended outcomes of these dialogues on sustainable water resources management focus on but are not limited to: a) universal access to safely managed drinking water and sanitation services; b) participatory groundwater management, especially highlighting the role of local stakeholders in groundwater recharge and its efficient use; c) climate-proofing of water infrastructure and services and disaster risk reduction

## United Nations Water Conference (UNWC)

The UN 2023 Water Conference was co-hosted by Tajikistan and the Netherlands in March 2023 at UN Headquarters in New York. The main output of the conference is a document on voluntary and non-binding commitments to accelerate progress to meet the global water and sanitation related goals and targets in the second half of the Water Action Decade and 2030 agenda. About 700 commitments aimed at driving transformation towards a water-secure world were made by governments, the United Nations system, other intergovernmental organisations, international and regional financial institutions, NGOs, academic institutions, the scientific community, the private sector, and philanthropic organisations.

India under the action agenda has announced that it allocated USD 50 billion to provide safe and adequate drinking water to all rural Indian households by 2024, which is well before 2030. In addition to drinking water, this conference also saw substantive linkages being acknowledged in climate action and water action. In the closing assembly of UNWC, the current president of United Nations General Assembly, Mr. Csaba Kőrösi summarised the game changers that can drive the world in achieving the Water Action Agenda. Many of those game changers talk about addressing climate change and integrating climate action with water action. Some of those game changers could be an integrated water and climate policy at national and global levels by 2030 and early warnings for all to help people safeguard their lives and property.


Image showing launch of CEEW publication by Hon'ble Minister of Jal Shakti, Shri Gajendra Singh Shekhawat at UN Water Conference, New York, March 2023

*Source: UN Water Conference 2023*

## Conference of the Parties (COP)

The Conference of Parties (COP) is an annual meeting organised by the United Nations Framework Convention on Climate Change (UNFCCC) where countries come together to discuss and address global climate change issues. Negotiations around the water sector have become increasingly important at COP. The Water Action Track was launched at COP25 in 2019 to mobilise stakeholders from across the water sector to increase ambition and action on climate change adaptation and mitigation, with a particular focus on achieving SDG 6. COP26 came as a breakthrough and saw the establishment of the Water Pavilion, which

provided a platform for stakeholders to share knowledge and experiences on water management in the face of climate change. Finally, in 2022, water and sanitation were also introduced for the first time in agendas, and the COP committee emphasised the importance of the water and climate nexus. At COP27, India also emphasised the need for a 'bottom-up approach' to address water management challenges and highlighted the importance of community participation in decision-making.

## Some Relevant Schemes and Policies by the Government of India

India has been proactive in making commitments and negotiations on global platforms around sustainable and climate resilient water management. The conviction in these commitments is backed by various national level policies that Government of India is delivering to achieve sustainable management of water resources and to safeguard its water resources in the face of climate change. We discuss some of those policies in this section.

### 1. Jal Jeevan Mission (JJM)

The Jal Jeevan Mission (JJM) was launched in 2019 with the aim to provide a functional tap connection within the premises of each rural household in India by 2024. The mission addresses SDG 6, with the aim to achieve target 6.1 which focuses on achieving universal and equitable access to safe and affordable drinking water for all by 2030. As per the JJM dashboard, as of May 2023, over 87 million rural households have been provided with tap connections within their premises, accounting for 61 per cent of total rural households in the country as compared to 17 per cent in 2019 when the mission was launched.

According to a CEEW study in 2023, USD 120.86 million was the savings from JJM, which is estimated as the income lost per annum on account of workdays spent by women in collecting water from distant sources. Additionally, by ensuring access to clean drinking water, India can save an estimated USD 1.34 billion per annum from reduction in medical expenditure on the treatment of water-borne diseases. The JJM also has tremendous potential to create various kinds of jobs in rural areas, such as in plumbing, water quality testing, community mobilisation, and water supply, and wastewater treatment operations.


### 2. Swachh Bharat Mission - Gramin (SBM - G)

The first phase of the flagship SBM - Gramin was successfully implemented, with all villages of India declaring themselves open-defecation free (ODF) in 2019. The mission has entered its second five-year phase (2020 - 25), moving from ODF to ODF-Plus with the objective of sustaining the ODF status and ensuring the safe management of solid and liquid waste in all villages of India. The country is steadily moving towards ODF-Plus, with almost 3,00,000 villages (out of 6,00,000) in the country declaring themselves ODF-Plus as of May 2023.

As a result, India has contributed to reducing global open defecation by over 50 per cent, according to the Ministry of Jal Shakti. This has progressed the country towards achieving SDG 6.2, that aims to achieve adequate and equitable sanitation access for all and ending open defecation by 2030, with a focus on women and girls and other vulnerable groups. Similar to JJM, the Swachh Bharat Mission Gramin has led to job generation in rural India as well as substantial household savings on account of improved public health due to access to latrines.

### 3. Atal Bhujal Yojana (ABY)

ABY has been implemented since April 2020 in 229 water-stressed blocks of seven Indian States for a period of 5 years. The aim of the scheme is to improve the management of groundwater resources in such areas, which accounts for about 37 per cent of such blocks in the country. Encouraging community participation and inculcating behaviour change towards water conservation are the pillars of this scheme. It

thus has the potential to provide the country with necessary data for planning of water resources and for climate action through community participation. It can fill a major data gap by providing data with increased frequency and better resolution. It can do this for the data on current and future water demands, and for rainfall and groundwater level data.

The community at gram panchayat level has to prepare and annually update gram panchayat water budgets where they assess surface and groundwater resources and identify current and future needs as a basis for planning. The community also has to prepare water security plans in which they identify sources of investments for interventions needed in the next five years to meet their water demands identified in water budgets. Similarly, the community also has to measure groundwater levels and rainfall. The making of these plans and disclosure of groundwater information are prerequisites for finances of the scheme to be released to states. As per a CEEW publication in March 2023, the scheme has initiated or completed the formation of water security plans for more than 8,000 gram panchayats, 3,500+ piezometers, 1,900+ digital water level recorders, and 2,500+ water flow metres have been installed to strengthen groundwater monitoring in villages and data from these has been put in public domain from 8000+ gram panchayats.

Another significant scheme is the National Aquifer Mapping and Management Programme (NAQUIM). Under NAQUIM, groundwater aquifers have been mapped and management plans have been made for 80 per cent of the country. As per our analysis in 2023, about 9 per cent of gross value added to the Indian economy in 2018-19 came from use of groundwater irrigation in agriculture. With renewed focus on data in international commitments, the stage for launch of more such schemes has been set. The rural economy stands to benefit from this data both in terms of planning for agriculture and WASH services and in reducing vulnerability to climate change.

## Way Forward

India is already on its mission to achieve SDG6 targets through various national missions and water-related interventions it is undertaking, which are in alignment with the major international commitments. The way forward for India should be to synergise and leverage on its existing programmes and commitments.

## Knowledge Transfer from International Collaboration

Delegates and experts from India who attend various international forums like COP, UN Summits, and G20 can play a critical role in pooling their knowledge and building a collective strategy to combat climate change. India can leverage the collective knowledge and experience gained at these forums to strengthen the existing policies and strategies to address climate change and build resilience in the water sector.

## Data Production by Leveraging Traditional Knowledge

Leveraging traditional knowledge and increasing community involvement in data governance and management will lead to the collection of more granular on-ground data, as emphasised by various international commitments and targets. Community-based monitoring and data collection programs as initiated under the ABY will enable sustainable and equitable management of natural resources while providing opportunities for community engagement and decision-making. Further, such participatory research will facilitate effective early warning systems, that will play a crucial role in reducing the disaster risks.

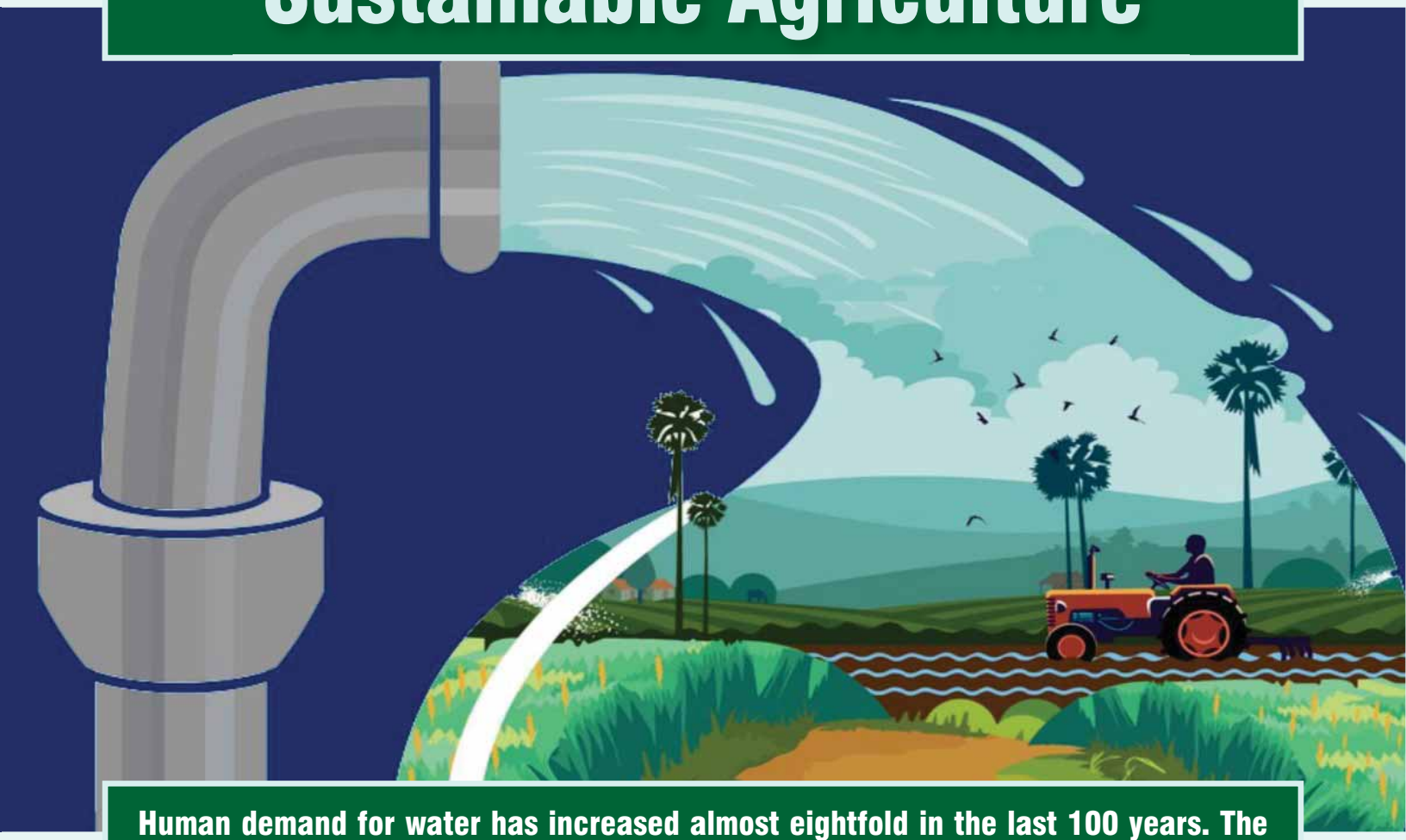
## Better Reporting of Data on Safely Managed Drinking Water Services

CEEW 2022 analysis highlights that the data reported by different agencies on the progress with the safely managed drinking water services in India needs to be strengthened to include all its components, i.e. access, reliability, and safety (potable water quality). This calls for increased collaboration between various agencies incharge of such reporting and developing synergies in their approach and instruments and tools used for data collection.

## Learnings from Experience

India can learn from the experience of its own existing policies and programmes in the WASH sector and ensure that they are able to improve resilience to climate extremes. In 2021, CEEW developed a climate vulnerability index that can be used to determine the areas where the rural population is more vulnerable to the impacts of the climate extremes. Such areas might need additional targeted interventions to ensure that the early gains in terms of improvement in access to WASH services remain sustainable. ❑

# Rainwater Harvesting for Sustainable Agriculture



**Human demand for water has increased almost eightfold in the last 100 years. The world contains an estimated 1,400 million cubic kilometers of water, but only 0.003 per cent of this vast amount could be used for drinking, hygiene, agriculture, and industry. Monsoon rains assume great significance in Indian agriculture, as almost 60 per cent of the sown area is still rainfed.**

**Dr Harender Raj Gautam**

Water is essential for maintaining the integrity of ecosystems and for the development of human society and the economy. Human demand for water has increased almost eightfold in the last 100 years. The global population is expected to reach 9.5 billion, but natural resources such as water and land will remain static. Water is a critical resource, and the world will face a 40 per cent shortfall between forecast demand and available supply by 2030. The Food and Agriculture Organization (FAO) estimates that over the last century, the global water withdrawal grew 1.7 times faster than population, which aggravates concern over the sustainability of water use as demand

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for agricultural, industrial, and domestic uses continues to increase. Climate change will further worsen the situation by altering hydrological cycles, making water more unpredictable, and increasing the frequency and intensity of floods and droughts. The world contains an estimated 1,400 million cubic km of water. But, only 0.003 per cent of this vast amount, which comes to about 45 000 cubic km, are 'fresh water resources' that could be used for drinking, hygiene, agriculture, and industry. But not all of this water is accessible because part of it flows into remote rivers during seasonal floods. The average annual rainfall over land is 1,10,000 $km^3$, but some 70,000 $km^3$ evaporate before reaching the sea. The remaining 40,000 $km^3$ are potentially available for human use, but this is distributed very unevenly, and two-thirds of it runs off in floods. Global freshwater consumption is currently around 4,000 $km^3$, only 10 per cent of the annual renewable supply. Thus, rainwater harvesting is the only alternative to reducing this gap.

Globally, rainfed agriculture occupies 80 per cent of the land and contributes about 60 per cent to food production. The remaining 20 per cent of land under irrigated agriculture supports about 40 per cent of the food supply and contributes to food self-sufficiency in a number of developing countries. In India, the proportion of cultivated land under rain-fed agriculture is 127 million ha, which is approximately 70 per cent of the total cultivated land. Agriculture is the largest consumer of water and accounts for 70 per cent of global freshwater withdrawals. In the last 30 years, food production has increased by more than 100 per cent. These agricultural activities involve over 1 billion people worldwide and generate over $2.4 trillion in economic value every year. Therefore, the importance of rainwater management in increasing overall agricultural production is well realised. However, the complexity of problems associated with rain fed agriculture is greater than that of irrigated agriculture.

Water resources management is a basic tool to achieve food security, prevent uncontrolled soil erosion, and prevent water loss in the agricultural sector. The World Economic Forum explains that water systems bear some similarities with food, climate, and economic systems, and that these similarities must be exploited in order to maximise benefits. In India, more than USD 2 billion per year is being invested on rainwater harvesting interventions to mitigate climate related risks. It demands for an in-depth analysis of the rainwater management problem in rainfed ecosystems and the development of a cost-effective technology for sustainable agricultural production. To further cope with these challenges, there is a need to adapt alternative food crops and irrigation practices for sustainable agriculture. Alternative food crops such as buckwheat, barley, and quinoa are highly nutritious with dry weight crude protein of 18.5, 14.7 and 13.8 per cent, respectively, compared to corn (8.7 per cent) and wheat (13 per cent). The use of rainwater is recognised as a viable alternative, supplementing conventional supplies to meet demands for drinking, washing, sanitation, and crop irrigation, in addition to alleviating potential droughts in the face of climate change. This is in addition to environmental co-benefits such as, mitigated sewer overflows, increased food and economic security, and reduced human and environmental impact.

## Need for Rainwater Harvesting

The Central Ground Water Board (CGWB) has classified 16.2 per cent of the total assessment units like blocks, mandals or talukas as 'over-exploited'; additional 14 per cent as either at 'critical' or 'semi-critical' stage.

It is matter of concern that most of the overexploited blocks are in northwest region of the country. Unsustainable groundwater use necessitates demand management and supply augmentation measures for improved water use efficiency in the agriculture sector. As per the assessment carried out by the CGWB in 2011, India's total annual replenishable groundwater resource is around 433 billion cubic meters (BCM) and net annual ground water availability is 398 BCM, of which India withdraws 245 BCM (62%) annually. 'Dynamic Groundwater Resources Assessment of India– 2022' report indicates that the major source of groundwater recharge is monsoon rainfall, which contributes about 55 per cent of the total annual groundwater recharge. Rainfall during the monsoon season contributes more than 70 per cent of the annual ground water recharge in states like Goa, Gujarat, Jharkhand, Kerala, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Rajasthan, and Daman & Diu. Further, there is 61 per cent contribution of recharge from rainfall both from monsoon and non-monsoon, to the country's total annual groundwater recharge and the remaining 39 per cent recharge comes from other sources like canal seepage, return flow from irrigation, recharge from tanks, ponds, and water conservation structures. Groundwater level data for 2021 and 2022 reveals that the general depth to water level in the country ranges from 5 to 10 mbgl (metres below ground level), with very shallow water levels of less than 2 mbgl observed in a few states, such as Assam, Andhra Pradesh, Meghalaya, Karnataka, Kerala, Jharkhand, and Tamil Nadu, in small patches. The annual groundwater recharge, also known as dynamic groundwater resources, for the entire country has been assessed at 437.60 billion cubic meters (bcm) and natural discharges work out to be 36.85 bcm. Hence, the annual extractable ground water resources for the entire country are 398.08 bcm. The total annual groundwater extraction for the entire country in 2022 has been estimated at 239.16 bcm, with agriculture being the predominant consumer of groundwater resources, accounting for about 87 per cent of the total annual groundwater extraction.

## Potential of Rainwater Harvesting

Monsoon rains assume great significance in Indian agriculture, as almost 60 per cent of the sown area is still rain-fed. The summer monsoon accounts for 70 to 80 per cent of the annual rainfall over major parts of south Asia. Timely onset and spatial distribution of rainfall is crucial for cultivation of Kharif crops, which account for about 90 per cent of paddy, 70 per cent of coarse cereals and 70 per cent oilseed production of the country. Rainfall, especially during the months of June and July, is crucial for sowing Kharif crops. Coastal areas of peninsular India, in particular Tamil Nadu, receive the bulk of their annual rainfall from the North-East Monsoons, between October and December. India's annual rainfall is around 1183 mm, out of which 75 per cent is received in a short span of four months during the monsoon (July to September), which in terms of quantity comes to an average of 4,000 bcm of precipitation every year. This results in runoffs during the monsoon and calls for irrigation investments for the rest of the year. Even if 5 per cent of annual rainfall were harvested properly, that would produce a substantial quantum of water to the tune of 900 million litres. There is a large variability in the monsoon rainfall on both spatial and temporal scales. However, only 48 per cent of it is used in India's surface and groundwater bodies. But, due to a dearth of storage procedures, a lack of adequate

**India's annual rainfall is around 1183 mm, of which 75 per cent is received in a short span of four months during the monsoon. Even if 5 per cent of annual rainfall were harvested properly, that would produce a substantial quantum of water to the tune of 900 million litres. Therefore, rainwater harvesting becomes very important. This is one of the important tools to make our agriculture more resilient to dependence on monsoon rains. It is estimated that about 24 million hectares metre of rainwater can be potentially harvested through small water harvesting structures in different rainfall zones of India. If the harvested water is suitably stored, about 30 per cent of it can be utilised for providing supplemental irrigation to rabi crops covering an area of about 95 million ha. An additional yield of 1 tonne per ha can be realised through supplemental irrigation.**

infrastructure, and inappropriate water, only 18-20 per cent of the water is actually used. Therefore, rainwater harvesting becomes very important. This is one of the important tools to make our agriculture more resilient to dependence on monsoon rains. It is estimated that about 24 million hectares of rainwater can be potentially harvested through small water harvesting structures in different rainfall zones of India. If the harvested water is suitably stored, about 30 per cent of it can be utilised for providing supplemental irrigation to rabi crops covering an area of about 95 million ha. An additional yield of 1 tonne per hectare can be realised through supplemental irrigation. A part of the remaining 70 per cent of the harvested water would help in recharging the groundwater aquifers, which may help in raising the groundwater level by 2 metre as experienced in different agro-climatic regions. Our agriculture is more prone to monsoon rains as we are growing high water requiring crops like rice and sugarcane. We should increase the area under low water requiring but high value crops like pulses and oilseeds to counter the erratic monsoons. With innovative and sustainable practices, we can conserve water in agriculture and ensure a bright future for both food production and the environment. For instance, precision agriculture that uses sensors and smart technology can help farmers optimise water use, reduce waste, and increase efficiency. Rainwater harvesting is an ideal solution to arrest the declining trend of water levels. The surface runoff, which goes to storm drains, is utilised. It helps reduce the flooding of roads and roundabouts. The structures required for harvesting the rainwater are simple, economical, and eco-friendly.

## Indigenous Knowledge of Rain Water Harvesting

Farmers have been using their traditional wisdom to develop a range of innovative methods to harvest rainwater in a decentralised manner across the world. These interventions are helpful in meeting their freshwater needs for domestic, livestock, and agricultural use. Water harvested from these structures is either used directly or facilitates the recharging of groundwater sources, depending on various topographical and biophysical factors. It has been estimated that for every square foot of imperious surface, a one-inch rainfall will collect 0.623 gallons of water. We can realise this potential by tapping the rainwater through the rooftops of our houses, and a 2,000 square foot building can collect 1200 gallons for every one-inch of rain. Rainwater in most areas is salt free and slightly acidic, and plants benefit from slightly acidic water.

In India, different types of rainwater harvesting systems have been designed, innovated, and practiced across the country since ancient times. Among these, surface water tanks in southern India; *haveli* system in central India; *khadins* and *johads* in western India, and ruza in eastern India are traditional practices of decentralised water harvesting systems. In these methods, the generated surface runoff is harvested through the construction of small-scale water structures. These systems have significantly contributed not only to generating various provisioning services but also in supporting the landscape to maintain biodiversity and continue to be productive. The haveli system used to secure surface and groundwater resources is helpful in maintaining the green cover and a range of flora and fauna. Further, the deposition of silt at haveli bed over a period of time helped to maintain productivity levels. However, due to a lack of maintenance, a number of these structures became obsolete in the last 3–4 decades and need to be repaired.

The Bundelkhand region of Central India belongs to the Ken and Betwa catchments of the Yamuna sub-basin of the Ganga river basin. Agriculture and allied sectors are the major source of livelihood for more than 80 per cent of the rural population in the region. However, agricultural and livestock productivity in the region is much lower than the national average and more than 90 per cent of the farming families live below the poverty threshold of US$ 1.25/day/person. Traditional rainwater management systems (haveli systems) have contributed towards rehabilitating degraded landscapes and changing them into productive forms in the Bundelkhand region. However, this system became defunct due to neglect. Further, the traditional design of the havelis was also often malfunctioning due to new rainfall patterns and storm events. Thus, there was a need for rejuvenation and innovations with active support from research and external expertise. In this context, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and consortium partners introduced an innovative approach for haveli rejuvenation by constructing a masonry core wall along with an outlet at a suitable location. In total, 40 haveli structures were constructed between 2010

and 2021 across seven districts of the Bundelkhand region. Rejuvenation of the haveli system created an opportunity to harvest surface runoff within farmers' fields, which helped to improve groundwater levels in shallow dug wells, which remained available during the following years. This has increased cropping intensity by converting about 20 per cent of permanent fallow lands into productive agriculture lands and also ensured irrigation availability, especially during the critical crop growth stage. This enhanced the land and water use efficiency of the system and increased household net income by two to three folds as compared to the baseline status.

## Government Initiatives

The Government of India has taken numerous measures to assess and manage the country's groundwater resources based on resource assessments conducted by the Central Ground Water Authority (CGWA) and the Central Ground Water Board (CGWB). Some key initiatives include:

- Formulation of a Master Plan for Artificial Recharge to Groundwater in India, which aims to implement around 11 million rainwater harvesting and Artificial Recharge structures to augment groundwater resources in India.
- Circulation of a Model Bill to all States/UTs to enable them to enact suitable legislation for groundwater regulation, including provisions for rainwater harvesting.
- Implementation of the National Aquifer Mapping and Management Programme (NAQUIM) to map major aquifers, characterise them, and develop Aquifer Management Plans to ensure the sustainability of groundwater resources in India.

These initiatives, along with various other schemes and programmes like the Atal Bhujal Yojana and *Pradhan Mantri Krishi Sinchayee Yojana* (PMKSY), *Har Khet Ko Pani* (HKKP), and Ground Water Irrigation (GWI), focus on improving groundwater management in water-stressed areas, ensuring community participation, and creating additional irrigation potential from groundwater resources.

The National Water Mission's (NWM) campaign 'Catch The Rain', with the tagline 'Catch the rain, where it falls, when it falls' is to nudge the states and stake-holders to create appropriate Rainwater Harvesting Structures (RWHS) suitable to the climatic conditions and sub-soil strata before the monsoon. The *Jal Shakti Abhiyan* (JSA) was launched in the year 2019 in 1592 blocks out of 2836 blocks in 256 water stressed districts of the country. The focused interventions of the campaign include i) water conservation and rainwater harvesting; ii) enumerating, geo-tagging & making inventory of all water bodies; and preparing of scientific plans for water conservation based on it iii) Setting up of Jal Shakti Kendras in all districts iv) intensive afforestation and v) awareness generation. With a focus on augmenting irrigation in agriculture, '*Har Khet Ko Pani*' is one of the componens of the *Pradhan Mantri Krishi Sinchayee Yojana*. Other schemes like Surface Minor Irrigation (SMI) and Repair, Renovation and Restoration (RRR) of Water Bodies, have multiple objectives like expanding cultivable area under assured irrigation by improvement and restoration of water bodies thereby increasing the tank storage capacity and revival of lost irrigation potential, improving water use efficiency, ground water recharge, increased availability of drinking water, improving the catchment of tank commands, etc.

## Future Initiatives

There is a need to focus on a community-based water management approach that will help build social capital, promote equity and social inclusion, and ensure the sustainability of water management efforts. State Governments should enact laws to check the blatant and unscientific use of this resource. Excessive digging of wells should be avoided or restricted in severely affected areas. Permission for digging wells should be linked with the construction of water harvesting structures. In urban areas, the harvesting of rainwater should be made mandatory so that the stored water can be used for other than drinking. The focus should also be on water reuse and recycling technologies, which are innovative ways to manage water resources sustainably. Smart water management systems with the use of real-time data and analytics to optimise water use, can reduce losses and improve water quality. These systems include sensors, data analytics, and automated controls that allow for efficient and effective management of water resources. Smart water management can help reduce water waste, lower costs, and improve the reliability of the water supply. We are required to break the hydrological anarchy by becoming proponents in our campaign and also in actions to save water to sustain the desired higher growth in agriculture. ❑

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