WATER CONSERVATION AND SAVING IN AGRICULTURE

Initiatives, Achievements and Challenges in Maharashtra

Government of Maharashtra

Water Resources Department
Government of Maharashtra, India

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WATER STEWARDSHIP IN RAINFED AGRARIAN MAHARASHTRA[1]

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Abstract

In the rain-dependent dry lands of India, erratic rainfall and drought result in a drastic fall in agricultural production and acute water scarcity for domestic and livelihood needs. Traditional knowledge and lack of local water governance practices in rural communities increase risks and losses. Hence, it is necessary to equip villages with knowledge and tools to take informed decisions at the farm, enterprise and community levels that enhance resilience and adaptive capacities. This paper is based on lessons learnt and observations from implementing a Water Stewardship Initiative (WSI) that seeks to facilitate a cognitive and organizational shift by bringing science, policy and governance together at the level of practice and community action. This initiative was launched by Watershed Organisation Trust, a not-for-profit organisation, in 100 villages in Maharashtra State, India. In the WSI, the approach adopted is of 'co-production of knowledge for behavioural and institutional change' towards building the communities' knowledge and capacity to effectively face varying weather conditions. This article presents the approach; key concepts and processes applied in the WSI and highlights its potential to be taken forward in other similar regions. It has significance to influence state policies in the water sector.

Keywords: ***Behavioural change, equity, drought, governance, resilience, sustainability, water budget, water security, water stewardship***

[1]This article is a modified version on the chapter titled, "Building Resilience to Climate Change: Water Stewardship in Rainfed Agrarian Villages in Maharashtra, India." by Eshwer Kale and Marcella D'Souza, published in "W. Leal Filho (ed.), Handbook of Climate Change Resilience, by Springer Nature Switzerland AG 2018. The original version of the paper is available at https://doi.org/10.1007/978-3-319-71025-9_51-1 and the permission is taken from the publisher to reproduce the modified version.

1. Introduction

In the rain-dependent drylands of India, acute water scarcity for drinking and a drastic drop in agricultural production is increasingly experienced due to frequent droughts. Models indicate that by 2025, climate change alone will bring scarcity to many places. Increase in population is a greater threat. In the absence of appropriate demand-side management, the combination of population growth and climate change will create water scarcity far and wide (Roger P 2008).

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Today, India is a water-stressed country with its per capita freshwater availability at 1545 cubic meters per person per year, which was above 5000 cubic meters at the time of independence in 1947 (Singh Y and Rahal A 2011; Khurana I and Sen R 2012; Prakash A et al. 2013). In this critical situation, it is necessary to equip people and communities with the knowledge and tools to make informed decisions at farm, enterprise and community levels so as to build adaptive capacities and enhance their resilience.

1.1 *Key challenges for the water sector and rainfed agriculture*

Maharashtra, the third largest state in India has a total geographical area of 30.76 million hectares (mha) of which 52 % area of the state is prone to drought (GSDA 2014). In groundwater dependent arid and semi-arid regions, the multiple demands from livelihoods, food and water requirements of an increasing population; an increasing area under agriculture and groundwater dependent irrigation put the groundwater at risk, which is aggravated by changes in the rainfall regime. On the one hand, users are barely literate about water resources and their appropriate use, and on the other, groundwater is still considered a private good. The lack of appropriate and effective governance mechanisms for water resources have established the rule of capture resulting in anarchy in groundwater management (Shah T 2009). The general understanding in India is that water beneath the land belongs to the owners of land (Ballabh V et al. 2008), which is well described by Ramaswamy Iyer (2003) as, 'water is attached like a chattel, to the land property'. This has led to mismanagement of groundwater resources particularly by the better-off of the rural society, coupled with the dependency syndrome that 'the state has to provide water for all users', while negating the responsibility of communities to manage their locale specific resource. Market price fluctuation for farm produce and the shift to high external input cash crops further worsens the groundwater crisis and farmers' woes putting not just farmers' livelihoods under threat, but also water for domestic use and sanitation, while increasing the workload of women.

1.2 *Groundwater, the backbone of arid and semiarid regions*

Groundwater is the backbone of India's agriculture and drinking water security, contributing to 84 % of the total net irrigated area in India (Shah M 2013) and 90 % of the rural water needs being met by it (Prakash A 2013). In the 1950s and 1960s, the share of surface water in irrigation was around 60 %, which reduced to less than 30 % in 2007, while the groundwater share increased to around 60 % in 2007 (Shankar V et al. 2011). A recent report of the Groundwater Survey and Development Agency (GSDA) indicates that since the past five years in many regions of the state, the water level in the month of October drastically drops: of the 353 blocks, in 230 blocks (10167 villages) the water level has dropped by over one meter while in 2587 of these 10167 villages, the groundwater level has dropped by over 3 meters. The report warns that 7139 villages in 132 blocks may face water scarcity for drinking water during 2018 (GSDA 2017). The CGWB report (2017) states that in the last ten years, groundwater levels have fallen in around 50 % area of Maharashtra (TOI 2018).

1.3 *Impacts of climate change on groundwater resources*

In water resources management today, climate change and global warming are of growing concern and India is one of the largest and important regions of high overall human vulnerability (Thow A and Blois M 2008). With global warming is likely to intensify, the climate change phenomenon may accelerate or enhance the global hydrological cycle (IPCC 2008). Precipitation forecasts for India under climate change scenarios suggest higher but more variable rainfall, except in the drier parts, where rainfall could decrease. While intensity of the rainfall may increase, the actual number of rainy days may decrease and the changing patterns of rainfall and runoff are expected to significantly impact groundwater recharge and availability (Zbigniew W et al. 2009). In water-scarce years, farmers and other users are likely to depend on groundwater options to compensate for inadequate rainfall and surface water supplies. The scenarios also indicate that after good rainfall years, the dry period of low or no rainfall which is currently of 2 to 3 years may increase 4 to 5 years. With the average global temperature rising, the rate of evaporation of the surface water will also increase. Therefore, in the rain-dependent drylands of India within which much of Maharashtra falls, erratic rainfall and drought will result in a drastic fall in agricultural production and acute water scarcity for drinking and livelihood purposes. Hence it is necessary to prepare and equip rural communities and farmers with knowledge, skills and means to address these challenges.

This article is based on the experiences of implementation of the Water Stewardship Initiative (WSI) by the Watershed Organisation Trust (WOTR) with an aim to facilitate a cognitive and organizational shift by bringing science, governance and policy together at the level of practice and community action. The approach adopted in WSI is of "co-production of knowledge and learning for behavioural and institutional change" towards building community knowledge and enhancing their capacities to effectively deal with varying weather conditions.

2. Overview of the Water Stewardship Initiative

This section provides the overview of experiences of local water governance in India and in particular, the WSI that the Watershed Organization Trust (WOTR) has implemented in 100 villages in Maharashtra.

2.1 *The Water Stewardship Initiative, the SDGs and policy*

The WSI provides important contributions for achieving the Sustainable Development Goals - SDG 6, 12, 13, 16 - in the context of climate change where 2°C temperature rise is expected by the end of the 21st century (IPCC 2014). Moreover, the Maharashtra Groundwater Development and Management Act 2009, calls for urgent community management of their groundwater resources.

2.2 *Water Governance: The concept and Indian experiences*

The concept of people managing water resources is not new in India. Groundwater depletion and its consequent misery have triggered attempts to create a new social order of 'community based natural resource management' (CBNRM). The argument behind the CBNRM is that there exists a certain kind of cooperation and community solidarity within village communities that sustains with endogenous or exogenous stimuli when the expected outcomes are for the benefit of the concerned group (Lopez-Gunn E and Cortina L 2006). These ideas are echoed in experiments by social entrepreneurs like Anna Hazare and Popat Rao Pawar which are perhaps the best-known examples of community revival through participatory watershed and water resource management in Maharashtra (World Bank 2010). Besides these, in Maharashtra there are

numerous successful participatory watershed development projects where NGOs put community at centre. The work of Hardevsingh Jadeja in Rajsamadhiala village near Rajkot, Rajendra Singh of Tarun Bharat Sangh in Rajasthan, the late Vilasrao Salunke's Gram Gaurav Pratishthan in Pune, Swaminarayan Sampraday and Swadhyaya Pariwar in Saurashtra, Gujarat are few pioneering voluntary, self-regulated and community based experiments towards sustainable use of groundwater (Shah T 2009). Triggered by groundwater scarcity all these experiments went beyond just harvesting rainwater, to invoking visions of sustainable and judicious use. However, most of the instances are characterized by the presence of a charismatic leadership and/or are location specific; therefore do not offer a process-based approach or a model that can be taken to scale. The Andhra Pradesh Farmer-Managed Groundwater Systems Project (APFAMGS) stands apart It shows how carefully designed community based approaches hold significant promise for addressing groundwater overexploitation issues, especially in hard-rock aquifers At the same time, the achievement of this initiative challenges the underlying assumptions in the discourse and practice of groundwater management in India that 'legal and policy reform is a necessary first condition for attempting groundwater management in the country' (World Bank 2010).

The WSI provides important contributions for achieving the Sustainable Development Goals - SDG 6, 12, 13, 16 - in the context of climate change where 2°C temperature rise is expected by the end of the 21st century (IPCC 2014). Moreover, the Maharashtra Groundwater Development and Management Act 2009, calls for urgent community management of their groundwater resources.

At the international level, for maximizing the economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems, the Integrated Water Resource Management (IWRM) promotes a coordinated development and management of water, land and related resources (UNEP-DHI 2009; Harsh 2012). In many developed countries, the IWRM framework is practiced by allocating water through regulation and incentive mechanisms such as water pricing (Shah A and Prakash A 2010) which increases the efficiency of water use and allows for better maintenance of the water-related infrastructure. However, in countries, like India, the challenge in applying IWRM practices is mainly in formalizing the existing informal water economy (Shah T and Koppen B 2014) where the number of water users is huge and water resource management is compartmentalized into surface and groundwater at the level of departments and agencies. Apart from this, a large proportion of the population in India does not have access to the most basic facilities of safe and adequate drinking water and sanitation, hence putting a price on water for these sections is not considered justifiable and possible (NWM 2010). In promoting IWRM practices, the financial, infrastructure and human capacities of countries to fulfil the responsibility of water governance matters a lot, however in India these resources are inadequate (Azhonia A et al. 2017). Although, in many countries the IWRM approach is not very successful (ADB 2007), it has provided an important framework for integrated water management and a tool for establishing multi-stakeholder dialogue.

2.3 *Rationale for and the objectives of the Water Stewardship Initiative*

Considering the above discussion, there is an urgent need to move forward following the

supply-side enhancement from participatory watershed development (WSD) across the country, towards the demand-side management and improvement in water governance at the local level. This is the underpinning of the Water Stewardship Initiative. In these 100 villages, soil and water conservation measures and or WSD have either been completed or are on-going, and while water availability and agriculture productivity shows a marked increase (Vani S et al. 2007), these villages also experience water shortage for irrigation and domestic use in summer. Because of the shift to cash crops and the absence of effective regulations on water use, lifting of groundwater for agriculture has increased, particularly by the better endowed farmers. Watershed Development Committees have not been proactive and are not confident enough to set up water use norms and practices and impose them. Unequal water access in villages have reached to an extent where better-off farmers have water available in their farm ponds (promoted through government schemes), even in the dry season and drought periods, while in the same period the lesser endowed farmers and women struggle to fetch water for their basic needs from public tankers (Kale E 2017). There appears to be an assumption in rural areas that the state is responsible for addressing the various needs regarding water of individuals, and communities do not have any responsibility in this regard. Community action which is the key to village development and progress is lacking. At another level, healthy dialogue and cooperation between government officials and village communities does not occur besides the implementation of government schemes, e.g. in the water context, those who have water resources can construct farm ponds and apply for micro-irrigation, both of which are beneficial to the resource rich. Moreover, water extraction for agriculture generally lacks relevant scientific information and knowledge of the agro-climatic and hydrogeological conditions that are essential for planning appropriate water use.

There is an urgent need to move forward following the supply-side enhancement from participatory watershed development (WSD) across the country, towards the demand-side management and improvement in water governance at the local level.

2.4 *The Water Stewardship Approach*

To address above discussed challenges, WOTR designed the 'Water Stewardship' approach that brings key local actors into a dialogue to achieve mutual cooperation and then for preparation and implementation of an action plan. The 'Water Stewardship' approach treats different water users, not as passive beneficiaries, but as water 'stewards' and considers them important stakeholders having the potential to be 'good water managers' who also protect the resource base and ensures it's sustainable, judicious and efficient use (AWS 2014). This concept considers that needs of every individual, for domestic, livelihoods and livestock and the ecosystem, have a right to water. This right comes with a responsibility and accountability to oneself and the community, for its appropriate management.

In WSI, the water resource is seen as public trust rather than private entity. Hence this approach necessarily brings different users/ stakeholders together on one platform to be informed and to dialogue, so as to come to a consensus in preparing a plan and executing the same. There three sets of important actors: **1)** the primary stakeholders i.e. all households within a given geography of a village / aquifer who are the water users for different purposes. **2)** The secondary stakeholders are the neighbouring villages that affect or are affected by the water availability of a particular village e.g. the downstream and upstream villagers, and **3)** the tertiary stakeholders are the decision

makers, administrators (government officials), water experts, donor agencies, civil society agencies, who influence the water related efforts at the village level. These diverse stakeholders need to come together on one platform for building consensus and collective planning for sustainable management of this precious resource. The WSI requires not just a set of actions to be carried out by the primary and secondary stakeholders, but also needs to be provided with sound scientific knowledge so as to make informed decisions. Consensus building through dialogue and workshops (stakeholder engagements) are important where perspectives, desires and conflicts between the different groups are encouraged to surface and sustainable solutions are sought.

The experience of WSI in 100 villages in Maharashtra is spread over 5 blocks in 3 districts (Figure 3). It attempts to find pathways to address the critical balance between supply and demand-side management and achieve water security in varying weather situations such as low rainfall, droughts and drought-like conditions, increase in annual and summer temperature. It aims to develop a scalable model for semi-arid regions, regularly affected by drought and heavily dependent on groundwater for agriculture and domestic use. The goal of the WSI is to ensure as far as possible, that water at the local (village) level is managed in a responsible manner that is socially equitable, environmentally sustainable and economically efficient in climate varying conditions.

In line with the above goal, the five specific objectives to achieve Water Stewardship are: (1) to build skills and capacities of villagers to prepare the Village Annual Water Budget that ensures water availability for domestic and livelihoods needs and that minimizes crop losses. (2) Based on the water budget, the village (households of all land and water resource owning categories) is motivated and facilitated to prepare plans for harvesting rainwater through new structures or repair of old structures and for increasing water productivity ("more crop per drop") through adoption of water efficient technologies and practices. (3) The village – either at the Grampanchayat or a sub-committee – is encouraged, organized and guided to formulate norms for water management to implement effective water governance such that it ensures equitable access to and availability of water for domestic use for its inhabitants throughout the year. (4) To promote a common understanding and trust between the different stakeholders related to the water sector i.e. the primary, secondary and tertiary stakeholders. (5) Develop workable operational guidelines to upscale the initiative in similar conditions (arid and semi-arid regions) with appropriate contextual modifications.

3. Key-components and processes adopted in the WSI

This section provides the processes, tools and activities adopted in WSI considered important for achieving the tangible and intangible results. While implementing these components, conscious efforts are made towards achieving quantifiable targets as well as ensuring the richness and quality in processes, especially skills and capacity development of the villagers.

3.1 *Institutional Development and Capacity Building*

Institutions are the 'pillars of governance'. In the WSI the Village Water Management Team (VWMT) is important for promoting water stewardship. Jal Sevaks (water caretakers) support and guide the VWMT for meeting the goal of sustainable water management.

3.1.1 *Jal Sevaks (Water Caretakers)*

Jal Sevaks - committed and motivated rural youth with a passion for the progress of their village, play a crucial role in this initiative as organizer, facilitator, and motivator to village communities for the preparation and implementation of water

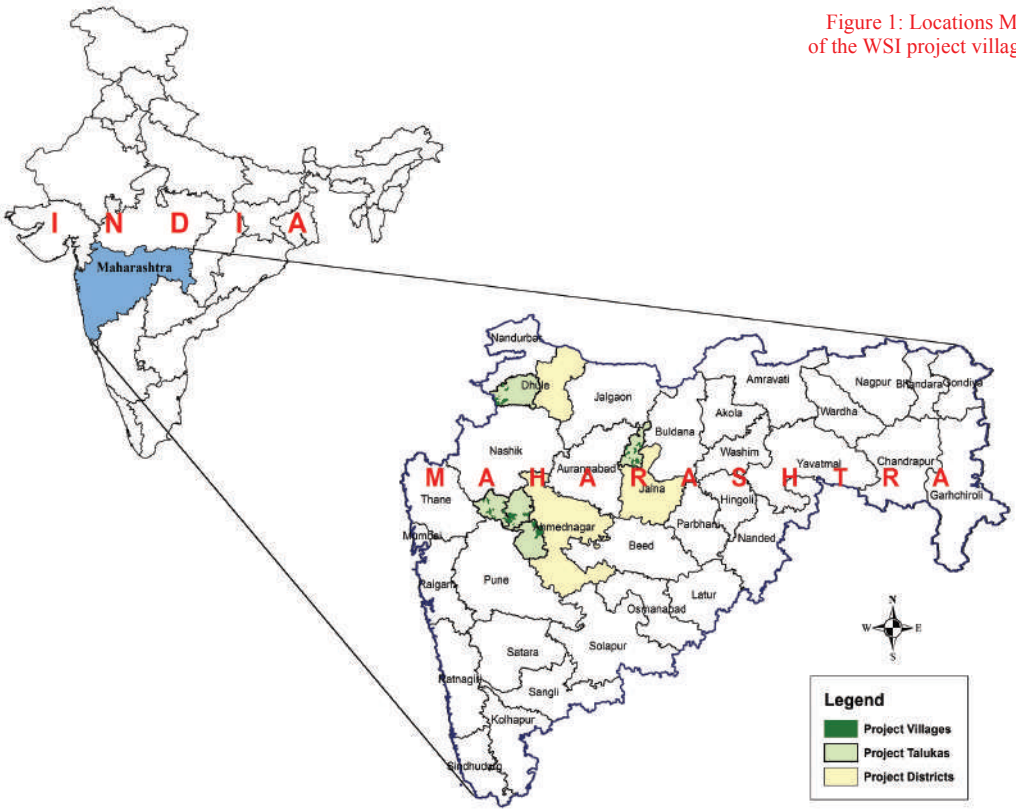

Figure 1: Locations Map of the WSI project villages

stewardship plans. They are capacitated to handle various challenges in the water sector at the level of village and cluster of villages. Jal Sevaks mobilize villagers of all land and water owning categories to be organized for: (1) formation of Village Water Management Team (VWMT); (2) to conduct a baseline inventory of the existing soil and water harvesting structures with detailed measurements; (3) to facilitate and guide the VWMT to prepare water stewardship plans, and (4) motivate villagers to implement the same. The Jal Sevaks use various motivational tools and methods to promote water literacy and its management. By engaging rural youth (Jal Sevaks) and building their capabilities, WSI develops a cadre of motivated and skilled water stewards who can take forward water management practices in villages.

3.1.2 *Water Stewards at village level – The Village Water Management Team (VWMT)*

The WSI believes that villagers can be 'water-managers' rather than passive 'beneficiaries' or 'target' groups. Provided with adequate information and knowledge of the different aspects of water as a 'good' essential for life and that it needs to be used and protected, the VWMT is motivated and provided with information to understand that they need to take responsibility of governing their water resource effectively. The roles and responsibilities of VWMTs are to create a positive and encouraging environment for adoption of water stewardship; ensure that the Gramsabha (village general body

meeting) is actively develops water use plans and set rules/norms at village level to implement the plans. It plans to engage the government departments, corporates and other NGO_S to obtain the necessary support for convergence and to realize the water stewardship plans.

As all water users are water stewards of their respective water resource, they necessarily need to take responsibility for adopting effective water management practices. Hence representatives of different categories of households within a village e.g. landownership groups, landless, women and other water dependent livelihood group are selected and form part of the VWMT.

3.1.3 *Bringing together the diverse players through Stakeholder engagement events*

For better water management, diverse stakeholders (primary, secondary and tertiary, as well as different categories of villagers) who have a shared problem are engaged at village / clusters of villages / aquifer levels. It is during such events that sharing of local scientific information and data (eg of the cluster of villages; of the aquifer and even of the block) is useful to develop a common understanding of the landscape, the water resources, climate variability – all of which affect the livelihood of various groups within villages. Stakeholders begin to understand the link between one village and the others and how together they can take decisions to improve crop production while managing the available water sustainably. Bringing the respective government officials, experts and facilitating agencies (tertiary stakeholders) to these engagements further strengthens the WSI. Stakeholder Engagement workshops foster free and healthy discussions and interaction between participants, and helps uncover the sticky problems.

3.2 *Preparation and Implementation of the Water Budget*

Once the VWMT is motivated to take concrete action for improving their village water health and to address the water related problems, they are guided to prepare the village water budget. The Water Budgeting tool presents a practical and tested method at village and micro-watershed level of approximately 1000 to 2000 hectares. It facilitates the preparation of appropriate crop plans based on the available water, after ensuring water for domestic use and livestock for all households throughout the year. It provides the possibility for villagers to consider water scarcity in drought years as groundwater is the main source for both domestic use and livelihoods.

While Jal Sevaks explaining the water budgeting board to villagers
(Photo Credit: Eshwer Kale, WOTR)

3.2.1 *Preparation of the Village Water Budget*

The Water budget preparation is done twice during the agriculture year. Around month of March, the first water budget is prepared to calculate the requirement for the whole year i.e. water use for agriculture (in the monsoon, winter and

summer seasons), and for domestic use and livestock. The purpose of calculating the requirement for the whole year is to assess the amount of water that can be harvested within the village from structures that were earlier constructed and/or to identify those that require maintenance. The second water budget is prepared early in October, to calculate the available water at the end of the monsoon and to plan its use for all needs particularly for agriculture in the winter and summer seasons. Currently, water for ecosystem services is not being factored in the water budgeting tool applied in the WSI, as estimates of water requirements for ecosystem services in the Indian context, is not yet available. Based on the water available for agriculture including perennial horticulture, villagers discuss and decide the types of crops to be sown and the area that can be taken up for these crops. Often, a water budget results in deficit water because people cultivate a greater area than planned; besides they may also cultivate water guzzling crops. An understanding of the water available provides them the opportunity to revise their crop plans so as to minimize the deficit and thus loss.

A Water budget exercise may result in either surplus water in the village, or a deficit, after meeting all water requirements. This exercise presents to the VWMT and villagers, an overall picture of the water use plans for agriculture. It gives them the opportunity to understand the village water resources, the potential and the different water needs of the members of all categories of households of their village. People become aware that the agriculture planned is often more than the water available - which then leads to crop and investment loss and they become aware that they often compromise the water needs of livestock and domestic use. Thus, this exercise is an eye opener to villagers. As a first response to deficits, the VWMT and villages make efforts to revise the total water required for crops by reducing the area under water guzzling crops. However, if a deficit remains, the water stewardship plans provide them with options of supply as well as demand-side measures, as also governance mechanisms: 1) additional water harvesting plan; 2) water-saving plan, and 3) application of social governance rules to ensure efficient water use.

3.2.1.1 *Preparation and execution of the water-harvesting plan:*

To address the water deficit in the budget, a water harvesting plan gives the inhabitants an opportunity to increase the water potential within the village by repairing defunct / damaged structures and where appropriate, to undertake new soil and water conservation measures.

3.2.1.2 *Water-saving plan:*

Villagers assess the existing water use practices and identify initiatives to save water, using water-use efficiency measures for irrigation along with soil quality and biomass enhancing practices. These are micro-irrigation, organic and vermicompost and mulching to increase the biomass content of soil. The VWMT motivates its farmers and assists in linking them with the different government schemes.

3.2.1.3 *Setting up norms for governance:*

For the implementation of crop plans based on the water budgeting exercise and regulating water-use in a sustainable, equitable and efficient way, it helps

when villagers themselves formulate the rules. The rules assist in controlling the behaviour and practices of farmers who do not use water judiciously. Initiated by the VWMT, the rules are decided by the Grampanchayat and ratified by the Gramsabha, so that it becomes obligatory for all households of the village. Some examples of rules prepared are: 1) no direct lifting/pumping of water from surface water bodies such as check dams and percolation tanks; 2) the government norms for the depth (of not more than 200 feet) for borewells to be complied with; 3) a ban or limit on the area for water-intensive crops. Thus, the water stewardship plan is a comprehensive tool that motivates villagers for water governance for both supply and demand-side.

3.3 *Piloting the key principles of the Maharashtra Groundwater Act, 2009*

The Maharashtra Government's Groundwater (Development and Management) Act 2009 (henceforth referred to as the 2009 Act) (GoM 2013) came into force in the state in December 2013. The broad objective of the 2009 Act is to protect drinking water sources and to promote the proper management of groundwater for irrigation. To achieve this it proposes an institutional structure for community participation - the Watershed Water Resource Committee (WWRC). Besides this, some important measures proposed are: restriction on the depth of borewells (max 200 feet); securing drinking water throughout the year; have the people prepare prospective crop plans based on groundwater budgets. Based on the groundwater levels / water stress, the blocks are categorised as: (i) Notified area (ii) scarcity area-within notified area, and (iii) non-notified area (GoM 2013). In the WSI, the following key principles of 2009 Act are tested on a pilot basis with the intent to operationalize the Act.

3.3.1 *Prospective crops plans:*

The Act mandates preparation and implementation of Prospective crop plans based on the available water stock. In the WSI, in all project villages, capacities and skills of the VWMT and the villagers have been developed to prepare and execute water budgeting plans, which prepare both supply and demand-side plans and measures while ensuring drinking water availability. These plans are prepared and executed by the VWMTs.

Around month of March, the first water budget is prepared to calculate the requirement for the whole year i.e. water use for agriculture (in the monsoon, winter and summer seasons), and for domestic use and livestock. The second water budget is prepared in October, to calculate the available water at the end of the monsoon and to plan its use for all needs.

3.3.2 *Institutional governance at aquifer level:*

The Act proposes to form WWRC comprising of even 11 villages if these are identified by an aquifer boundary These work together to benefit from, while managing the aquifer in a sustainable manner. The application of aquifer based management is piloted in the Bhokardan block of Jalna district, where representatives from 14 villages that share a common aquifer, are brought together and form the aquifer management committee. They are capacitated to prepare water use plans at the aquifer level. Water resource literacy is undertaken using the tool CoDriVE-

Visual Integrator-CDVI- (WOTR 2013) in a 3 dimensional model of the landscape above and the shallow aquifer characteristics below surface level.

3.3.3 *Rules for water use:*

In the Act, important provisions regarding the ban on sinking deep well (below 200 feet) and the levy of a cess on extracting groundwater below 60 meters in non-notified areas are made, however these are barely monitored. As an encouragement to initiate governance, in the WSI the approach, communities make their own rules rather than externally enforced ones. However, strict rules at the state level are necessary to create a supportive governance environment for motivating villagers to frame their Grampanchayat and aquifer level rules. In the project, through the intensive stakeholder engagement process at the cluster of villages' level, and by informing villagers of the key provisions of the 2009 Act, the VWMTs were motivated to frame rules considering their local context. In more than 80 of the 100 villages, the VWMTs have framed such rules that have been ratified by the Grampanchayat. The rules are mainly regarding the ban on directly lifting of water from water harvesting structures; putting a ceiling on the depth of borewells or/and the ban on borewell drilling in the village and a ban on growing water-intensive crops.

3.3.4 *Registration of groundwater abstraction structures:*

In the Act, registration of all wells is a precondition for applying the regulations. In some WSI villages, an inventory has been completed of all water harvesting structures, wells and borewells.

3.4 Results and outcome of the WSI

The execution of different components of the WSI resulted in improving water management, specifically in regard to the supply and demand and the institutional environment to govern it. These impacts are observed in the behaviour of the water stewards regarding water-use access, practices and crop management which are considered an outcome of this process.

3.4.1 Changes in the behaviour of the Water Stewards

Feedback from the primary stakeholders from the different districts shows that discussions and scientific information provided during stakeholder engagement workshops have changed the perspective of many villagers with regard to water issues. As shared by a few villagers, the stakeholder engagement workshops provided them an opportunity to deliberate and discuss water issues as a 'shared problem', putting aside all other differences and dynamics within the village. They have learnt how to calculate the water budget and to use it efficiently. Others shared that they now understand water as a common property and that everyone has a right over it; therefore water should be used judiciously. Mrs. Meera Shinde, a VWMT member from Lingewadi village, Jalna, describes how the situation has changed in her village: *"Earlier, for fetching drinking water, no private well owners allowed others to draw water from their wells. After exposure and learning about this in stakeholder engagement workshops and discussions of the same within the village, now, some well owners switch on their private pumps to allow others to take water for home use. As water is needed for all, even for the animals and birds, we have made special water-troughs for the animals in a remote the*

Photo 2: Aquifer Management workshop at Bhokardan block with 3D maps
(Photo Credit: Eshwer Kale, WOTR)

hilly area where monkeys, wild boar and deer face difficulties in finding water in summer. They now frequently come and drink water from these troughs".

Although, framing and enforcing rules regarding water use is challenging, in some villages, people have taken the initiative. Mr. Kisan Icche, VWMT member and village Sarpanch from Kotha Jahangir, explained how the stakeholder engagement workshops motivated their VWMT to make rules at the village level. "Getting motivated through Stakeholder Engagement workshops, we passed a resolution in the gramsabha banning drilling of new borewells and changing the crops to be grown in rabbi season. We tried to convince every irrigated farmer to use sprinkler and drip instead of flood irrigation and by this year (2017-18), almost 60 to 70% farmers installed drips and sprinklers. Because of the rule, not a single borewell was drilled during this year in the village". In Kotha Jahangir, the Gramsabha passed a resolution banning the drilling of borewells deeper than 150 feet, and farmers require permission from the Grampanchayat before drilling a borewell. They have also passed a resolution banning sand extraction from the river bed. Such rules, suitable to local conditions, are made in more than 80 villages. Thus, stakeholder engagement workshops have succeeded to an extent in building a common understanding and consensus, changing perspectives and motivating villagers to work together towards efficient and judicious use of water.

3.4.2 Actions towards local water governance

In all 100 villages, VWMTs have been formed and ratified by the Grampanchayats. Most of the VWMT members participated in the stakeholder engagement workshops where they prepared water stewardship plans that include the Jal-Arogya takta (Water

Health Chart), water budget, water harvesting and water-saving plans. In many villages, the VWMT successfully mobilized their people for 'Shramdaan' (sweat equity) to repair defunct/damaged water harvesting structures. The VWMT framed rules for better water management at the village level, which is a major contribution. This is of relevance as, currently, even state agencies struggle to enforce external regulations on villages for water management. The VWMTs in most of the villages have compiled their water stewardship plans and have submitted the same to district authorities. This is an important exercise where government authorities also find an encouraging environment at the village level to implement their schemes. Villagers too have found a space to interact and dialogue with government authorities.

The 24 Jal Sevaks (Water Stewards) played a crucial role in facilitation and motivation of the VWMTs in these 100 villages. They collected relevant data on time regarding soil and water harvesting structures and other socio-economic details of the villages. Water budgets displayed on boards in a prominent location are regularly updated for the respective season. In all villages, two simple rain gauge units were installed, and the VWMTs record the rainfall. The activities resulted in creating important spaces for villagers to discuss and share their interest and concern regarding water management practices.

3.4.3 *Benefits: Increase in water availability and improved governance*

Village communities in 100 villages annually brought 38 billion litres of water stored in different water harvesting structures under governance through creating water budgets and local rules. In more than 60 villages, people provided shramdaan to repair defunct water harvesting structures and constructed new structures (61 sand-bag dams across streams) and followed up for the completion of soil and water harvesting projects of government and other funders – a convergence initiative. Through these harvesting efforts, 8.95 billion litres of additional water harvesting potential has been created in these villages. More than 2000 farmers in this initiative have adopted practices of micro-irrigation (drips, sprinklers, and mulching), and through this, saved 3.24 billion litres of water.

The WSI has promoted a community-embedded scientific method of water budgeting at the village level supported by appropriate governance practices. This enables villagers to better face the water crisis especially in times of low rainfall and drought. Ultimately, the water security achieved by this exercise contributes to an increased and sustained production of crops and livestock, as well as water for households and livelihoods.

Stakeholder engagement workshops brought together hundreds of 'Water Stewards', researchers, scientists and administrators and resulted in an important forum where different aspects of water scarcity and climate change, impacts on livelihoods and ways to adapt and address these were discussed. This has helped villagers to understand how climate change impacts them and helps prepare them to better adapt to climate variability. These various actions and interventions work towards building resilience of villagers and the farming community, reduce the impacts of climate variability and enhance the

adaptive capacities of local communities and respective stakeholders.

4. *Lessons learnt, Challenges and Recommendations*

This concluding section highlights the learnings from the WSI; discusses the challenges faced and presents the recommendations based on the experiences garnered during implementation of the WSI.

4.1 *Lessons Learnt*

The important gleanings from the experience of the WSI are highlighted below,

(1) The WSI treats water users as important stakeholders - 'water stewards' -with responsibility, rather than as passive beneficiaries, recipients and opportunists.

(2) Authentic locale specific scientific information plays an important role in generating discussions, dialogue and preparing plans at the village level. This information is important for informing the water stewards so that they take appropriate decisions regarding their village water use practices.

(3) It builds the skills and capacities of farmers, village leaders and local youth to prepare water budgets, plan their cropping pattern accordingly, ensure drinking water availability throughout the year and adopt water efficiency enhancing technologies.

(4) The Water Budget approach followed allows for a balanced and integrative approach to water management. In the WSI, both aspects - supply and demand-side - are addressed. This helps mitigate risks, reduce agricultural losses and secure drinking water supplies for the community which is particularly important in the context of climate variability.

(5) The WSI is in line with the Maharashtra Groundwater (Development and Management) Act, 2009, which is an important policy intervention to improve the overall level of groundwater management in the State of Maharashtra (over 80% of Maharashtra's agriculture water needs are met from groundwater reserves). This Act, however, faces hurdles in its implementation; the WSI provides an opportunity to pilot major components of the Act and identify strategies and practices that can bring about behavioural and institutional changes envisaged in the Act.

(6) It has a direct policy and institutional connect. The multi-stakeholder engagement workshops not only facilitate cross learning and consensus building but also present 'ground realities' and practices that work to officials and decision making channels. It thus contributes to improving the institutional and programmatic environment while building capacities of development administrators and practitioners.

Discussions and scientific information provided during stakeholder engagement workshops have changed the perspective of many villagers with regard to water issues.

(7) The approach and impacts realized through this people-led project provides incentives to them to adopt and adapt the best suited effective practices. It is noted that many neighbouring villages are willing to work together to address their water problems having observed how farmers in the WSI project villages have benefitted after changing their water-use and cropping practices.

4.2 *Challenges and Recommendations*

From this WSI implementation experience, the following recommendations are proposed:

1) While promoting water stewardship, the biggest challenge faced is in motivating villagers to shift their focus from supply-side interventions to demand-side management. This is precisely because almost all state programs and NGO-Corporates projects provide support to increase surface water harvesting which is 'visible'. Hence, there is an urgent need to create a strong policy and institutional framework supported by aligned programs which promote effective demand-side water management.
2) The Maharashtra Groundwater (Development and Management) Act 2009 has many important progressive provisions. However, considering the high variation in agro-climatic, biophysical, land typology, and hydrogeological features in the state, enforcement of common rules (such as ban deep wells-below 60 meters and the levy of cess on extracting water below 60 meters) does not seem practically feasible. Hence, in the WSI, villagers were motivated to make and enforce village specific rules/ norms of water use which seems a practical way acceptable to the local people.
3) Bringing villagers together from different villages (more than 11 as suggested in 2009 Act) along aquifer lines, and building consensus between them for aquifer based crop planning is challenging. Each village insists on their individual priorities. Hence, a practical way in this regard is to be worked out locally, with the local administration providing facilitation, regulatory and enforcement provisioning to realize these plans.
4) The WSI is in line with the state policy as enunciated in the Act 2009. The learning and strategies evolved from this pilot and executed in 100 villages can serve as a blueprint for operationalizing and implementing the 2009 Act across the state of Maharashtra. It also helps inspire and inform similar efforts in other states.
5) Promoting water stewardship and building the capacities of communities regarding water budgeting and effective governance is a continuous and on-going process which needs, at the least a medium term perspective. In a project mode of generally of 2 to 3 years, success will be limited. Hence, medium-to-long term committed efforts are necessary in order to achieve sustainable breakthroughs, particularly given the fact that villages face constant changes from exogenous factors.
6) Considering the existing gender inequalities and biases in society, as well as limited participation of women in public programs, conscious and well-focused strategies are required to ensure their active participation.. Being important stakeholders, gendered perspectives will enhance the chances of good water management practices being adopted.
7) The promotion of water literacy and water budgeting is the need of the hour. The Jal Sevaks play an important role in this. Water management can be scaled up with the support of Jal Sevaks. Similarly, capacitated and empowered youth can be engaged in the various water management programs of the state, such as the Jalyukt Shivar and other Watershed Development Programs.
8) The tested WSI approach and strategy which is science-based, participatory and inclusive needs to be up-scaled by the State. It engages all key actors across levels; helps build support for the cause and disseminates learnings to policy makers, administrators as well as those tasked with project formulation and implementation.

In a situation where the climatic regime leans towards increasing water stress and scarcity, the WSI is a timely response to a crucial and urgent social, economic and ecological need. The WSI approach can help provide equitable access and sustainable use of water for life, livelihoods and nature. The WSI offers a "do-able" operational and implementation strategy to the existing legislative framework that seeks to regulate water use. Hence, there is an urgent need to promote the WSI, widely adopt and replicate it, especially in arid and semiarid regions.

While promoting water stewardship, the biggest challenge faced is in motivating villagers to shift their focus from supply-side interventions to demand-side management.

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