COMPENDIUM OF BEST PRACTICES

WATER MANAGEMENT IN TRIBAL AREAS

AGA KHAN RURAL SUPPORT PROGRAMME (INDIA)

A PROGRAMME OF THE AGA KHAN DEVELOPMENT NETWORK

AXIS BANK FOUNDATION

AXIS BANK

COMPENDIUM OF BEST PRACTICES

WATER MANAGEMENT IN TRIBAL AREAS

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FOREWORD

Water security is one of the primary challenges that rural communities experience. This further becomes a driver for other challenges like food security, health and livelihoods. Most conversations with a rural household will indicate the seasonal stress they face, calling it out to erratic and bad monsoon. Erratic monsoons are now a reality, as much as true, is the fact that, there is lack of management of water, watershed and irrigation.

There are enough examples of engineering marvels of water conservation around us, including the traditional systems of water harvesting, such as, the bawari, jhalara, nadi, tanka and khadin. Even today the traditional knowledge and wisdom is used as part of water crisis solution. Livelihoods for rural communities are more intricately linked to water and face higher risk from water-related challenges. To evolve a solution, and one which can be linked to improved livelihoods, we need a multi-pronged approach involving the revival of traditional structures, as well as, creating new infrastructure for water conservation. Further, there is a need to recharge the groundwater level in watershed areas, increase water-use efficiency in agriculture by ensuring the adoption of water management techniques and conserve fertile soil through soil and moisture conservation.

Confronted with this reality, Axis Bank Foundation realizes that, focusing on the issue of water, and integrating this to other activities, is a key to sustainable development. Axis Bank Foundation, along with its partners, works in some of the most socio-economically backward regions of Central India, especially with higher tribal populations. Axis Bank Foundation seeks to create systems and opportunities, which would ultimately lead to better income generation and self-sustenance. Water is one of the key areas of the interventions, and water-related elements transcends through most of Axis Bank Foundation supported projects.

This report highlights the importance of water management, and practices in Central India, and is part of a project anchored by AKRSP(I), to influence policies for enhanced water control by tribal communities. While it is important to allocate more resources for water control in tribal areas, it is also critical that, studies provide options of how the resources need to be used for greater effectiveness. Hopefully this report provides options for policy-makers, practitioners and donors, as they try and enhance water security in some of the poorest regions of India, the Central-Indian tribal belt.

Dhruvi Shah
Chief Executive Officer
Axis Bank Foundation
May 2021

FOREWORD

Amongst all the vulnerable communities in India, tribal communities are the poorest with 47% of tribal communities below the poverty line. They are also the most predominantly rural community, (the other vulnerable community, the scheduled castes, have made a major transition to urban areas over the last two decades).

A large number of NGOs have been working for a long time in tribal areas; evolving solutions to enhance their livelihoods. Many of the agriculture solutions are based on access to irrigation, and large-scale studies of 'small farmer, prosperous farmer', show that water control has become a necessary, but not sufficient condition for tribal prosperity. It is also very clear, that while individual efforts by many NGOs have been effective; it is essential for both state and markets to be influenced, to scale up water control interventions for tribal communities. The percentage of area under irrigation in tribal areas is half of that in non-tribal areas: and therefore the potential to scale up is high.

Given this context, AKRSP(I), with the support of Axis Bank and Axis Bank Foundation, has initiated a research and policy initiative to enhance water control for tribal communities. One question, which is often raised is that, water interventions are dependent upon the geographical conditions (soil,slope,rainfall etc.) to be effective and therefore, how can we argue for interventions for a community, rather than a geography? The response to that is based on the fact that, tribal communities in India are in two distinct geographies; the North East (coming under Schedule 6) and the Central India Belt (coming under schedule 5). AKRSP(I) is largely focussing on this Central India region, which has 70% of the tribal population of the country. And here the overlap between geography and community becomes clear: the tribal communities are located in geographies, which have the following common characteristics:

1. Forest land between 10-50% of the total land
2. Undulating hilly and mountainous terrain; slopy agriculture land
3. Reasonably high rainfall (700-3000 mm)
4. Geology not conducive to high groundwater storage and access;depletion in summer months affecting drinking water availability.
5. Region traversed by small streams, rivulets, rivers during monsoon
6. Cultivable land at some height from the flowing rivers.

7. Small land holdings: >90% marginal and small farmers
8. Lack of reliable electricity, with power lines not reaching inner villages/farms or being damaged during heavy monsoons.
9. Stored water and streams/rivulets being used for multiple uses: drinking water, fishing, agriculture etc.

Research also shows that most irrigation investment by the state has been in the application of technologies, which work in the plains. Large Dams, large lift irrigation schemes, large number of well schemes, and water-focused schemes, which are delinked to land development are most common government interventions. These have become partially or fully non-functional because they have not addressed the unique characteristics of the tribal geographies.

Tribal communities, being poor and largely rural, have less political representation and voice. Hence resource allocation for them is less than that for non-tribals. Poor access to bank credit and liquidity crunch leads to lack of private investment in irrigation(individual wells/borewells) and, given the poor groundwater availability in these geographies, it is also less rewarding.

Therefore there is need for the following:

A. Highlighting the evidence to enhance the investment for water control/irrigation in tribal regions, so that larger number of tribals access water control, and the area under irrigation and kharif water support, increases substantially.

B. Ensuring that the increased investment is effective: i.e. providing participatory technology options, which are proven to be effective in tribal areas by tribal communities.

This study focusses on Part B. This series of best practices shows, how tribal communities and NGOs have evolved solutions, which are effective in the tribal context, and for/by tribal communities.

Each of the best practices mentioned in the compendium, while given for a specific geography, can be applied to other tribal geographies as well. For example, the case studies on Participatory irrigation Management(PIM) approach, or the Diversion based Irrigation schemes (DBIS) have application across the entire Central India tribal belt. Hence these best practices can be shared with tribal departments /Rural development departments/Irrigation departments across all these states and districts, and included in the technology options when the district irrigation plans have to be operationalised for tribal communities. This will ensure that when funds are allocated by the state or other non-state players, they are used effectively to enhance water control.

Apoorva Oza
Chief Executive Officer
Aga Khan Rural Support Programme (India)
May 2021

ACRONYMS

ACT	Arid Communities and Technologies
ACWADAM	Advanced Centre for Water Resources Development and Management
AKRSP(I)	Aga Khan Rural Support Programme (India)
ASA	Action for Social Advancement
BJ	Bhujal Jankar
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CARD	Centre for Advance Research and Development
CIS	Canal Irrigation Society
CSO	Civil Society Organisation
CWMI	Composite Water Management Index
DBI	Diversion-based Irrigation System
DPAP	Drought Prone Areas Programme
DSC	Development Support Centre
FES	Foundation for Ecological Security
FFS	Farmer Field School
HLA	Hamlet Level Association
HUF	Hindustan Unilever Foundation
IC	Irrigation Cooperative
ID	Irrigation Department
IMT	Irrigation Management Transfer
IWMP	Integrated Watershed Development Programme
KVK	Krishi Vigyan Kendra
LIC	Lift Irrigation Cooperative
LIS	Lift Irrigation System
MARVI	Managing Aquifer Recharge and sustaining groundwater use through Village-level Intervention
MCM	Million Cubic Metres

MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MOA	Memorandum of Agreement
MOSPI	Ministry of Statistics and Programme Implementation
MOU	Memorandum of Understanding
NABARD	National Bank for Agriculture and Rural Development
NGO	Non-Governmental Organisation
NIWCYD	National Institute for Women, Child and Youth Development
NRLM	National Rural Livelihood Mission
O&M	Operations and Management
PEC	Project Execution Committee
PGWM	Participatory Ground Water Management
PIM	Participatory Irrigation Management
PRA	Participatory Rural Appraisal
PRADAN	Professional Assistance for Development Action
PSI	People's Science Institute
RKVY	Rashtriya Krishi Vikas Yojana
SC	Scheduled Caste
SRIJAN	Self Reliant Initiatives through Joint Action
SRLM	State Rural Livelihood Mission
ST	Scheduled Tribe
TADP	Tribal Area Development Plan
TMC	Tank Management Committee
TSP	Tribal Sub Plan
UHM	Undulating Hilly and Mountainous
USGS	United States Geological Survey
WASSAN	Watershed Support Services and Activities Network
WUA	Water User Association

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This compendium is a result of the collective wisdom of grassroots organisations working for the betterment of tribal communities. The best practices shared here are the result of learnings from years of implementation experience in selected geographies of the Central Tribal Belt.

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INTRODUCTION

The Central Indian tribal belt covering over 100 districts in 8 states and extending from Banswara in Rajasthan to Purulia in West Bengal is the largest concentration of tribal population in Asia and accounts for 70% of India's tribal population (Sah, Bhatt, & Dalapati, 2008; Baviskar, 1995). The belt alone is home to 214 scheduled tribes out of the 573 scheduled tribes of India (Ahluwalia, 1978).

Geographically speaking, the central tribal belt is located between 18 degrees and 25 degrees North latitude (Phansalkar & Verma, Improved Water Control as Strategy for enhancing tribal livelihoods, 2004). About a third of the geographic area is under forest cover and the region is well-endowed with natural resources. It is therefore ironic to note that despite the abundance of forests and rivers, the central tribal belt is the one of the largest concentrations of poverty in the world facing lack of food and water security (Ibid).

The region receives medium to high rainfall and forms the catchment of some of the major river systems of the country. Notwithstanding this, the agricultural productivity of the region is low and the agriculture is primarily rainfed with very low infrastructural investment in the way of canals and major irrigation projects. In contrast, the non-tribal districts in the region have a high percentage of area under irrigation and higher irrigated landholdings. In Madhya Pradesh for instance; irrigated land holdings for 30 non-tribal districts are 59%, which is a lot more than the average land holdings (41%) of 22 tribal districts.

The table below compares irrigated land holdings and groundwater development level among tribal and non-tribal districts of Madhya Pradesh and Gujarat.

Region	Cropped area under irrigation	Level of groundwater development
Gujarat		
Districts having all Tribal blocks (4)	44%	32%
Districts having Tribal and Non-tribal blocks (10)	59%	58%
Districts having No tribal blocks (19)	51%	76%
Madhya Pradesh		
Tribal Districts (22)	41%	43%
Non-tribal Districts (30)	48%	65%

The maps on the following pages (page 12 and 13), showcases the Central tribal belt and the percentage of irrigated land holdings in the belt. The central Indian tribal population is concentrated in geographically remote and inaccessible locations. This was not always the case.

The tribal population which is now sequestered in the resource-constrained hilly tracts of Central India once flourished over a large region of central India, having under their control the vast plains. The flourishing kingdoms of the central India were ruled by the Gond, Chero, Munda and Bhil Kingdoms in the medieval period, which fell prey to the marauding Mughals. Thereafter, subsequent rule and oppression by the British reduced the tribal peasants to tenants and bonded labour on their own lands. The British appetite to draw revenue income from land led to the tribal community losing control of their land to other immigrant non-tribal caste such as the banias.

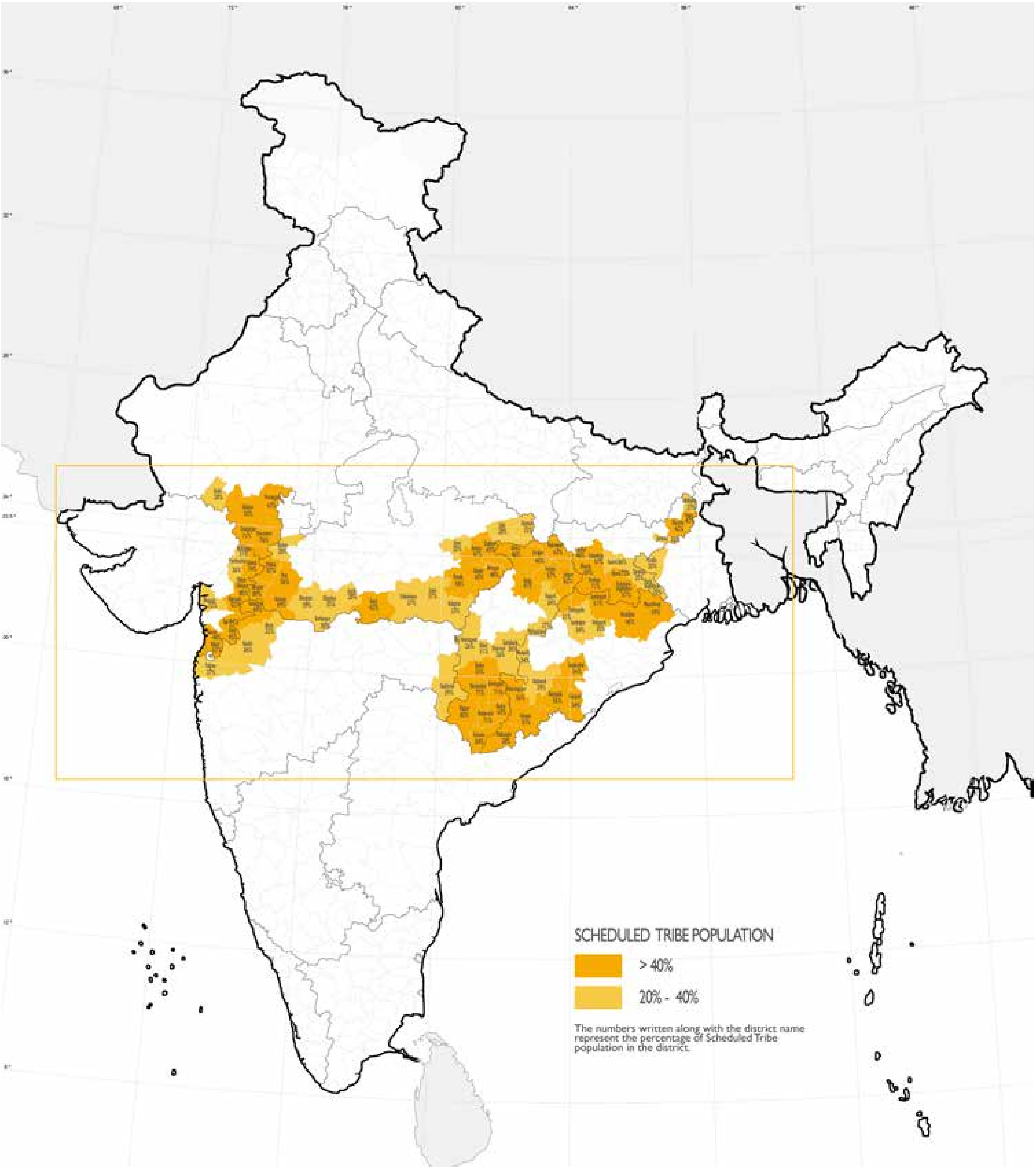
The 'zamindari' system perpetrated great injustice and cruelty to tribal farmers. Most of them fled to remote and inaccessible regions of Central India, which were free from rulers and their non-tribal counterparts. The geographical remoteness led to their alienation from most development programmes and infrastructural projects of the post-independence era (Sah, Bhatt, & Dalapati, 2008). Geographic remoteness has cost the tribal community dearly, as it leads to underdeveloped credit, land and output markets. It also results in delay in technology adaption.

Agriculture in the central tribal belt is marked by use of traditional farm tools, lack of mechanization, resource-poverty, remoteness from market, poor access to agricultural and irrigation schemes of the state, and predominance of rainfed cultivation (Phansalkar & Verma, 2004). The primary livelihood for a majority of tribal households is agriculture followed by Livestock rearing and collection of forest produce.

While some tribal communities such as Gonds, Oraons, Santhals, Mundas and Bhils have had a long engagement and experience with agriculture, others such as Kokams, Kohls and Baiga kondhs, are relatively new to agriculture, as they were traditionally dependent upon forests for their food requirements (Ibid).

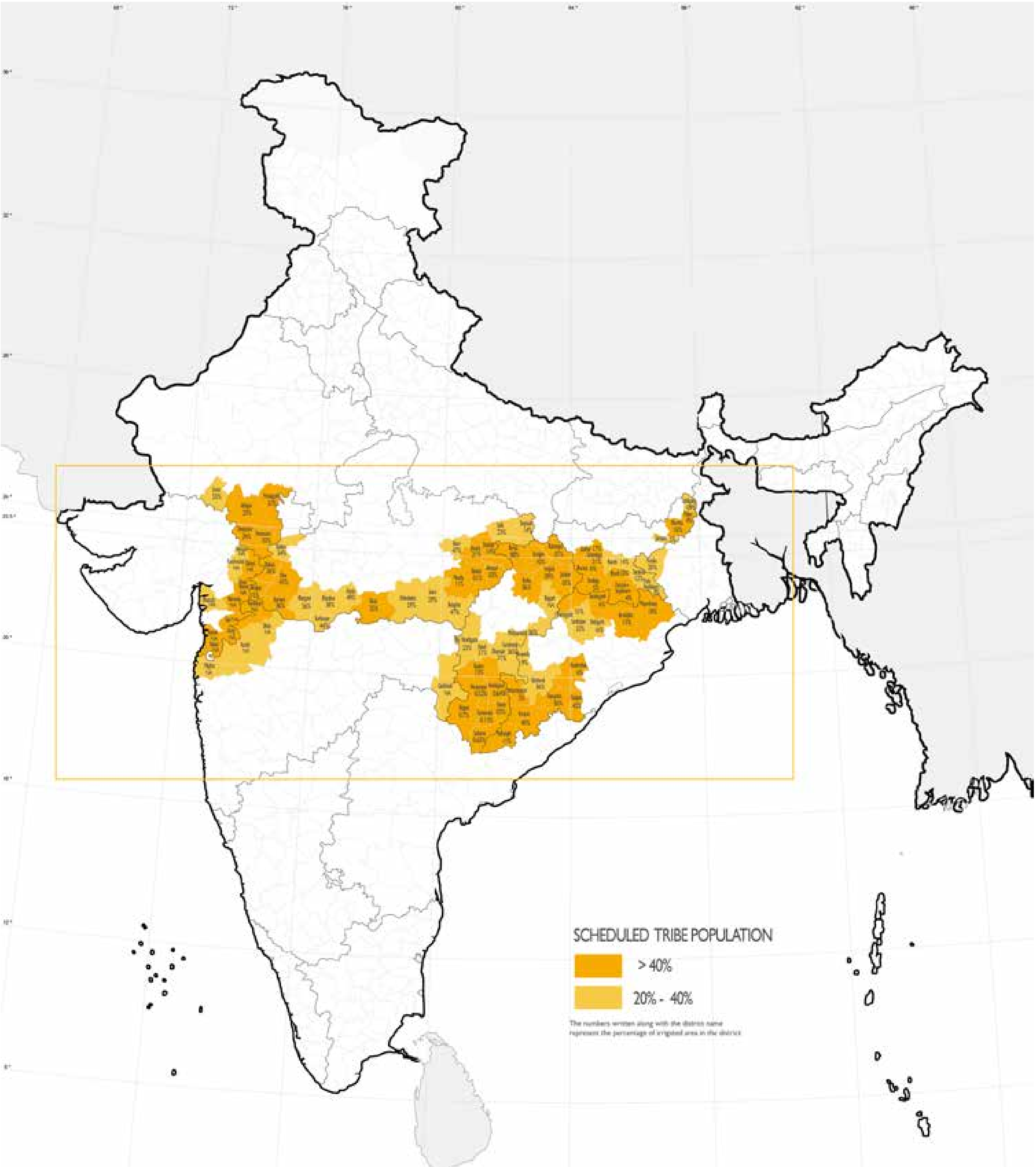
CENTRAL TRIBAL BELT

DISTRICT-WISE SCHEDULED TRIBE POPULATION



CENTRAL TRIBAL BELT

DISTRICT-WISE PERCENTAGE OF AREA UNDER IRRIGATION COVERAGE



A majority of tribal landholdings are rainfed, as has been discussed above. Apart from the low state of irrigation development in tribal districts, tribal farmers also derived less income from agriculture than non-tribal farmers even in tribal dominated blocks of tribal districts, their net agricultural returns were lower; and tribal households' dependence on migration for livelihood was twice as much as that of non-tribal people (Verma, Dasgupta, & Singh, 2004).

Along with small and fragmented land holdings and lack of water control, the tribal geographies of the country have a few other notable characteristics such as Undulating, hilly and mountainous terrain, inaccessible and remote regions, reasonably high annual rainfall, rocky and less permeable groundwater aquifers, high proportion of forest land, rivulets and rivers spread across the landscape, and lack of access to basic amenities such as; reliable electricity, piped drinking water.

The problem with the current water management interventions is that they focus on building of infrastructure, which is i) not suitable to tribal geographies and ii) not participative and excludes communities from management and operational aspects.

Water resource and irrigation development in India has mostly followed the civil engineering model, which is focused upon construction of large dams and canal systems. While this system is suitable for plains and valleys, it is cumbersome to implement in undulating terrains, alienating tribal farmers residing in hilly and undulating terrains (Phansalkar & Verma, 2004).

To allow for sustainable development of communities living in the central tribal belt, it is imperative to restore water control back to the communities. This coupled with customized interventions targeted at specific challenges of the region, will lead to ensuring water for livelihoods and thus improved incomes.

Civil society will have a pivotal role to play in ensuring community engagement in building and use of water infrastructure. Civil Society Organisations and Non-Government Organisations intervene in rural villages with the help of social capital that they slowly and gradually build through years of community engagement and empowerment.

Such organisations understand that in order to bring true change and sustain it, engagement of local community from the start is key, as the community will ultimately be responsible for ensuring the continued operations and management of any intervention.

Addressing specific challenges unique to the Central tribal belt and ensuring community-led management of interventions designed, are the key to ensuring water access and control of the resource by the tribal communities.

This document endeavours to present a few such customized interventions, which have ensured Water for livelihoods and drinking water for the central tribal belt. The aim of this document is to develop a compendium of best practices for water management of Tribal areas, which can be used by policy makers and the government as a guiding document to develop programmes and policies that can be scaled up and replicated in various tribal and rural pockets of the country.

A brief snapshot of the case studies and the unique challenges they address is represented below:

Characteristics/Challenges of tribal areas	Best Practices in the Compendium
Undulating, Hilly and Mountainous terrain	*DIVERSION-BASED* Irrigation system *SPRING-BASED* water supply systems
High dependency on rainfed Kharif crop, predominantly Paddy,hence criticality of kharif support irrigation.	*STABILIZING* rainfed kharif cultivation by provision of support irrigation through linking the Integrated Natural Resource Management with labour planning of MGNREGA *DEEPENING* and widening of seasonal streams by construction of saucer-shaped pits called *DOHAS* for Kharif support irrigation
LACK OF ACCESS to surface water flows despite high rainfall and plenty of streams *CULTIVABLE* land at some height from the flowing rivers	*IMPROVING WATER HARVESTING* potential through construction of checkdams along the length of streams and then deploying lift irrigation by forming Lift Irrigation Cooperatives. *PARTICIPATORY CANAL IRRIGATION MANAGEMENT* by handing over control of water distribution, usage and maintenance of canal irrigation projects to the farmers
Hard-rock aquifers having low groundwater storage thus limited groundwater development potential	*PARTICIPATORY GROUNDWATER MANAGEMENT* aimed at management of groundwater resources of a village *INTEGRATED VILLAGE-LEVEL WATER SECURITY* planning which uses water budgeting to correct the demand–supply gap.
Importance of complementary livelihoods such as fishing	Use of farm ponds as multi utility structures through creation of *FISHING COOPERATIVES*
Homogeneous society leads to ease of collectivization	*HALMA* – reviving a tribal practice of voluntary labour to undertake water harvesting works
Decline in use of traditional water harvesting structures*	*RESTORATION* of traditional water harvesting tanks/ taalabs

**This characteristic is not unique to tribal areas, as most parts of India have seen a decline in use of rainwater harvesting wisdom passed on by our ancients.*

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DIVERSION-BASED IRRIGATION SYSTEMS

RATIONALE - THE WHY

Irrigation is as old as settled farming and several ingenious methods to irrigate fields have been developed over centuries across the world. In India, one of the most traditionally pervasive methods to irrigate crops has been diversion of water in perennial/seasonal streams through an intricate network of channels, thus allowing water to flow to fields using gravity flow of the water. This system, known as Diversion based Irrigation in modern times, has been practiced in various parts of the country since times immemorial under different local names.

Kul in Himachal Pradesh, Dongs in Assam, Apatani farming system in Arunachal Pradesh, Zabo in Nagaland, Ahar Pyne in South Bihar and Jharkhand, Khadin in Rajasthan, Pukhar in Southern Rajasthan and parts of Madhya Pradesh, Phad in Western Madhya Pradesh and Maharashtra and Tar Bandh in Mahakaushal (Bhaduri, 2012), all these traditional irrigation systems make use of the natural gravity flow of water to irrigate fields.

RELEVANCE FOR THE CENTRAL TRIBAL BELT

Diversion-based Irrigation systems (DBIs) have a good potential of development in undulating, hilly and mountainous terrains (UHM) terrains due to the natural slope and abundance of streams and springs in these regions.

Another reason for development of DBI in such terrains, is the great disadvantage these regions face in respect to tapping the other prevalent sources of irrigation available to the plains. Such terrains lack suitable storage sites, and transportation from rivers or storage sites is expensive. Combined to this, the fact that, the aquifers and rocks of such terrains have low groundwater development scope (Joshi, 2011). The Central tribal belt is thus the perfect landscape for the implementation of diversion based irrigation systems due to the abundance of streams and UHM terrain.

The present case details one such Diversion based Irrigation method, namely the Phad, traditionally implemented in tribal-dominated UHM regions of Madhya Pradesh and Maharashtra which dates back to the early 16th Century.

DIVERSION-BASED IRRIGATION -THE WHAT

Phad Irrigation System calls for diversion of water from a river or stream through construction of bandharas into a small canal taking off from the upstream side of the bandhara. The water is then supplied to phads or small blocks of land. Each phad has a number of agricultural plots belonging to different cultivators (Pawar, 2017).

To optimize the traditional phad irrigation system, the implementing agencies/NGO have improved upon the ancient practice. A small storage tank is built across the stream. Water is then transferred via pipelines and valved outlets to beneficiary farmers. This reduces transmission losses of water and increases the life of the system as compared to the traditional earthen channels, which need frequent repair and maintenance.

IMPLEMENTATION PROCESS - THE HOW

The implementation of a diversion-based Irrigation system follows the following processes:

1. Site selection
2. Community Need Assessment
3. Formation of Irrigation committee
4. Construction of Diversion-based Irrigation (DBI) system
5. Formation of bye-laws
6. Training community on operations and maintenance
7. Handing over the DBI system to community

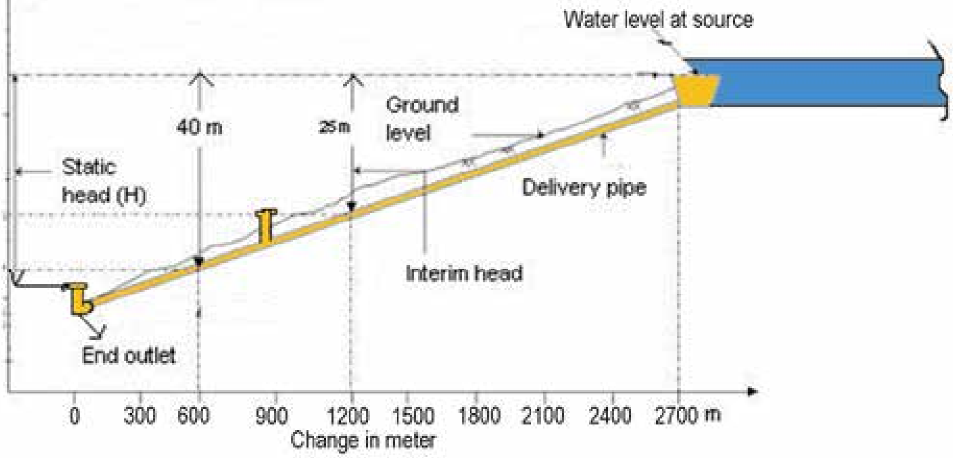
Site Selection

As diversion-based irrigation system uses gravity flow of water to transport water to farmer fields, it is crucial that the source of water be located at a higher elevation than the agricultural fields. The site selection parameters to be taken into consideration are mentioned in the box on the subsequent page.

Community Need Assessment

A sociological survey is undertaken to understand the agricultural practices, crops cultivated, status and use of irrigation systems and area under traditional phad irrigation if any. In the survey, the community's willingness to manage and use a diversion-based irrigation system and to form a irrigation collective is understood. A project is initiated only if the community actively participates and elicits interest in the meetings.

Technical diagram of DBI



Source: Diversion-based Irrigation Concept note (Singh 2017), Khandwa, Internal Docueumt, AKRSP(I)

TECHNICAL SPECIFICATIONS FOR SITE/SOURCE SELECTION FOR DBI

1. The elevation difference between the source point (the point where stream is diverted) and the lowest outlet, referred to as 'head'; should be atleast 4-5 metres per kilometre.
2. An initial drop of 1-1.5 metres is required for the first 100 metres.
3. Base flows in the stream should be upto September, if the objective is Kharif crop stabalisation and upto January to support the Rabi crop. Streams with perennial base flows are preferred for DBI.
4. The discharge rate of a stream should be measured at different points of the year, most commonly at the end of September, January and May; as the base flows fluctuate throughout the year. Streams, which have discharge rate of 10 litres per second, even in May can be deemed as suitable.
5. The discharge rate of the DBI source, which intends to serve 20 hectares of agricultural land should be at least 20 litres per second at end of January.
6. Command area of 1 kilometre-long DBI will be around 20 hectares benefitting 5-8 farmers. The command area calculation should be done for different seasons as the discharge rate will affect the area of land that can be irrigated. Generally the command area will be maximum in Kharif and will successively decrease as the base flow tapers off.

Formation of Irrigation Committee

An irrigation committee (*sinchai samiti*) is formed by collectivizing farmers falling in the command area of the proposed DBI. A bank account is opened in the name of the *sinchai samiti* to deposit the water tariff collected towards future repair and maintenance

Construction of DBI system

The construction of the DBI system involves technical planning, trench digging, construction of the inlet tanks, laying down pipelines, and construction of valved outlet stations. The technical planning stage measures the discharge of determined source point, determination of outlet point locations, head difference between source point and outlet points, and command area of each outlet.

This is followed by digging trenches for laying pipelines. The excavation of the inlet tank, which is placed at the source point is also undertaken simultaneously. The beneficiary farmer families contribute voluntary labour for digging operations. A mason is hired for constructing the tank; which has an inlet, a siltation chamber, a storage chamber and an outlet for transporting water through pipelines to various outlet points.

Formation of byelaws

The *sinchai samiti* forms mutually agreeable bye-laws regarding the distribution of water, maintenance of structure, regular cleaning of the tank, fixation of water tariff, collection of water tariff, frequency of meetings, conflict resolution mechanisms, fines and penalties.

Warabandhi, which means fixation of turns, is done to ensure equitable distribution of water. Bye-laws such as; no two valved outlets can be used simultaneously, penalty upon taking water out of turn, one farm will be irrigated at one time, etc. are formulated upon completion of the construction.

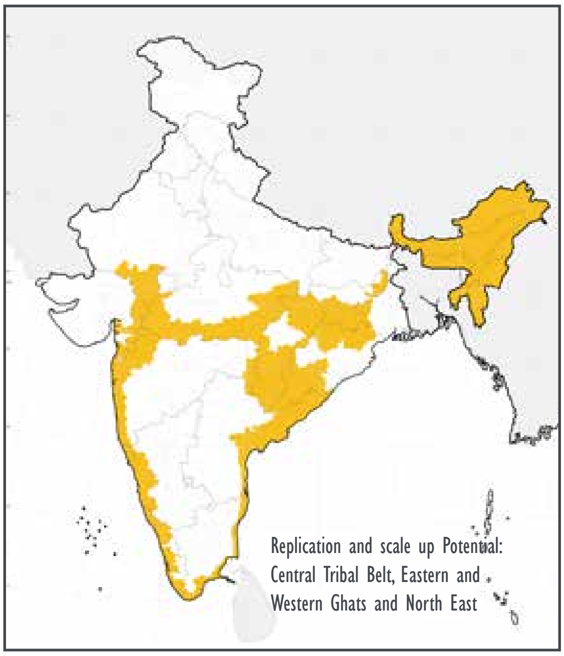
Training the committee on Operations and Management
The sinchai samiti members are trained on operations of the DBI, maintenance of the pipelines and the tanks, book keeping, and corrective measures in case of non-functioning of the DBI system.

Handing over the DBI system to the committee
After demonstration of the system, it is handed over to the sinchai samiti for operations and management.

REPLICATION AND SCALE-UP POTENTIAL

Diversion-based Irrigation has been traditionally practiced all across the country for centuries. Known by different names in different areas, DBI has been a cost-effective method to access water both for drinking and irrigation purposes in undulating, hilly and mountainous (UHM) terrains. The technological simplicity, and need of limited material, make these systems easily replicable.

DBI implementation has been undertaken by Tata Trusts on a nation-wide scale since 2008 through a dedicated programme, which is being implemented in 13 states with the help of 21 NGO partners. A Large scale replication of DBI system can be undertaken under MGNREGA, NRLM, SRLM and IWMP programmes of the government.



Replication and scale up Potential: Central Tribal Belt, Eastern and Western Ghats and North East

LESSONS FOR REPLICATION

1. Site selection plays a crucial role in the success of a DBI system. Adequate elevation difference between source point and lowest outlet point is crucial for operational success.
2. Along with development of DBI system, efforts should be made for source protection by undertaking watershed work in recharge zones.
3. Active community participation and robust conflict resolution mechanism are prerequisites for success of the DBI system.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

This case presents the experience of Aga Khan Rural Support Programme (India) in implementing Diversion-based irrigation system in tribal villages of Barwani and Khargone districts of Western Madhya Pradesh.

Location and Context
Barwani and Khargone districts are located in Nimar region of Madhya Pradesh. These are predominantly tribal districts with 69% and 39% of the total population belonging to Scheduled Tribes respectively. The topography is undulating, hilly and mountainous with abundance of seasonal and perennial streams. Only 36% of the net sown area in Barwani is irrigated, while 56% of net sown area in Khargone district is irrigated. Most agricultural land is rainfed and cultivation is undertaken for Kharif crop only. Migration for the rest of the year for livelihoods to Gujarat and Maharashtra is common.

The stage of groundwater development in the districts is greater than 65%, which indicates moderate over-extraction, as groundwater forms the predominant source of irrigation. The districts lack natural replenishment of the groundwater, because of low and moderate permeability of the deccan traps. There is a crucial need to shift to surface water and rain-water usage for irrigation purposes.

Intervention
AKRSP(I) initiated work on first DBI in 2016, as the undulating topography offered good scope for development of gravity-flow irrigation systems. Mr Anil Singh Baghel, an expert in setting up DBI systems, who in the past successfully operationalized DBIs in Kalahandi, Odisha and Udaipur, Rajasthan under the DBI programme of the Tata Trusts; took up the initiative to set up the first DBI in Rojannimal village of Sendhwa block in Barwani district.

At a Glance	
Intervention	Diversion-based Irrigation System
Location	Barwani and Khargone districts in Madhya Pradesh
Implementation	Aga Khan Rural Support Programme (India)
Period	2016 - Ongoing
Unit Cost	Rs. 3,00,000/DBI (DBI length<=1000 mts) Rs. 50,000/ DBI (Community Contribution)

The challenging aspect was operationalizing a DBI system with a low head difference. The Rojanimal DBI had a head (elevation difference between the source point and the lowest output point) of 4 metres per kilometre, while DBI usually have a head of about 9-10 metres per kilometer. Despite the technical obstacle, the team successfully operationalized this DBI, which paved the way for focused efforts to implement DBI at other suitable locations.

Over the last 6 years, 13 DBI systems have been operationalized which have brought 111 hectares of land under irrigation coverage and benefitted 93 farmers. The cost of implementation comes to Rs.300 per running meter. An average DBI system is around 800-1000 metres long and it provides irrigation to 5-10 hectares of land, thus benefitting 5-8 tribal farmers.

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SPRING-BASED WATER SUPPLY SYSTEMS

RATIONALE - THE WHY

A spring is a place where the groundwater naturally flows out to the surface due to structural features such as fractures and fault lines (USGS, 2000). Springs can also erupt as a function of the water table when an unconfined aquifer is exposed along the slope in depressions. Such fractures and fault lines act as channels through which the groundwater flows until it emerges through an appropriate opening in the form of a spring (Bryan, 1919).

About 15% of India's population depends upon springs for meeting their drinking water and consumption needs (Aggarwal, 2019). The water from the rivers originating in the Himalayas is not readily available to the villages and towns situated in the mid-hills, as the fast-flowing rivers quickly flow downward by cutting deep gorges in the hills, while the glaciers are far above (Ministry of Jal Shakti, 2019). These communities depend upon rain-fed springs and streams to meet their drinking water requirements. 90% of the drinking water supply in Uttarakhand is based on springs (Goswami, 2018), while in Sikkim, 80% of rural households depend upon springs (Jamval, 2018). In Meghalaya too, springs are an important source of drinking water as well as irrigation. Springs also happen to be the source of many rivers and streams in Central and South India. Krishna, Godavari and Cauvery are spring-derived rivers (India Water Portal, 2005).

Given the remoteness and difficult topography, it is very difficult to supply water through conventional sources to mountain dwelling population. Compounded with it, is the erratic electricity supply with frequent power cuts, which makes water supply, even if available, uncertain. Spring-based supply systems due to their gravity-based flow allow for access to water 24*7 and in the true sense provide drinking water security to mountain dwellers.

RELEVANCE FOR THE CENTRAL TRIBAL BELT

The undulating terrain of the central tribal belt faces a similar condition wherein the water from rivers originating in these forested lands quickly flow downstream. Springs offer a reliable source of water for the midland and highland regions of the Central tribal belt.

Women are known to travel several kilometers daily to such springs near their habitation to fetch drinking water for the household. Although spring water is being used by the tribal communities of the region, the quantum is less compared to the discharge capacity of these springs. This is due to the lack of any structure to conserve the discharge from these springs.

SPRING-BASED WATER SUPPLY SYSTEM - THE WHAT

A spring-based water supply system is developed by constructing a spring chamber, which is a square-shaped mini pond-like structure, at the mouth of the spring to ensure its protection. This chamber is connected to a distribution tank with has a three-chambers; inlet chamber, filtration chamber and distribution chamber. The water is filtered in this tank through the slow sand filtration technique, in which the water passes through fine sand, pebbles and a perforated concrete slab. The filtered water enters the distribution chamber, which is then is supplied through a pipeline network to common stand posts spread throughout the village. 5-8 households share one such standpost.

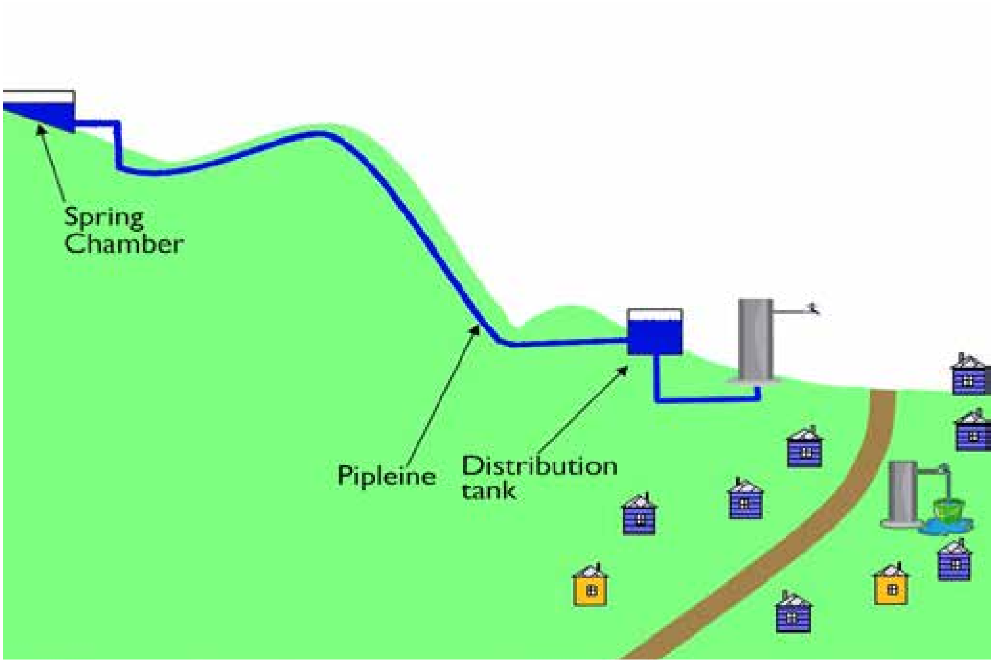
IMPLEMENTATION PROCESS - THE HOW

This section shares the process to set-up spring-based water supply system

1. Need Assessment
2. Identification of a potential spring source
3. Formation of Pani Samiti (Water committee)
4. Testing of water quality of the spring
5. Planning the water supply network
6. Construction and Shramdam
7. Formation of bye-laws for sustainable use and conservation of the drinking water source
8. Training community on operations and maintenance
9. Handing over the Spring-based supply system to the community
10. Ensuring Sustainability of the Springed Water supply system

Need Assessment

Sociological and geohydrological surveys of the region are necessary for identification of both need and potential for development of a spring-based drinking water supply system.



Construction and Shramdam
The construction phase involves development of 2 distinct structures and laying down a pipeline network. A spring chamber protects the source of the spring from rubbles, animal droppings and other dirt. Also, if the spring flows over an area, it is important to entire flow of water. This chamber is connected to the distribution tank, which is a three-chambered structure with inlet, filtration and distribution chambers.

The water is filtered through the slow sand filtration and reaches households through a pipeline network. The laying of pipelines is a community exercise, which is led by the Pani Samiti. The pipelines are laid underground to protect them from being damaged.

Identification of potential spring source
To identify a potential spring source, the elders of the village are consulted to locate old spring sources, which have been alive since a long time. Meetings are held with village community and transect walks are held to locate probable spring sources. Discharge of springs, thus located is estimated using the simple bucket method, in which a bucket/container is placed below the spring mouth and the amount of time it takes the spring flow to fill the bucket is calculated. The discharge rate of the potential spring source thus identified should note be less than 60 litres per minute.

After identification of the potential spring source, a socio-technical survey is undertaken. It assesses the viability of setting up a spring-based water supply system by taking into consideration various factors such as elevation of source, distribution tank, distribution outlets, configuring the location of distribution outlets, peak demand of water in winters and summers, etc.

Formation of Pani Samiti and planning of water supply network
A *pani samiti* is formed in a village-level meeting. While committee formation, care is taken to ensure maximum representation of women. Location of distribution outlets is decided such that source contamination is avoided. A bank account of the pani samiti is also opened to deposit user fees collected, which would allow for future repair and maintenance of the supply system.

Formation of byelaws
The pani samiti in consultation with village community in a common meeting, decides upon mutually agreed bye-laws to ensure sustainable use of water. A water user fees is also mutually decided to account for future repairs and maintenance. Bye-laws concern penalties for wastage of water, peak-time demand management, and frequency of cleaning chambers and pipelines.

Training community on Operations and Maintenance
Training are provided by facilitating NGO on maintenance of spring and distribution chambers, and pipelines, book-keeping and finances, and corrective measures in case of breakdown of supply system.

Handing over of the supply system to the community
Post a few months of demonstration and troubleshooting, the system is handed over to the community for operations, maintenance and overall management. The pani samiti is primarily responsible for the continued functioning of the system and ensuring regular supply of the water.

ENSURING SUSTAINABILITY

Working on providing water supply is just one side of the work, equally important is ensuring source sustainability of the spring, especially now. Spring discharge of most springs is reported to be declining in recent years (Pandey, 2018). Source Sustainability is achieved by following a Springshed approach to water conservation and management.

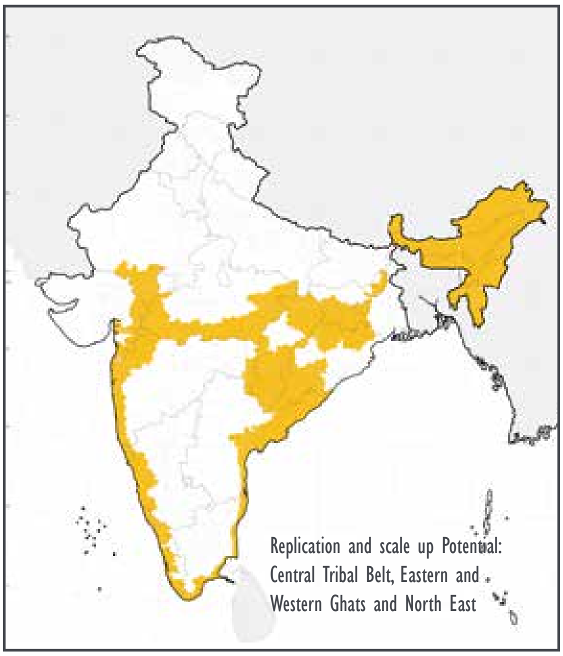
The first such systematic effort was undertaken in Sikkim through the Dhara Vikas Programme implemented by Rural Management and Development Department of Government of Sikkim. Identification of recharge zones followed works like digging of trenches and ponds to catch the surface flow and enhance infiltration. Civil society is also playing its part in spring revival through springshed management programmes in their working geographies. Notable organisations working in the domain are Himmotthan society, Central Himalayan Action Research Group (CHIRAG), People's Science Institute, Himalaya Seva Sangh (HSS), Vishaka Jila Nav Nirman Samiti (VJNNS), Grampari and Keystone Foundation.

GOVERNMENT POLICY

In 2019, the ministry of Jal Shakti, released a framework document which sets out a policy pathway to revive and rejuvenate springs.

REPLICATION AND SCALE UP POTENTIAL

Traditional spring-based supply systems constructed with bamboo pipelines traversing their way from the hill to the different hamlets have dotted the North-eastern landscape since centuries.



Replication and scale up Potential: Central Tribal Belt, Eastern and Western Ghats and North East

The inherent technological simplicity; both in construction as well as operation and maintenance, make these systems easily replicable and scalable. Wide scale replicability of the spring supply systems and springshed management can be undertaken through MGNREGS, CAMPA, Finance Commission grants, IWMP, NRLM, SRLM, etc.

LESSONS FOR REPLICATION

1. While Spring-based supply systems provide the much-needed water security to mountain dwellers; however, it is important to note that to ensure long-term sustainability of these water supply systems, it is imperative to undertake springshed management simultaneously to ensure source sustainability.
2. Capacity building of community on maintenance and repair of the system is a must to ensure sustained use.
3. Community-led source protection should be undertaken through watershed works in the recharge zones.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

The present case is based on the experience of WaterAid on implementing Spring-based water supply system in tribal villages of Mandla and Dindori districts in Eastern Madhya Pradesh.

Location and Context

Mandla and Dindori districts, located in Eastern Madhya Pradesh (MP) are part of the Mahakaushal region, home to Gond and Baiga tribal communities. The districts rank among top 5 tribal districts in MP with over 50% Scheduled Tribe (ST) population. The districts are characterised by undulating topography and a rich natural resource base which is facing degradation and deforestation. Rainfed farming of paddy is predominant which meets food requirements for six months. This is combined with migration and sale of forest produce for the rest of the year (Foundation for Ecological Security, 2006).

WaterAid along with its implementation partner, NIWCYD, initiated work in 52 villages on Mandla and Dindori in 2018 on drinking water security by repairing handpumps. However, it was observed that, people preferred meeting their drinking water needs from springs, which were a good distance away from the villages and women trekked atleast 2 kms daily to fetch the required water.

At a Glance	
Intervention	Spring-based Water Supply Systems
Location	Mandla and Dindori districts, Madhya Pradesh
Implementation	WaterAid and National Institute for Women, Child and Youth Development (NIWCYD)
Period	2018 - Ongoing
Unit Cost	Rs. 2,50,000 (Total cost); Rs. 35,000 (Community Contribution)

INTERVENTION

WaterAid developed 3 spring-based water supply systems in Kaputi, Katharia and Pondi villages of Dindori district in 2018. Pani samities were formed in all three villages for the upkeep and maintenance of the supply systems. A total of 135 tribal households have been benefitted. The water from the spring reaches the households through common standposts with taps shared between every 5-8 households To ensure source sustainability, WaterAid has undertaken survey of 12 villages including Kapoti and identified recharge zones of the spring, which was tapped for supplying water. The organisation is planning to undertake water conservation measures such as building checkdams and contour trenches in the identified recharge zones.

The spring-based drinking water supply systems developed by WaterAid have received appreciation from the government departments which plan to replicate the model in other undulating districts of the region. Two similar spring-based supply systems have been developed by PHED (Public Health Engineering Departments) in the district.

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INTEGRATED NATURAL RESOURCE PLANNING UNDER MGNREGA

RATIONALE - THE WHY

India is home to 18% of the total population of the world and 15% of the total livestock population, however, India has just 2.4% land to sustain the enormous animal and human populations. This limited land resource is in a highly vulnerable state with 30% of the country total land mass undergoing degradation. According to the Desertification and Land Degradation Atlas 2018, prepared by Indian Space Research Organisation (ISRO), 96.4 million hectares of land of the country is degraded.

The Central tribal belt of India is a contiguous patch over 1500 kms long and 500 kms wide stretching over the belly of the nation. Forest-based livelihoods and sustenance agriculture are practiced by tribal communities. The deforestation accompanied by degradation has made these livelihoods vulnerable. 60-70% of the area cultivates only Kharif Paddy which is the predominant crop (Verma, 2007).

Despite the high rainfall received by the region, ranging from 900-1500 mm annually, crop failures are common due to frequent dry spells either at the onset of monsoon or in mid-September (Sah D. C., 1999). Crop failures even in years of sufficient rains are ubiquitous to the region, due to dry spells and shallow soil depth.

MGNREGA AND LAND TREATMENT - THE WHAT

MGNREGA, the Mahatma Gandhi National Rural Employment Guarantee Act, entitles a household to 100 days of unskilled manual work in a year. It includes in it ambit, a range of assets such as; Water harvesting and conservation, drought proofing including plantation and afforestation, irrigation canals, Irrigation facilities for land owned by SC/ST households, renovation and repair of traditional water bodies including desilting, land development, road construction in rural areas, and any other work notified by the central government.

Due to its vast scope, MGNREGA can be used as a tool to develop degraded lands and create sustainable livelihoods for poor communities. Use of innovative techniques, need and topography-based planning, and saturated work approach can lead to generation of 150-200 mandays of employment per hectare of land.

INNOVATIVE LAND TREATMENT MEASURES FOR CENTRAL TRIBAL BELT

It is crucial to plan land treatment as per the land type and slope, along with prioritizing the need of the community, for effective land and water resource development.

SLOPE	PROBLEM	TREATMENT
>8% Slope	High erosion, very shallow soil depth	Staggered trenches Contour trenches Bunding Plantation
3-8% slope	Shallow top soil, low in organic matter, low moisture retention	30x40 Model Plantation
<3% Slope	Moderate soil depth, land use below potential Scope for both harvesting and Infiltration	5% Farm Ponds Chain of Farm ponds along drainage Village Taalab

Innovative Models

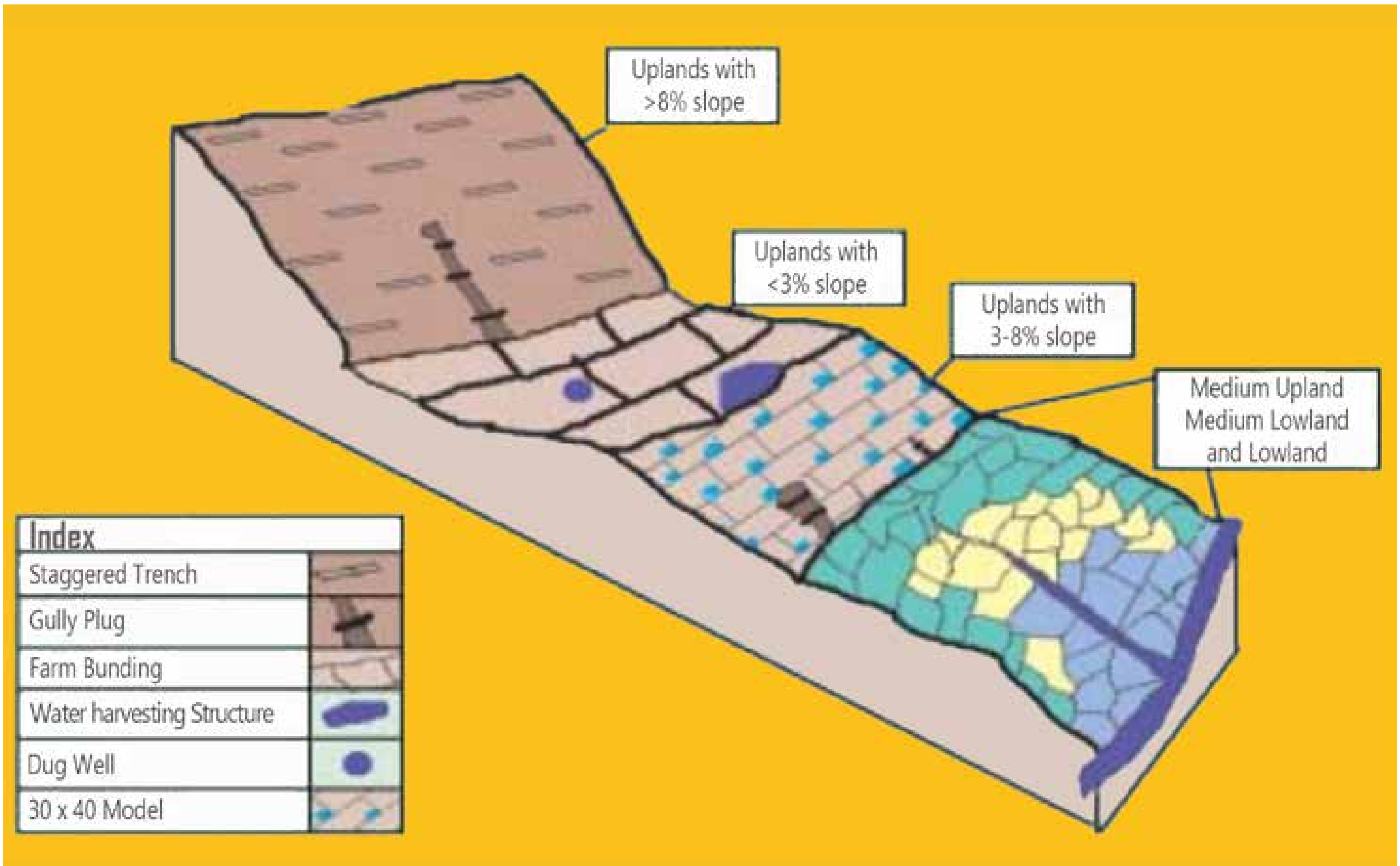
30x40 Model

It is a method of in-situ soil and water conservation. A patch of uplands is divided into small plots of 30x40 ft; 30 ft along the slope and 40ft across the slope, starting from the ridgeline. This is followed by digging 3-ft deep pits at the lowest point in each plot and bunding the plots by using the soil dug out of the pits. The pits measure 7x7 ft at the top and 5x5 ft at the bottom.

The excavation can be done either post monsoon or after harvest of Kharif crop, if land is under cultivation. Post the treatment, plantation of timber, fruit and fuelwood species can be undertaken on the patch, which can be mixed with intercropping of pulses. The purpose of the 30x40 model is to slow the velocity of runoff and allow for moisture retention and infiltration, which are facilitated by the pits dug in the uniform patches.

5% Farm Ponds

The dimensions of farm ponds are standardised under MGNREGA. Due to this, the small and marginal farmers having small patches of land of 1 hectare and less are by design excluded from farm pond construction. 5% farm ponds are proportionate to farm land size irrespective of land holding. As small and marginal farmers are most vulnerable to suffer crop failure during dry spells, these farm ponds provide a crucial service.



Source: Implementing Integrated Natural Resource Management Projects under the MGNREGA 2005, Delhi: MoRD.

This model is suitable for medium uplands. They are dug on 5% of the area of a plot by marking an area of one-fifth the length of the plot and one-fourth the width at the upper right corner of the plot. The depth of the pit is 5-7 feet. Wall the pit with 4-inch high bunds from the excavated earth. The best time to construct the pond is from December to June. Dug in a series, such farm ponds along with providing critical irrigation, increase percolation and thus water availability downstream.

UNIT COST

The cost per hectare of land treatment under the 30x40 model is Rs. 67,565, when cost of earthwork is Rs.165 per 100 cubic meter. A hectare of land generates 356 labour days.
The cost for 5% farm pond is 3,00,000 and 1800-man days of labour is generated for constructing 1 farm pond.

IMPLEMENTATION PROCESS - THE HOW

This section will share the detailed steps to be followed to develop a holistic watershed plan to be implemented under MGREGA. The most crucial component of the process is community involvement in the planning phase. An important consideration while planning land and water treatment interventions is the need and priority of the community.

Following steps are followed:

1. Village selection, formation of Hamlet-level associations and Project Execution Committee (PEC) formation
2. Baseline data collection
3. Resource Mapping and Ownership mapping
4. Problem Identification and Option generation
5. Proposed activity and land use map generation
6. Budget Preparation
7. Approval and sanctions from panchayat and block level

Village Selection, formation of Hamlet-level Associations (HLA) and Project Execution Committee (PEC)

Gram Sabha prioritizes villages according to poverty status. Once the village is selected, HLAs are created by selecting 10-12 members who will be responsible for developing land and water treatment plans at halmet levels through participatory planning tools. PEC is formed of representatives of all HLAs. The responsibilities of PEC are to compile hamlet-level plans and form a village-level proposed plan and budget, present the plan at gram sabha and panchayat levels for approval, implementation of works, maintaining muster rolls, utilization register, stock registers, etc.

Baseline data collection

A village profile is prepared by collection of data on people, resources and facilities. The collection of data from individual household is done by hamlet representatives. The data on various aspects such as land ownership, common lands, labour availability, livestock data, water bodies inventory, area under plantation, groundwater-based assets, number and status of roads, education-level and infrastructure, sanitation infrastructure, etc. is collected.

Resource and Ownership Mapping

Resource mapping comprises of mapping/plotting different land types, water bodies, drainage line, and direction of water flow on the revenue map of the village. This is followed by ownership mapping, which involves recording the pattern of land ownership and data on present land use.

Problem Identification and Option Generation

The problems with each patch of land mapped are identified, and various options to overcome the problems are generated. A field visit to each land patch will yield better discussion. The problem identification and option generation should be undertaken simultaneously as land owners present during the field visit can bring forward inputs from experience with using the land.

Proposed activity plan and land use map generation

Based on the analysis of the options generated, the community selects the most cost effective and acceptable alternatives. These form the basis of the proposed activity plan. The activities decided are chalked out on the resource and ownership map to prepare a final land use map, which reflects the activities/structures to be undertaken on various patches of land.

Budget preparation

The budget is prepared on the basis of the proposed activity plan. Manpower needs are estimated based on availability and structure needs. The current rates of labour under MGNREGA are taken into consideration for calculation of labour cost. Material cost is estimated using market rates of the material required.

Approval and sanction from panchayat and block level

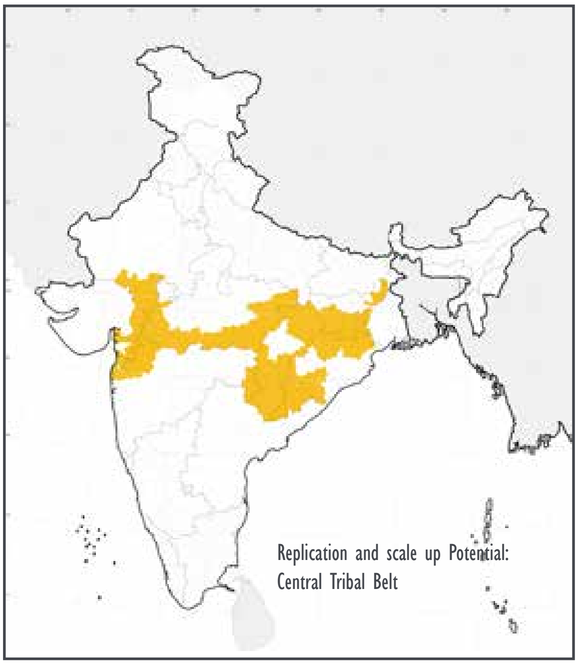
The hamlet level plans are presented at gram sabha and consolidation of plans is done to prepare a village-level plan. Post this the final plans are presented for approval to gram panchayat and if approved at panchayat level are forwarded at block or district level for sanctions and work allocation under MGNREGA.

IMPACT

The intensive and saturated treatment of land resources and creation of water harvesting potential has an observable change in the first year of implementation itself, with manifold change in agriculture production and productivity in subsequent years. The major impact areas are mentioned below:

1. Increase in cropping intensity
2. Productivity enhancement by atleast 20% in rainfed Kharif paddy
3. Shift to kharif and rabi cropping from rainfed Kharif
4. Diversification of income from sale of horticultural produce post 30x40 treatment
5. Diversification of income from adoption of silk rearing on previously fallow land post 30x40 treatment

REPLICATION AND SCALE UP POTENTIAL



The interventions suggested are relevant for the Central tribal belt and other undulating regions of the country, which are facing high land degradation and deforestation. MGNREGA holds tremendous potential to execute land treatment works as it is fundamentally a guarantee of unskilled labour work in rural areas. As the most of the land treatment measures are labour intensive, they fall perfectly under the purview of MGNREGA.

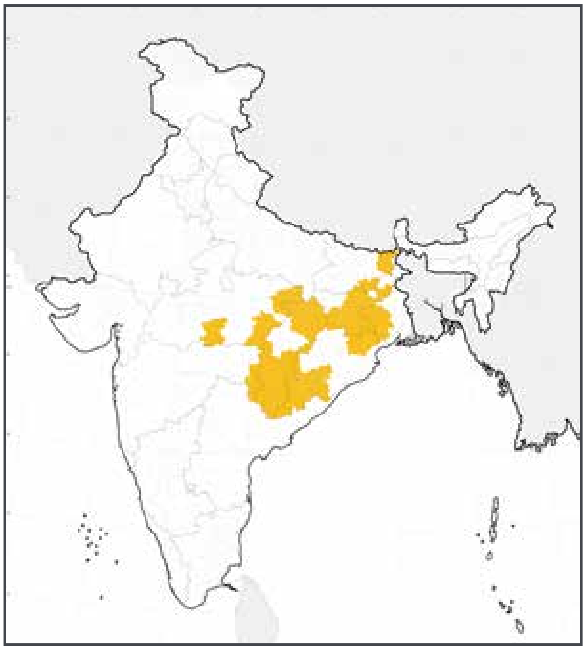
The scale up can be undertaken under plenty of other government schemes such as; Integrated Watershed Development Programme (IWMP), Drought Prone Areas Programme (DPAP), Watershed Development Fund of NABARD, Prime Minister Krishi Sinchayee Yojana, etc.

LESSONS FOR REPLICATION

1. High levels of public participation, effective management by NGOs or a Government-NGO collaboration and equitable sharing of gains among community members are the foundation to a successful land development project (Kerr, Pangare, Pangare, & George, 2000).
2. A facilitating NGO plays a key role in empowering community to prepare such detailed and rigorous patch-wise plans, as it involves constant hand holding, capacity building, facilitation of discussions, regular meetings and follow-ups.
3. The smooth execution of works such as; approval of village-level plans, payments of labour, release of funds for material procurement under MGNREGA can be greatly facilitated by entering in a MOU or agreement beforehand with the government, where the government entrusts the NGO/organisation with the responsibility to undertake such works in the said number of blocks or districts.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

The present case elaborates learnings from Professional Assistance for Development Action (PRADAN)'s experience of implementing Integrated Natural Resource Management (INRM) interventions in Central India tribal belt. Their work is entirely in the undulating and hilly tribal regions in the states of Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal and Orissa.



At a Glance	
Intervention	Land treatment through MGNREGA
Location	Madhya Pradesh, Chhattisgarh, Jharkhand, Orissa, West Bengal and Bihar
Implementation	PRADAN
Period	2000 - Ongoing
Unit Cost	Rs. 67,565/hectare-30x40 plot, Rs. 3,00,000/farm pond-5% farm pond

The organisation has over four decades of experience on rejuvenating land resources of the undulating terrain by saturating treatment scope at village-level. What initiated as a village-level initiative has been successfully scaled up over many blocks and districts of the states mentioned through leveraging MGNREGA funds.

IMPACT

Over the years, the INRM work has benefitted 72,874 women farmers. 27,798 Irrigation structures/schemes have been created to provide irrigation to 14,133 hectares thus benefitting 58,487 families. While 25,447 households have benefitted by treatment of 11,839 hectares of land.

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INCREASING POWER OF STREAMS FOR STABILIZING RAINFED KHARIF

RATIONALE - THE WHY

The contiguous belt stretched across the belly of the nation from Banaswara in Rajasthan to Purulia in West Bengal is characterized by undulating terrain, uneven topography, shallow top soils and hard rock aquifers.

Rainfed Kharif Paddy is the most common crop cultivated by tribal farmers. Given the increased vagaries of the climate in recent years, crop failures are becoming an increasingly common phenomenon due to dry spells at crucial crop growth periods. This is making incomes from rainfed agriculture extremely uncertain and affecting adversely the food security of tribal farmers. The most important precondition for making farming profitable for these small and marginal tribal farmers is stabilisation of the Kharif crop (Phansalkar & Verma , 2004).

To provide critical irrigation to crops during dry spells, most tribal farmers in the hilly terrains rely upon seasonal streams or nalas which run dry two months post monsoon. Such streams act as lifeboats for resource-less farmers in times of critical irrigation requirements. However, these streams are mostly seasonal in nature and provide at the most 2 additional irrigation to crops.

Undulating terrains, and increased intensity of rains, due to climate change impact, lead to heavy runoff. This coupled with suboptimal baselevels is resulting in drying of the seasonal streams faster than ever before. The rejuvenation of such streams/nalas will not only increase the power of these streams but also recharge groundwater and provide for the irrigation needs of small and marginal farmers.

DOHA – THE WHAT

Dohas are saucer-shaped structures built along the length of the stream to enable a renewed period of vertical erosion, which leads to achieving a new and lower base level (Vedpathak & Hangargekar, 2019). This lowered base level allows for more quantum of water to stored thus increasing the storage and recharge capacity of the stream. This in turn increases the power of the stream.

Dohas are by no means a new technological innovation. Farmers of the water scarce Vidarbha and Marathwada have a long history of building saucer shaped structures in beds of streams and nalas to improve the water harnessing potential of the streams. This structures referred to as 'doh' in Marathi are built at the bed-level of stream at the spot in the stream which stores water even when the rest of the stream dries up (Bringing water to parched Vidarbha, 2018). This enabled storing rainwater below ground level. Several dohas are constructed in the stream-bed, along the distance of the stream separated by some distance.

IMPLEMENTATION PROCESS - THE HOW

The process followed to enable community-led development and maintenance of Dohas is below:

1. Selection of stream for excavation of Dohas
2. Formation of Water User Groups (WUGs)
3. Excavation of Doha pits
4. Handover of Dohas to WUGs
5. Water distribution for irrigation

Selection of stream for excavation of Dohas

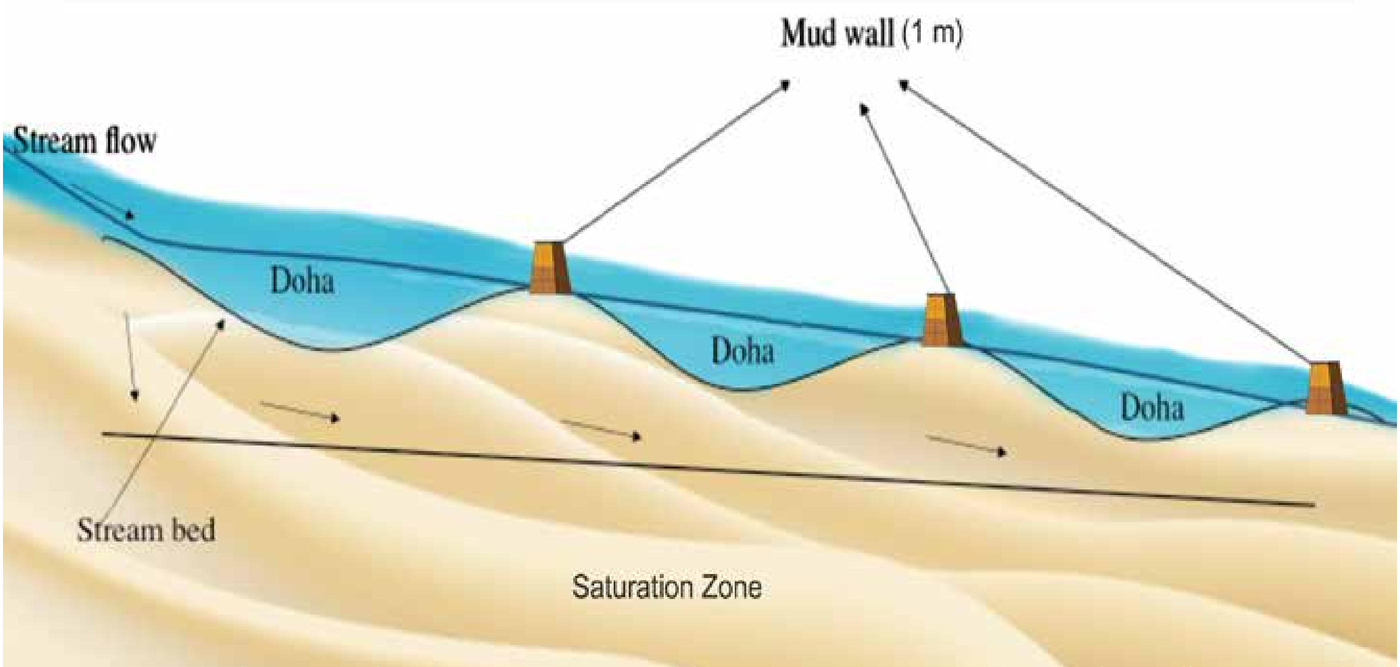
The most crucial aspect of Doha development is the selection of the appropriate stream for excavation. The bed slope of the stream should be less than 3%. Dohas are thus suitable intervention in second and third order streams with a network of 1000 hectares onwards.

Formation of Water User Groups

Formation of Water User Groups (WUG) is undertaken by holding village-level meetings. As several Dohas are to be excavated along the length of the stream, several water user groups are formed. For instance, User Group A will comprise of farmers who have farm lands near Doha 1. The user groups play an important role in excavation of the dohas and their eventual maintenance.

Excavation of Doha pits

The excavation of Dohas can be undertaken through excavators or through physical labour contributed by WUG members. The excavated soil is used for bunding the structure, particularly the bank sides of the Doha.



Source: Policy Consultation report on Methods of Water Harvesting: Implication for National Strategy (Singh & Kachari, 2019)

TECHNICAL SPECIFICATIONS OF DOHA

1. Selection of a stream network of 1000 Hectare onwards
2. The bed slope of the Doha site should be less than 3%
3. The Doha should be saucer shaped to minimize siltation
4. Dohas are most suitable on IInd and IIIrd order streams, however Ist order streams with low elevations can also be considered.
5. The depth of the Doha pit should be within 1.5-4 metres.
6. Adoption of Top to Bottom approach should be followed while construction of Doha pits.
7. 1 metre high retaining wall can be constructed at the end point of each Doha pit to create additional storage capacity.
8. The width for Doha will vary from one stream to another and will be in the range of 10 to 20 metres.
9. 10-15 metres of stream width should be left on both sides of the excavated structure to act as a natural bund.
10. Two consecutive Doha pits are separated by a gap of 15- 20 metres.
11. Dohas are not excavated on sections of a stream with a natural bend or turn.

Handover of Dohas to WUGs

Post the excavation and bunding, the Dohas are handed over to WUGs associated with the Doha structure. The responsibility of repair and maintenance of the structure lies with the relevant WUG. As the construction of the structure is simple, it needs minimal maintenance. Regular desilting of the structure is a must, as it is built in stream beds.

Water distribution for irrigation

It is crucial that the farmers regulate water distribution from Dohas to ensure equity. As Doha's are dug in stream beds, the farmers with fields or wells in the vicinity of the stream are at an advantage as they can easily access the Doha for irrigation purposes. The farmers further away from the stream can benefit, if they lift the water using pumps and transport it using pipes. Only those farmers with the wherewithal can benefit, which usually leaves out the small and marginal farmers. WUGs can play a crucial role in regulating water distribution such that all farmers with land in a Doha stretch, are benefitted equally, if possible.

Implementation of Doha on any seasonal stream leads to increase in water availability in existing sources but does not increase the number of irrigation sources. It recharges groundwater thereby creating a community asset and not multiple individual assets (Deora & Nanore, July 2019). It is important for the community to understand this nuance to enable the sustainability of the structures.

IMPACT

1. Dohas create water storage potential of 850 cubic meter to 2,00,000 cubic meters per Doha and Water recharge potential of 4250 cubic meters to 10 lakh cubic meter per Doha. The wide range mentioned here is due to the variation in the size of the Doha depending upon stream order and slope. Lower order streams can have longer Dohas, measuring 200 m(l)*15 m(w) separated by gap of 100 metres, while higher order streams will have shorter Dohas, measuring 30 m (l)*15(w), separated by a gap of 15 meters.
2. Kharif paddy stabilisation due to availability of critical irrigation during dry spells.
3. Rainfed tribal farmers shifted to double cropping, particularly those with fields proximate to Dohas.

REPLICATION AND SCALE-UP POTENTIAL

A key feature of Doha is that it is an earthen structure constructed without the need of cement or other construction material. As it is constructed in stream beds, there is no issue of ownership. Their low-cost and eco-friendly nature provides a good potential for replication and scale up of the structures in seasonal/ perennial streams.

The first Doha structures were built by Dilasa Sansthan in Maharashtra, and in the last decade more than a dozen different Civil Society Organisations have implemented Dohas in their working areas. Action for Social Advancement (ASA) and SRIJAN (Self Reliant Initiatives for Joint Action) have built Dohas on a large scale in North-central and Central India.


Replication and scale up Potential: Tribal and rural villages across India

These structures have had good success in most terrains and different stream orders indicating a decent scope of scaling up the intervention. The scale-up of Dohas at National level is possible by including it as a standard intervention under the Mahatma Gandhi National Rural Employment Guarantee Scheme.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

Action for Social Advancement (ASA) initiated work on Dohas in 2018 after a few of its team members visited the field areas of Dilasa Sansthan. They saw potential in Dohas and replicated the structures in undulating terrains of the Satpura Maikal landscape. While the structures were built in IInd and IIIrd order streams in Maharashtra in uniform plain landscapes, ASA piloted the intervention on Ist order streams of undulating landscapes of Mandla, Dindori, Shahdol, Annupur and Betul districts situated in eastern Madhya Pradesh.

Location and Context

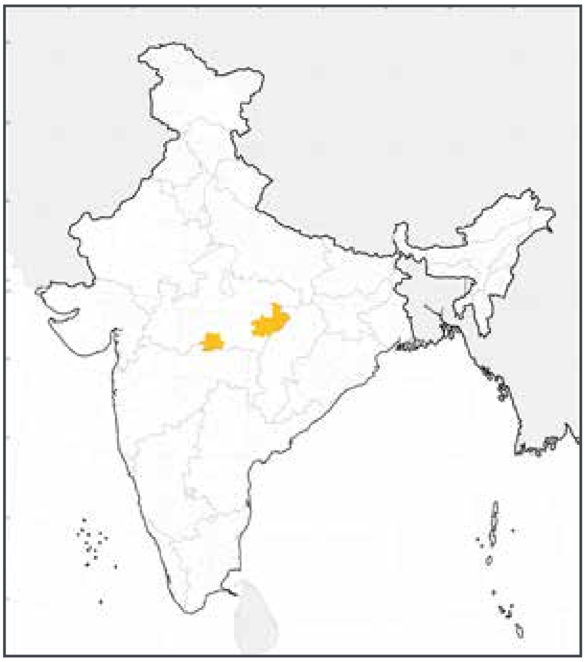
Scheduled Tribes are the dominant population of the region making up for more than 40% of the total population in these districts. Despite the fact that this region receives around 1000 mm of annual rainfall, the tribal community members of the region cultivate only Kharif crop as most of the rainfall received flows down the mountains. The only reliable source of irrigation for the tribal farmers are seasonal streams in which water is retained only till a few months post monsoon.

Intervention

The Doha model offered a viable solution to rejuvenate the seasonal streams thereby improving the agriculture-based livelihood of these tribal farmers. As the conditions and streams differs in the hilly landscape, the average size of Doha built by ASA in Ist order streams is smaller than those built by Dilasa Sansthan.

The average Doha in the region is 30-meter long and 1.5 to 3 metre deep. One such Doha stores 850 cubic meters of water and enables 3-4 farmers having land in proximity to irrigate their fields. Two such Dohas are separated by a distance of 15 meters. A one-kilometre long stream has around 10-12 Dohas and each Doha has 2-3 beneficiary farmers. The stream sections with curves and bends are excluded while excavating the structures.

At a Glance	
Intervention	Doha
Location	Mandla, Dindori, Shahdol, Annupur and Betul districts in Madhya Pradesh
Implementation	Action for Social Advancement (ASA)
Period	2018 - Ongoing
Unit Cost	Rs. 14,000/Doha with excavator; Rs. 30,000/Doha with labour; Dimensions: 30m(l)x15m(w)x3m(d)



A key aspect taken into consideration by ASA while implementing Dohas in any village, is the formation of Water user groups comprising of direct beneficiaries of the Doha; who use the water from the structure for irrigation, to ensure the maintenance of the structures. Due to the undulating landscape, the Dohas are vulnerable to continuous silting, which needs to be periodically removed to ensure optimum storage of water. The assumed life-span of these structures without maintenance is four to five years. This makes community participation an inalienable part of the intervention.

Impact

Over the last 2 years, ASA has led the construction of 750 Dohas directly benefitting around 1400 tribal farmers by bringing 1100 hectares of rainfed land under irrigation.

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PARTICIPATORY CANAL IRRIGATION MANAGEMENT

RATIONALE - THE WHY

Prior to 1980, irrigation was considered a technical endeavour, which was overly focussed upon creation of infrastructure; such as dams, weirs, and canals, and the operational and management aspects of these structures were grossly ignored (Swain & Das, 2008). Deficiencies in irrigation planning, management, and lack of community ownership led to disenchantment of communities from canal systems.

Recognizing this gap between government and community, in the early 1990's Irrigation Management Transfer to farmers through Participatory Irrigation Management was officially recognized as the most appropriate mechanism to efficiently utilize irrigation water, ensure equitable distribution, and incentivise repair and maintenance (Swain & Das, 2008). Gujarat, Maharashtra and Andhra Pradesh were the pioneer states in terms of state policy on Participatory Irrigation Management (PIM) and its implementation as well.

The importance of PIM to improve efficiency, equity and O&M of Canal irrigation systems is widely accepted and adopted. The 12th Five Year Plan document (2012-2017), as well as the National Water Mission document, have both stressed upon community involvement in management of irrigation through formation of Water User Associations (WUAs).

RELEVANCE FOR THE CENTRAL TRIBAL BELT

According to Micro Irrigation Census, 2001; Madhya Pradesh, Chhattisgarh and Jharkhand have 56,724, 51,449 and 43228 surface flow minor irrigation projects with a cumulative irrigation potential of 1.66 million hectares of which the utilisation factor is 70% (Ministry of Water Resources, 2001). Jharkhand and Chhattisgarh are tribal states with more than 75% tribal population and 15 districts of Madhya Pradesh are tribal dominated. It is very likely that majority of these schemes have been implemented in the tribal-dominated districts of these states.

PARTICIPATORY IRRIGATION MANAGEMENT - THE WHAT

Participatory Irrigation Management refers to management at various levels by irrigation users and in all aspects of management (Groenfeldt & Sun, 2001). It includes participation in planning, design, construction, maintenance, distribution as well as financing (Gandhi & Namboodiri, 2009).
Experience of the last three decades of PIM implementation has shown that it provides a 'win-win' situation to both farmers and the government. The tangible benefits of PIM are; equitable distribution of irrigation water, increased irrigation coverage in command, regular operation and maintenance, crop planning, increased cost recovery, and higher income to farmers. The indirect benefits are articulation of farmers' concerns, formation of social capital, inclusive development (Kulkarni, Sinha, Belsare, & Tejawat, 2011), and need-based canal design.

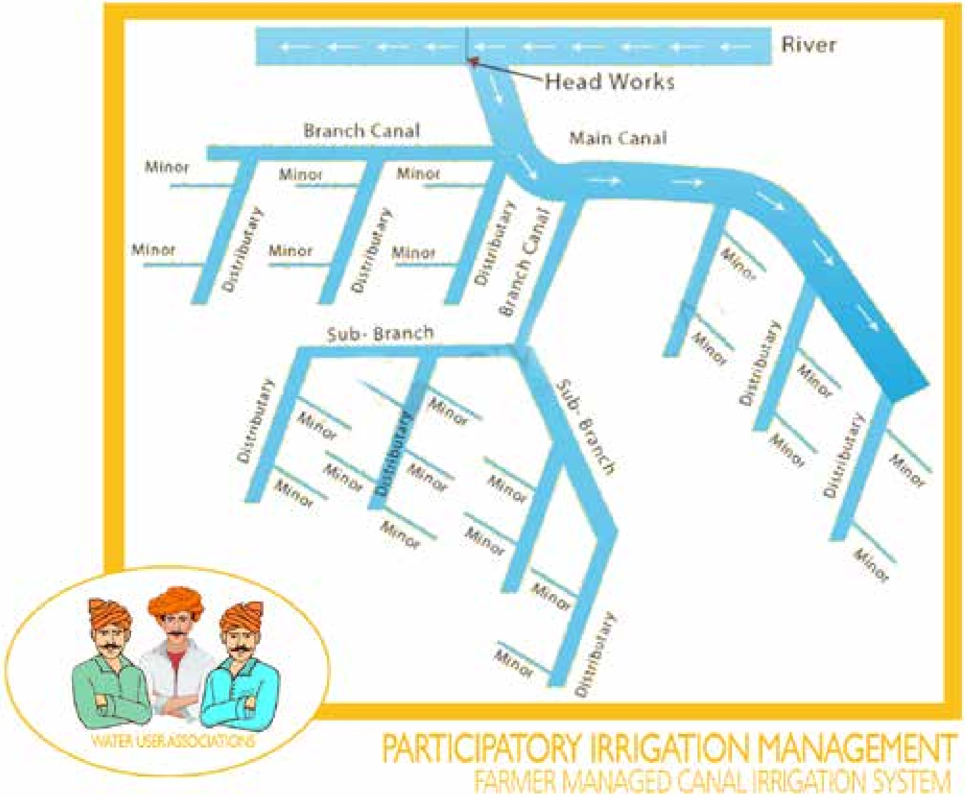
IMPLEMENTATION PROCESS - THE HOW

In order to implement PIM, the first step usually is potential assessment of Canal irrigation through a major, medium or minor project in a given geography. This involves careful study of government irrigation projects in the selected district/block, site visits to command locations and dialogue with command area farmers.

Based on the results of the potential assessment, the irrigation department is approached by the intervening NGO and a mutual MOU is entered into between the government and non-government partners, wherein the government empowers the NGO to facilitate creation of Water User Association (WUAs)/Irrigation Cooperatives (ICs)/Canal Irrigation Societies (CIS) in a particular canal network. This is followed by initiation of participative processes to facilitate formation of WUAs.

The implementation process followed is as below:

1. Baseline Data collection
2. Community mobilization
3. Registration of WUA & selection of working committee
4. Joint Inspection Visit and agreement between WUA and Irrigation Department
5. Training and Capacity building
6. Coordination meeting
7. Irrigation Demand, Water Tariff, Distribution schedule
8. Payment of water charges to government
9. Reporting and Annual General body meeting



Baseline Data Collection

Maps of the canal Irrigation network are procured from the irrigation department to ascertain command area of a canal minor, number and names of farmer in the command area, and previous records of irrigation. Baseline information regarding the cropping patterns and yields of the last 3-4 years, irrigation from canal, and contribution of other irrigation sources is collected for cost benefit analysis of development of irrigation systems through Topical Participatory Rural Appraisals (TPRA) methodology (Oza & Desai, 2007).

Community mobilisation

The intervening NGO initiates dialogue with the community to understand their interest in access to irrigation from the canal infrastructure. This is often the most difficult task as in most instances, the community members have negative perceptions about canals. The most common reasons of distrust are; defunct canals, erratic water supply, lack of supply schedule, tail end deprivation.

Community members are contacted through several modes; individual connect with local leaders, village-level meetings and canal minor-wise meeting. Exposure visits to other successful community-managed irrigation projects are arranged. Their doubts are addressed and success stories of similar canal irrigation projects are shared.

Registration of WUA and nomination of working committee

Interested members in a command area form a WUA by paying membership fees. According to government rules, 51% of the farmers in a canal command need to become members to register the WUA as a cooperative. The intervening NGO facilitates the registration of the WUA. Post which, the WUA enters in a formal agreement/MOU with the irrigation department to manage the Irrigation system. Sometimes members of more than one village get together to form a WUA depending upon the canal command area. Representation of all member villages is ensured.

A working committee is also elected in a general meeting. The number of members varies and depends upon the size of the WUA. If a multi-village working committee is elected; equitable representation is ensured to all villages, castes/tribes, head, middle and tail reaches of the canal. The working committee is responsible for management of the overall affairs of the WUA. It handles water distribution and supply, crop planning, water charge fixation and collection, system repair and maintenance, and conflict resolution among users. The working committee nominates a president and a secretary. Operators are hired to distribute water and watchmen to guard the canals. A longer canal may have 4-5 operators and watchmen.

Joint Inspection Visit

After the registration of the WUA, a joint inspection visit is held to physically inspect the condition of the canal. The visit is jointly attended by Irrigation Department (ID) officials, working committee and community members, and representatives of the NGO. The need for repair, construction or lining of canals is looked at. While the government provides the funds, the community members offer their physical labour as shramdam. Apart from this 10% of the canal rehabilitation charges are provided by the WUA members.

Trainings and Capacity building

Various trainings and capacity building exercises are held by the facilitating NGO for the working committee to provide them with requisite skills to manage a canal irrigation system. Trainings such as leadership training, water management training, accounts training, technical training, are held for different members of the committee. The water management training provides the committee with the knowledge and skills to determine water tariffs, distribution schedule, bye-laws for use of water by members, etc. Along with the trainings, constant handholding support is provided in initial stages when interaction with government officials is undertaken or written applications are to be submitted. The secretary is trained on book keeping and maintaining accounts.

Coordination Meeting

A coordination meeting is undertaken between the Irrigation department, WUA and facilitating NGO, in September, before the start of the rabi season, where the irrigation department informs about the availability of water in the dam, the number of possible irrigation, and their frequency (number of rotations).

Irrigation Demand, Water Tariff, Distribution schedule

Irrigation Demand : The committee holds a general meeting with the WUA members to ascertain irrigation demand. Based on the precipitation of the year, soil moisture level and the availability of water; the farmers decide whether the critical support irrigation for Kharif is required or not. One irrigation for Kharif means one less irrigation for rabi.

In this meeting, farmers also undertake crop planning based on the supply of water. If the supply is less, the water intensive crops are foregone for millets and lentils. Accordingly, demand forms are filled by the farmers, which are colour-coded to allow for easy comprehension. These demand forms are complied by the WUA committee and submitted to the ID. The table below illustrates a sample demand form submitted.

Sample water Demand

CROP	WATER REQUIREMENT
Wheat	250 hectares
Mustard	100 hectares
Sugarcane	150 hectares
Total	500 hectares

Water User Fees: Based on the rates of irrigation provided by the ID, the WUA committee arrives at a per hectare per crop water user fees; taking into consideration various expenses of the committee such as salaries, repair and maintenance fund, etc. A budgeting exercise is recommended for arriving at a water user fees.

Distribution Schedule: A popular system of water distribution practiced since ancient times is known as the Warabandhi; which is practiced by many WUAs to ensure equitable and easy water distribution. It is a system of water distribution by turns according to a predetermined schedule specifying the day, time and duration of supply.

When the system is operationalised, the date and number of days for which water will be available in any particular canal is known to the WUA. The operator has the records of farmers and the crops grown. Based on the water availability in a particular minor canal, he informs the concerned farmers about the timing of gate opening and their turn to take irrigation.

Payment of Water Charges to Government

The WUA collects the water charges from members in advance. Efforts are made to collect water charges at the start of the sowing season. Priority in water distribution is given to members, who have paid the water charges and fine is levied on members who delay in payment of charges. Timely payment of charges to the ID is awarded by provision of 20% rebate on the water charges collected and 30% for operations and maintenance. Thus 50% rebate in water charges is possible on timely payment of water charges.

Reporting and Annual General Meeting

The secretary of the WUA manages the books and records of expenditure, receipts of water charges, water demand, water supplied and land area irrigated. S/he develops the financial statements at the end of each financial year. Income expenditure statement and Balance sheet are prepared. The surplus remaining at the end of each year is carried forward to the next year and the additional fund thus created helps tide over rough non-irrigation years.

An annual general meeting is held at the end of each year, where the members of the WUA are informed about the performance of the cooperative. The water supplied and used, crops taken, payments of water charges received, defaulters, etc.

SAMPLE WATER RULES OF A WUA

1. Every farmer has to fill up irrigation demand form within the due date otherwise 50% extra will have to be paid.
2. If any farmer were found receiving irrigation without having a valid receipt of the payment made to the WUA, then he will be punished and any operator found allowing such a farmer to irrigate would also be penalized.
3. All beneficiaries have to pay water charges in advance.
4. Non-members would be charged up to 30% more than the members if they are supplied water.
5. In case of water scarcity, WUA gives preference to member over non-members.
6. Every member will receive irrigation according to his/her turn. Before irrigation, farmers should be able to produce a gate pass on the operator's demand.
7. Nobody can receive irrigation without permission of the operator.
8. If there is any harm to WUA's canal, gate, siphon, kachi (unlined) canal etc. due to a member's negligence, he has to fully restore the damage done.

Penalties

The WUAs form rules to penalize misappropriations. Farmers violating rules or norms agreed upon by the majority of members are penalized for doing so. Penalties are levied for offenses such as wastage of water, over-irrigation, taking irrigation out of turn, irrigation in terms of number of waterings, irrigating for longer duration than stipulated and taking water twice in one rotation. The rates of penalty vary from one WUA to another, however, the concern is to ensure equity. Financial implications prove to be an effective deterrent against misappropriations.

IMPACT

1. Increased land under double cropping. Assured irrigation has led to the shift from rainfed paddy to Kharif, rabi as well as summer cropping.
2. Change in cropping pattern from subsistence crops to high value cash crops.
3. Increased cropping intensity and crop productivity
4. Reduction in migration rates, increase in wage rates in the village and higher land prices (Mukherji, Verma, & Rath, 2002).

REPLICATION AND SCALE-UP POTENTIAL

There exists tremendous potential all across the nation to implement PIM. 24 out of 29 states have partly or fully adopted the PIM approach by forming WUAs. There are currently over 93,000 WUAs all over the country (Indian Network on Participatory Irrigation Management, 2020). In all there are 1880 major and medium canal irrigation projects operational in the country with a potential to irrigate 46.24 million hectares of land (Ministry of Water Resources, 2012).

With relevance to the central Indian tribal belt too, there exists a good potential to scale up PIM. 326 Major and medium irrigation projects have been completed in Madhya Pradesh, Chhattisgarh and Jharkhand (Ministry of Jal Shakti, 2020) which have substantial tribal populations. Along with that, these states have 1.51 lakh surface flow minor irrigation schemes.

Replication and scale up Potential: Tribal and rural villages across India

LESSONS FOR REPLICATION

1. A strong political will and active involvement of government; especially irrigation department, is needed for the success of PIM.
2. Competent and strong leadership at the village-level and/or the WUA-level is crucial.
3. Capacity building of the working committee of the WUA needs to be undertaken on various managerial aspects to empower them as efficient managers.
4. The working committee and its leadership should change ever 3-4 years.
5. The WUA should design mechanisms which allow the middle and tail reaches to access water at early stages of water supply.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

The present case is based upon the experiences of Aga Khan Rural Support Programme (India) and Development Support Centre (DSC). These two organisations have been trailblazers for PIM implementation as well as state-level PIM policy formulation in Gujarat.

In 1995, the government of Gujarat issued a policy resolution adopting PIM programme in the state. This was followed by launch of 13 pilot PIM projects in Gujarat, which were implemented by DSC and AKRSP(I). Based on the experience gained by the implementation of PIM in these pilot projects, the Government issued several administrative orders to facilitate implementation of PIM in other projects of the state. This was followed by the implementation of the PIM act in 2003.

Cumulatively both the organisations, have over the last 2.5 decades of implementing PIM projects in Gujarat, brought 1,27,168 hectares of agricultural land under irrigation by collectivizing 1,23,665 farmers from 529 villages into 403 WUAs.

AKRSP(I) has expanded PIM implementation in Madhya Pradesh and DSC in Madhya Pradesh as well as Maharashtra. Taken together, these organisations are responsible for bringing 4,29,509 hectares of land under canal irrigation by formation of 836 WUAs.

Location and Context

Narmada is a predominantly tribal district with 82% Scheduled Tribe population. The average rainfall is 1178 mm and 66% of the population is rural, depending upon agriculture as the primary source of livelihood. The tribal farmers in the programme area cultivated rainfed paddy in Kharif with intercropping of tuvar and jowar. Rabi cropping was almost non existent among tribal farmers. The non-tribal farmers took rabi as well as Kharif with very few rich farmers growing sugarcane.

Intervention

AKRSP(I) initiated work on PIM in Narmada district in early 1990s. The first tribal canal irrigation society set up was Pingot's Jeevan Deep Co-operative Irrigation Society. The community mobilization was a very difficult task in the beginning. The farmers in the command were reluctant to believe that water would flow down a canal that had been left unused for several years.

At a Glance	
Intervention	Participatory Irrigation Management
Location	Mehsana, Aravalli, Sabarkantha (DSC) Narmada, Bharuch, Tapi (AKRSPI)
Implementation	AKRSP(I) and DSC
Period	1990 - Ongoing

Positive efforts by the organisation and the government led to its formation and successful operationalization. Post the implementation most tribal farmers in the command took to summer cropping of groundnut and moong and many non-tribal farmers shifted to the lucrative sugarcane farming (Mukherji, Verma, & Rath, 2002).

The cropping intensity and productivity have increased manifold post PIM in the programme areas and migration rates have reduced greatly. Over the years, it has come to serve as an example of tribal farmer managed canal system and led to implementation of many more PIM projects in tribal south Gujarat.

Over the years, AKRSP(I) has formed 34 WUAs, while the process is ongoing to form another 39 WUAs in the tribal South Gujarat districts. These 73 WUAs have 29,222 hectares of area under the irrigation command which will benefit 36, 797 farmers.

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SEQUENTIAL CHECKDAMS & LIFT IRRIGATION COOPERATIVES

RATIONALE - THE WHY

Rivers are meccas of life. The earliest settlements of human kind were riparian civilizations which, being agriculture-based, flourished through the regular availability of water from the rivers. Eventually, humans learnt to control the flow and timings of the river flow by construction of barriers across the direction of the river flow.

Over time and through technological advances, the height of the dams kept increasing to store more and more water, and grand structures >150 metres high were spread across the world. India is the fourth largest dam builder of the world with 4710 completed large dams in the country. However, the efficiency of these dams is poor in terms of irrigation coverage. Canals irrigate less than 25% of India's net irrigated area (Irrigation, 2010).

Another problem with India's big dam-canal strategy is that, it has historically neglected the watershed areas in remote drylands inhabited by tribal communities. Worse than being side-lined in canal water supply, is the relocation of tribal community due to construction of big dams. According to a report on Displacement, 16.4 million people have been displaced by 3030 medium and large dams, and tribal community account for of over 40% of the displaced population (Negi & Ganguly, 2011).

Rajiv Gandhi, the Prime Minister of India from 1984 to 1989, had this to say about mega dams; 'We can safely say that, almost no benefit has come to the people from big surface irrigation projects .... For 16 years, we have poured out money. The people have got nothing back, no irrigation, no water, no increase in production, nothing.'

Check dams neither displace people nor lead to skewed distribution. Sequential Check dams spread along a river, provide water equitably to everyone along the course of the river (Agoramoorthy, Chaudhary, & Hsu, 2008). Checkdams built in a series have the same water storage potential as a big dam. Infact, there is a strong scientific evidence to show that small scale water harvesting structures yield much more water than big dams.

According to ground breaking research done by Michael Evenari, a micro catchment can harvest 15.21% of rainwater, while a medium dam can harvest only 3% of the rainwater. (Centre for Science and Environment, 2011).

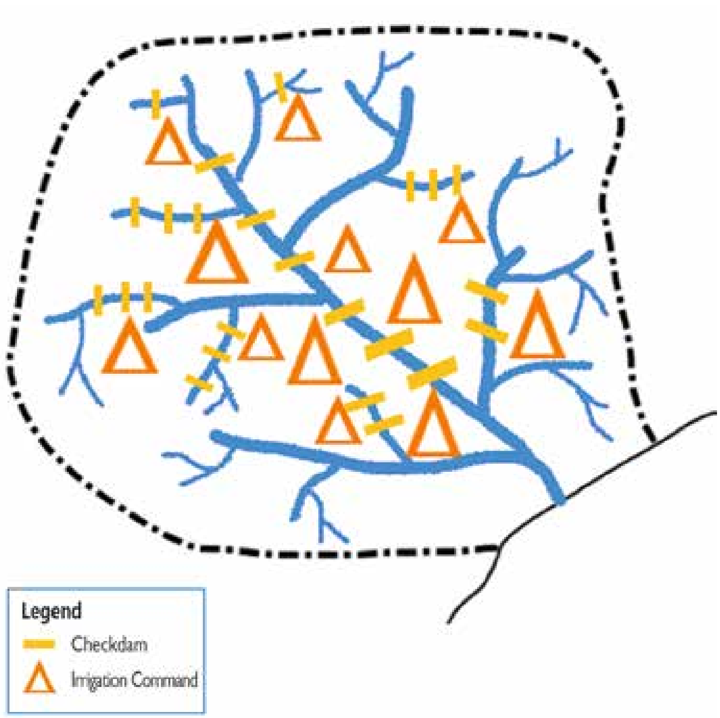
SEQUENTIAL CHECK DAMS AND IRRIGATION COOPERATIVES - THE WHAT

Check dams constructed in a series on a river allow, both water recharge into aquifers, and water harvesting for irrigation purposes. After creation of check dams, lifting infrastructure erected enables farmers in the command area of the dam to irrigate their fields.

The core of the work approach is, saturation of water harvesting potential of a selected river basin.

The key elements of the work approach are mentioned below:

1. Identification of a river or sub river basin to work in a saturated approach
2. Creating Water harvesting potential along the length of the river through series of water harvesting structures
3. Lift Irrigation Cooperatives (LIC) established to sustainably harvest the stored water for irrigation in the command area.



Caption: Water basin of a river with check dams

IMPLEMENTATION PROCESS - THE HOW

The key steps of implementation process of mentioned below:

1. Demand from village community to construct check dam and/or establish lift irrigation system
2. Preliminary feasibility survey to understand need, capacity and tentative costing of the storage and/or lift systems.
3. Application submitted to government, either Irrigation department or Tribal Sub Plan or any other applicable plan.
4. Detailed survey and costing.
5. Construction of Check dams and/or Lift Irrigation System (LIS).
6. Formation of Lift Irrigation Cooperatives (LIC).
7. Hand over of the Lift Irrigation system to Cooperatives.
8. Management and control of Lift irrigation system by the cooperative.

Demand from village community is the most crucial step of the process. As the village community elicits interest to access irrigation service, their active participation in the long run is ensured.

A preliminary feasibility survey by the facilitating NGO is undertaken to understand community's need, whether construction of check dam is required or the village has a surface-based irrigation source and needs the lifting infrastructure.

Post the preliminary survey; the facilitating NGO, includes the village application in its records. A proposal mentioning requirements of physical structures; check dams as well as lift irrigation systems, is submitted to government under various schemes or programmes such as the Tribal Sub Plan, Rashtriya Krishi Vikas Yojana (RKVY), etc. Plans of interested villages falling in the operational geography of the NGO are submitted. CSR funding options are also explored. As and when funding is approved, the construction of structures is undertaken. Checkdams are constructed accordingly, in a series and post creating water harvesting potential, Lift irrigation systems are installed.

LIFT IRRIGATION COOPERATIVES

The cooperative is set up by all interested farmers in the LIS command by paying a mutually decided membership fees. 51% farmers in the command area of a irrigation system need to become members to register a cooperative.

In the same meeting, the executive or working committee of the LIC is elected. Efforts are made to ensure equitable representation from all falias/hamlets and castes/sub-groups. Representation of women in the executive committee is also ensured. The roles and responsibility of the Executive committee and the bye laws are mutually decided upon in a general village meeting. The committee is headed by a Chairman and a secretary is appointed, who is responsible for book keeping, tariff collection and overall financial management. Paid employees hired by the committee include watchman, distributor and operator. The general policy for water distribution, water tariff, charging mechanisms are decided in a general village meeting.

A method of estimating the water tariff is through estimation of various expenses; electricity expenses for pumping, salaries of the operator, distributor and watchman, and expenditure on repairs and maintenance. To this a margin is added to generate surplus; and the total is divided by the area under LIS. This gives the charges per unit of area.

Equitable Water distribution is a crucial factor, which decides the success of a LIC. A traditionally used method; Warabandhi, which literally translates to fixation of turns, is a system of equitable water distribution according to predetermined schedule where beneficiary farmers receive water as per their turn. This system is adopted by many cooperatives to limit water wastage and to ensure that people don't misappropriate advantages of the LIS. Warabandhi is decided at the beginning of the irrigation season and priority is given to members, who have paid advance irrigation charges for the season.

IMPACT

The major impacts observed post the intervention are:

1. Increase in water storage and recharge potential.
2. Improved groundwater table.
3. Increase in area under irrigation through direct irrigation in command through LIS and through groundwater-based irrigation in catchment.
4. Increase in cropping intensity.
5. Increased capacities of communities to manage their water resources

Smt. Bakulaben Deepsinh Parmar is one of the prosperous woman farmer of Kamboi village of Limkheda earning net income of Rs.2,45,000/- from floriculture cultivation on her small piece of land 1.5 acre. There are 150farmers engaged in floriculture cultivation in this village and total annual income of this village through sale of flower is Rs. 1.25 crore. This has been possible due to ensured irrigation from Lift Irrigation systems and floriculture trainings by NM Sadguru.

Source: N M Sadguru Annual Report 2020

REPLICATION AND SCALE UP POTENTIAL

Water harvesting using checkdams built in a series, has the potential to transform the drylands into productive agricultural fields, sustain ecology and even revive rivers during the dry season. The structures can be planned across both major and minor river basins of the country, to allow for equitable distribution of benefits to both upper and lower catchment populations.

Existing government schemes and programmes offer good potential for scale up in various states. These structures can be included under Tribal Sub Plans, Tribal Area Development Plans, MGNREGS, Rashtriya Krishi Vikas Yojana (RKVY), Tribal Development Fund and other projects under NABARD, etc.

LESSONS FOR REPLICATION

1. Strong leadership is a prerequisite for active LIC. Nurturing leaders by various trainings and exposure visits is therefore necessary.
2. Building capacities of executive committee members in various aspects of operations and management, needs to be undertaken by the facilitating NGO to ensure smooth operations.
3. Conflict resolution strategies and protocols need to be formulated along with formation of bye-laws.
4. The water distribution infrastructure needs to be planned through community participation.
5. Norms and schedules of water distribution must be clearly defined and readily available with all beneficiaries to avoid conflicts.

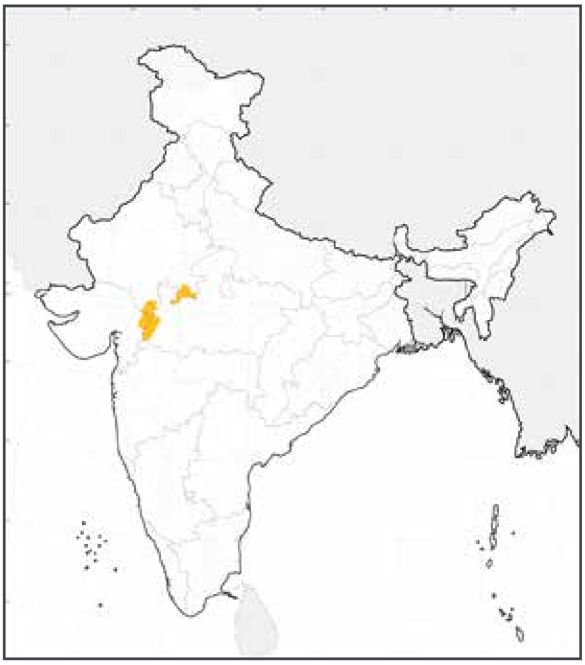
Replication and scale up Potential: Tribal and rural villages across India

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

The current case depicts the learnings from the experiences of NM Sadguru Water and Development Foundation. The organisation has created distributed storages in the form of series of check dams on small river basins, which hold over 138 MCM (Krishnan & Indu, 2014). This was followed by establishment lift irrigation systems managed by cooperative societies,which directly irrigate 47,897 hectares and additionally, some 14,369 hectares gets benefitted downstream through well irrigation possible due to groundwater recharge.

In Gujarat alone, distributed storage potential of 41 MCM has been created by construction of 221 check dams. All this work has led Dahod to become the best irrigated district of Gujarat. The cropping intensity of the region where Sadguru's work is concentrated is 1.96, while overall cropping intensity of Dahod is 1.40.

At a Glance	
Intervention	Sequential Checkdams and Irrigation Cooperatives
Location	Dahod, Banswara, Jhalawar and Jhabua districts
Implementation	NM Sadguru Water and Development Foundation
Period	1975 - Ongoing
Unit Cost	Rs. 70 lacs/Check dam | Rs. 60 lacs/LIS



Location and Context

Founded in 1974, the organisation set up a firm footing in Dahod district, before expanding to other regions. Dahod is a tribal district with over 72% population belonging to Scheduled tribe (ST). It is located at the western edge of the central tribal belt. The region has hilly undulating landscape with high rainfall.

In 1974, when the organisation set up operations in the district it had only 6% of total agricultural land under irrigation, one of the worst in the state.

Intervention

Sadguru worked in a saturated approach by constructing checkdams in many small river basins. A unique feature of the organisation's approach is that work is initiated after the demand submitted by villages. This makes the work of the organisation more valuable as it is powered by community's need rather than by the NGO's want.

The organisation constructs three kinds of structures: Gated masonry check dams across big rivers, gated masonry check dams across small rivers/rivulets/ nalas and earthen tanks. Cumulatively 431 masonry water harvesting structures have been executed by Sadguru Foundation over the last 50 years which have a potential to irrigate 61,866 acres thereby benefitting 29,396 households. 440 community lift irrigation schemes have been executed by the organisation having a command area of 56,440 acres which are fully managed by Lift Irrigation Cooperatives.

In order to increase income earning potential of the tribal farmers, the organisation has been promoting productivity enhancement of cereal crops, high value crops, horticulture, floriculture, and vegetable cultivation. The increase in annual income of farmers has been from Rs. 35-40,000 to Rs. 1,50,000 through crop diversification and allied activities (N M Sadguru Water and Development Foundation, 2020).

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PEOPLE-LED INTEGRATED WATER SECURITY PLANNING

RATIONALE - THE WHY

According to Composite Water Management Index (CWMI) report of the Niti Aayog released in 2018, by 2025 India's water demand is projected to be more than twice the available supply. A severe water crisis is looming which will make water scarce for most of the general population. About 12% of the nation is already living in 'Day Zero' like conditions.

Due to government ownership and responsibility to supply water, the population demands more and more water. The focus of the government thus, is perpetually is upon 'supply-and-more-supply' provision to meet the ever increasing demand.

For water management to be effective, there needs to be public ownership of the resource, which will bring in accountability and a much-needed transition from 'demand-more demand, and supply-more supply' open looped system.

This requires reinstating of the water control and management to the communities. A decentralized people-led movement is necessary for restoring the water balance of our nation. People-led integrated water security planning will result in need-based design of interventions, which can be implemented at micro-level without too much investment and brouhaha.

RELEVANCE FOR THE CENTRAL TRIBAL BELT

Large government schemes tend to leave out tribal hinterlands from their implementation plans, simply because of ease of implementation of programmes in valleys and plains. Decentralised approaches to development thus offer a viable solution in tribal hinterlands. Village-level Water Security Plans represent the unique opportunity to plan need-based water control strategies and then tap government funding to implement the same.

WATER SECURITY PLANNING - THE WHAT

A water security plan may be defined as a village level document which uses the principles of water budgeting and integrated water resource management to secure the multiple water needs of a village for drinking, domestic use, irrigation and livestock by bringing in local water-source sustainability.

IMPLEMENTATION PROCESS - THE HOW

The preparation of a detailed water security plan requires; sustained efforts to collect water demand and supply data, participatory processes, community-led governance and facilitation by NGOs.

The following processes are followed to develop Water Security Plan at the village level:

1. Formation of Village-level Water Governance Committee/*Sujal Samiti*
2. Collection of Data through PRA and village-level para geohydrologists/*Bhujal Jankar*
3. Preparation of Water Budget/Water Balance
4. Preparation of Water Security Plan
5. Focussed efforts to Implement the Water Security Plan

Formation of Village-level Water Governance Committee

A village-level water governance committee is formed, which is responsible for management of all water resources of the village. It includes in its ambit; drinking water, irrigation water, surface water sources, groundwater, piped supply, canal irrigation, etc.

Collection of Data through PRA and village-level para geohydrologists

A Participatory Rural Appraisal (PRA) is conducted to understand the water situation. Aggregate village water demand is estimated from multiple uses; drinking, domestic use, livestock and irrigation.

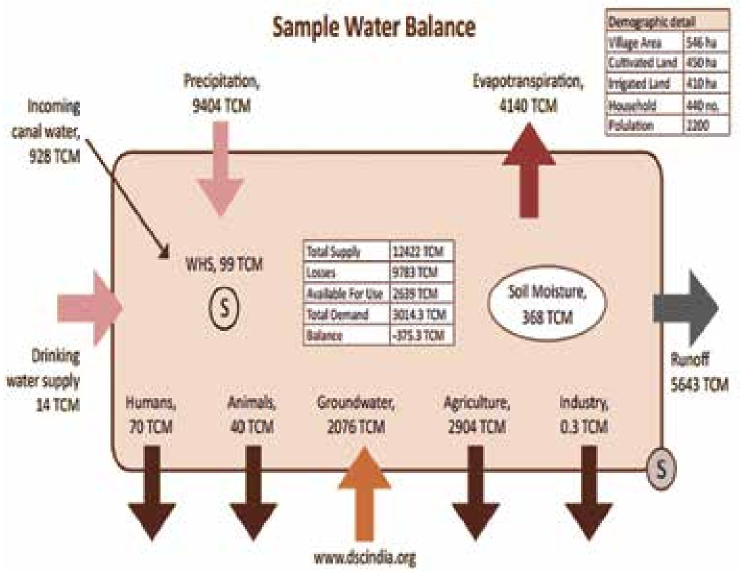
To enable accurate data collection regarding available supply of water from surface and groundwater sources; a cadre of village-level para geo-hydrologists is developed. They are trained to undertake groundwater monitoring, record precipitation data, check dam levels, and to undertake baseline farm-level surveys to understand crop water requirement, evaporation losses.

Preparation of Water Budget/Water Balance

Water Budgeting is an exercise which evaluates the water balance by subtracting aggregate demand of water from the available supply of water. A positive balance indicates water security, while a negative balance connotes water deficit or scarcity.

Preparation of Water Security Plan

Based on the results of the water budgeting; the village community facilitated through an NGO, finds out possible solutions at village-level to reduce demand by adopting water use efficiency measures, while at the same time enhancing supply by planning recharge and storage structures in suitable zones. A Water security plan is thus prepared by the Water governance committee based on inputs and decisions taken by the community.



Focussed efforts to Implement the Water Security Plan

The village-level water security plan is presented to the gram panchayat. Works which can be undertaken under MGNREGA or other panchayat alloted funds are picked up first. Efforts are made by the Water governance committee and facilitating NGO to tap government as well as non-government funds to implement the plan.

IMPACT

1. Ensuring source sustainability, making villages self-reliant in meeting their water needs.
2. Development of Village-level groundwater experts who can interface between planners and community.
3. Better management of groundwater resources.
4. Low cost of implementation compared to government programmes.

SCALE-UP AND REPLICATION POTENTIAL

People-led integrated water security planning has the potential of making tribal rural India self-sufficient in meeting its water needs. Implementation of village-level micro plans to ensure water security is not only efficient in terms of achieving source sustainability but also in terms of cost.

LESSONS FOR REPLICATION

1. It is necessary to prepare an integrated plan which looks at various dimensions; livelihood, natural resource, and agriculture development to ensure sustainable use of water.
2. A holistic approach to community mobilisation is required, which ensures participation of children and women.
3. The Water security plan needs to be integrated with participatory groundwater management, watershed development, and agriculture extension.
4. Involvement of panchayats is crucial, as they act as conduit for government funding needed for implementation of the water security plan.
5. Capacity building of village youth as para geohydrologisits is a continuous process, and hand holding support is required for atleast 5-6 years.

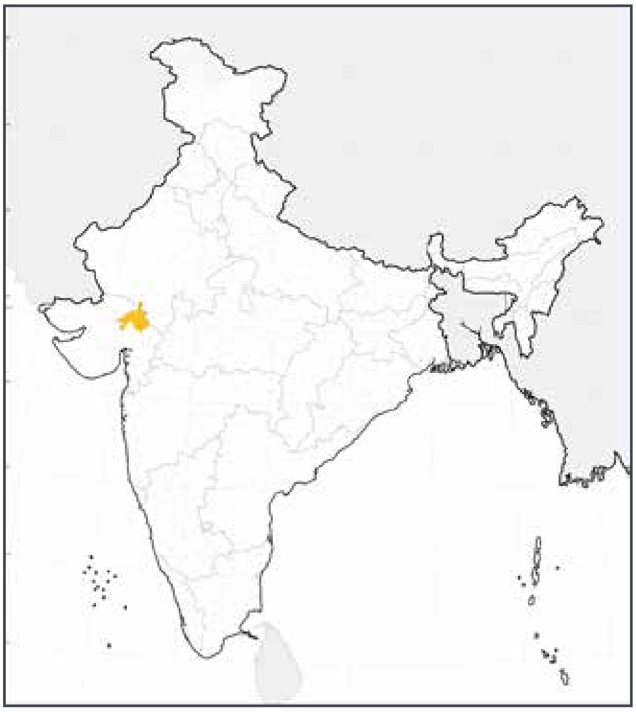
GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

Development Support Centre (DSC) has been empowering communities in 24 villages of Aravalli, Mehsana and Sabarkantha districts of Gujarat to prepare Village-level Integrated Water Security Plans since 2015.

Location and Context

The project was initiated in Meghraj block, which is situated in the Aravalli district. Over 22% of the population belongs to scheduled tribes. Falling in semi-arid zone, the region has undulating land with 5-10% slope. Small and Marginal farmers dot the landscape with 77% households, who own less than 1 hectare of land. Majority of landholdings were rainfed, and groundwater formed the major irrigation source.

Given the water scarcity in the region; DSC had intervened in Meghraj in 1998 through implementation of watershed works. Along with physical structures, the community was mobilized into various institutions such as Watershed committee, Pani Samiti (for drinking water) and Water user groups.



At a Glance	
Intervention	Community-led Water Security Planning
Location	Mehsana, Sabarkantha, Aravalli districts
Implementation	Development Support Centre (DSC)
Period	2015 - ongoing

The situation of water had improved post the watershed work, with most farmers shifting from rainfed to irrigated farming, enabling them to take two crops a year. The increase in water availability, however, led the farmers to dig new wells and tubewells. This led to extraction of groundwater on an unsustainable scale.

The farmers of the region were faced with water scarcity once again, as new wells dug failed and existing wells dried up a few months post monsoon. Also, the committees formed for management of water resources worked in isolation and there was very little collaboration with the Panchayats.

Intervention

There was a need for an institutional mechanism, which could look at water holistically and in an integrated manner. DSC thus initiated the formation of Sujal Samities in Meghraj block on a pilot basis to manage

all kinds of water resources. These samities were formed with representatives from the existing village institutions, Panchayat and 50% women.
This was followed by formation of bye-laws and fixing the roles and responsibilities of the Sujal Samiti. The samiti was handed responsibility to prepare village-level water security plans in consultation with village community.

Parallelly, DSC build a cadre of 20 para geohydrologists, known as '*Bhujal jankars*' by training them to perform geo-hydrological evaluation of their area, monitor groundwater quality, water table depth, check dam water level monitoring, and recording precipitation data, needed to estimate groundwater recharge.

The Bhujal Jankars (BJs) and DSC staff measured and counted availability of ground water sources for domestic and agricultural purposes for a span of three years from 2015 to 2018. Demand estimation was done by BJs and Sujal Samiti through a Participatory Rural Appraisal. Water budgeting exercise was undertaken based on these data.

The Water Balance for 22 villages revealed that the present water availability was 60.79 Million Cubic Meter (MCM) against the present demand of 154.6 MCM, thus leaving a negative balance of 93.81 MCM every year.

This deficit is met by over exploitation of deep ground water. 22 Village-level Water Security Plans (WSP) were developed by Sujal Samities in consultation with village community to fill up the gap between the demand and supply of water.

The villagers are planning to harvest rainwater and improve on farm water use efficiency to conserve 2 MCM water and 15.34 MCM water respectively.
In the water security plans, the following have been endorsed by the communities of different villages.

- Irrigation of rabi crops through canals
- Canal lining repairs
- Recharging defunct wells
- Ban on digging of new wells
- Expansion of drip coverage
- Convergence with Panchayat for implementation
- Increasing water use efficiency on farms by training from Farmer Field Schools and KVKs

If the plans are executed in completion, it will help 5 villages to get rid of water deficit scenario completely and greatly reduce the water deficit of other villages.

In 2019, DSC won the '**Water Digest Award**', in the Best Water NGO-Water Education category for the work DSC has done upon developing capacities of communities to prepare integrated village-level water security plans.

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PARTICIPATORY GROUND WATER MANAGEMENT

RATIONALE - THE WHY

India is the largest groundwater user in the world today. It uses 248.69 million cubic kilometers of groundwater annually (Central Ground Water Board, 2019), which accounts for a fourth of the global total (World Bank, 2012).

The total annual replenishable groundwater is 432 million cubic kilometers (Central Ground Water Board, 2018-19). The stage of groundwater development of the country is 63%. This stage has crossed 100% in Delhi, Punjab, Haryana and Rajasthan, meaning that the annual groundwater extraction has exceeded the recharge in these states and they are already reeling under a good amount of water stress. In Gujarat, Uttar Pradesh, Tamil Nadu, and Himachal Pradesh, this rate is between 70-100% implying that the groundwater is severely over exploited (Ibid).

The reason for such unprecedented extraction of groundwater is its contribution to the nation's irrigation needs. 89% of the groundwater extracted is for irrigation use and 11% contributes to drinking water usage (Central Ground Water Board, 2019). Even within the irrigation sources matrix, 65% of the area is irrigated through groundwater-based assets, while only 35% is irrigated through surface-water sources (MOSPI, 2017).

Several reasons have brought on this imbalance, which has made agriculture highly dependent upon groundwater. The access to groundwater increased phenomenally in the 1970s when subsided electricity, coupled with easy access to pumps sets, made pumping groundwater affordable. In the initial years, farmers pumped at shallow depths to extract water. However, when the water table started declining and with the advancement in technology, farmers initiated the era of drilling tubewells to extract water from deeper aquifers. This has further worsened the situation.

RELEVANCE FOR THE CENTRAL TRIBAL BELT

The western and central parts of India are faced with an alarming rate of groundwater depletion at the rate of 70 cm per year in some regions (Mishra, 2018). Coupled with it the fact the Central tribal belt is geologically a low recharge zone. The hard rock aquifers of the region have low porosity and thus store limited volumes of water. As the groundwater is not easily replenishable, it implies increased vulnerability to drought in low rainfall years.

PARTICIPATORY GROUNDWATER MANAGEMENT - THE WHAT

The reason for the abysmal groundwater condition of the country is the lack of understanding of groundwater science, focus on augmenting supply without regulating demand, missing policies and regulations on groundwater usage in agriculture, and a lack of understanding of groundwater as a 'common pool' resource (Arghyam, 2015).

In order to conserve the groundwater aquifers of the country, a paradigm shift is needed from simply undertaking supply side interventions to undertaking need-based interventions based on the understanding of groundwater aquifers. Another important component is participatory tools to ensure sustainability of the interventions. Participatory Ground Water Management (PGWM) thus focusses upon 'aquifer-based, common pool resource' approach.

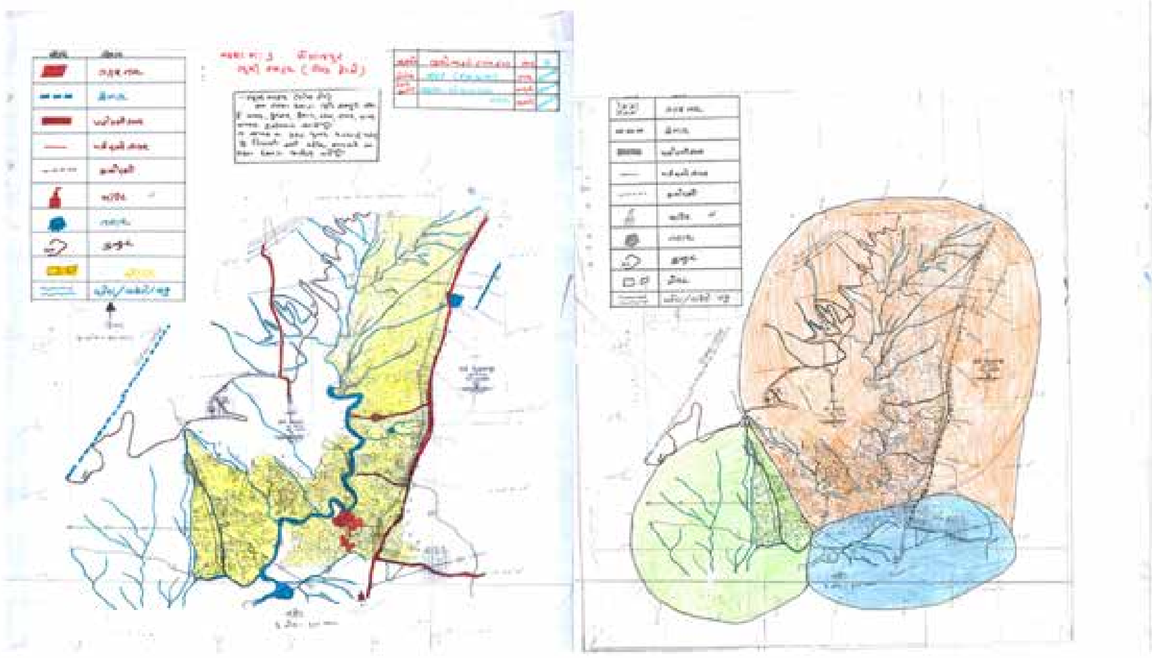
IMPLEMENTATION PROCESS - THE HOW

The process to implement PGWM programmes is below:

1. Identification of watershed and villages
2. Selection of interested rural youth for para geohydrologist or Bhujal Jankar (BJ) training
3. Training and capacity building of selected rural youth as para-geohydrologists
4. Collection and continuous monitoring of groundwater data
5. Analysis of the collected data to understand the groundwater situation
6. Advancement of knowledge generated to community members
7. Enable design of participatory processes to manage groundwater resources
8. Form Village-level Groundwater cooperatives

Identification of watershed and villages

Based on aquifer mapping, the villages sharing a common source aquifer are recommended for selection. This is done to ensure that the effectiveness of the interventions undertaken can be quantified based on comparison of baseline values and post intervention values of variables.



LAND FORM MAP WATERSHED MAP

ABOUT : These maps are prepared by Bhujal Jankar of Polajpur village.

On the basis of the status of water in the water resoruces, and the demand estimation a water budget is prepared. This gives information about water surplus or deficit. Based on the results of the water budget participatory groundwater mgmt interventons are planned.

Selection of rural youth for para geohydrologists

Below are the criteria for selection of BJs

- S/he knows how to read and write in local language and has basic knowledge of mathematics.
- S/he has good oral communication skills.
- The person is connected to agriculture and familiar with the issues in the village.
- S/he is interested in helping the community.
- S/he can give time for training themselves and training others.

Training and capacity building of selected rural youth as para-geohydrologists

The recruited youth are trained through relevant theory and practical exercises in their local setting. The training program is of 46 days, divided into eight modules spread over six months. It covers mapping, water and land resource analysis, geo-hydrology, water balance analysis and preparation of groundwater management strategies.

Continuous data collection and monitoring

Post the training, the BJs record information regarding water resources of their village continuously. They take weekly measurements of waterlevel in wells, test water quality, record water levels in check dams and measure daily precipitation during monsoon months.

Analysis of data collected

The data collected by BJs is analysed through use of various statistical and mapping tools in order to understand the groundwater situation of the village.

Advancement of knowledge generated to communities

Based on the analysis of the data, a few crucial maps such as the landform map, land use map, watershed and water sources maps, are developed, which help transfer of complex details of geo-hydrology to community members in a visual way, which helps greatly with comprehension.

Enable participatory groundwater management

In a common meeting with villagers, the BJs and village communities calculate water balance which shows the demand-supply gap of water in a village. Based on the results, participatory strategies to manage groundwater resources are mutually arrived at by villagers.

Form Village-level Groundwater cooperatives

The main aim of the project is improved participation of communities through formation of village-level groundwater cooperatives, which would develop rules to regulate groundwater use, plan structures to augment supply and develop governance mechanisms for participatory water resource management.

IMPACT

The major impacts of Participatory Groundwater Management are:

1. Emergence of collective thinking regarding Groundwater as a common-pool resource.
2. Initiation on demand-side management of water; such as change in cropping pattern, adoption of water use efficiency technology and methods.
3. Common pooling of groundwater-based irrigation resources and ban on drilling new wells.
4. Implementation of watershed activities based on the identification of recharge zones.

REPLICATION AND SCALE UP POTENTIAL

Participatory Ground Water Management (PGWM) programmes, which focus upon 'aquifer-based, common pool resource' approach have been implemented since the 2000s in various regions having different types of aquifers and associated geohydrological characteristics.

Various NGOs such as Arghyam in Karnataka, People's Science Institute (PSI) in Himachal Pradesh, Advanced Centre for Water Resources Development and Management (ACWADAM) in Maharashtra, Watershed Support Services and Activities Network (WASSAN) in Andhra Pradesh, Arid Communities and Technologies (ACT) in Kachchh and Development Support Centre (DSC) in North Gujarat has led to creation of many replicable and scalable pilots such as cadre of geohydrologists, common pooling of borewells, aquifer-based watershed planning, crop water budgeting, and water security planning.

Replication and scale up Potential: Tribal and rural villages across India

LESSONS FOR REPLICATION

1. The focus of the program in the initial phases should be upon developing the understanding of community about groundwater as a common pool resource.
2. Capacity building and mentoring of BJs is intensive and time-consuming hence continued and secure funding is needed.
3. Formation of Village Ground Water Cooperatives has to be a participatory and community-initiated process in order to enable active functioning.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

DSC implemented Managing Aquifer Recharge and sustaining groundwater use through Village-level Intervention (MARVI) project in 2009 with an aim to develop a cadre of village-level para geohydrologists, referred to as 'bhujal jankars' or groundwater-informed volunteers.

Location and Context

DSC initiated the implementation of MARVI project in 6 villages falling in Meghraj Watershed located in Aravalli district of North Gujarat. The region has a semi-arid climate and an average rainfall of 600 mm. In the past, a number of water harvesting and recharge structures such as percolation tanks, check dams, farm ponds, etc. have been constructed in Meghraj watershed under the IWMP and MGNREGA programmes of the government.

The watershed is located in a hard rock aquifer area, which is known to have poor recharge capacity. The hard rocks have low porosity. Connectivity and movement of water occurs through fissures, faults and fractures. The aquifers store limited volumes of water, which when withdrawn by pumps is not easily replenishable.

Intervention

BJs are trained in their local settings to perform geo-hydrological evaluation of their area. During the course of their work, BJs continuously share this information with the village community in their local language thus developing community knowledge and awareness on the subject. BJs have the potential to act as the champions of groundwater future. They provide scientific basis for initiation of groundwater dialogue, which eventually leads to informed choices and decision-making regarding crop selection, regulations on groundwater use, recharge strategies, and other aspects of groundwater management.

At a Glance	
Intervention	Participatory Ground Water Management
Location	Aravalli, Sabarkantha, Mehsana districts of Gujarat
Implementation	Development Support Centre
Period	2009 - Ongoing

Initially started in 6 villages of Aravalli district, DSC internally scaled up the programme to 24 villages of Aravalli, Sabarkantha and Mehsana districts due to the merits of the programme in transferring elusive groundwater knowledge to community as well as organisation staff.

Currently, 400 dug wells are being regularly monitored by 20 such para geohydrologists nurtured by DSC. One of the most crucial impacts of the project has been the preparation of village-level water security plans (for details refer page 42-45 of this document) based on the data provided by bhujal jankars.

Impact

The MARVI project is evidence that villagers with no formal background in earth sciences or research experience can effectively collect information on water table depth, precipitation, check dam water levels and drinking water quality.

The major impacts of the project have been as follows:

1. Formation of 2 Village Groundwater cooperatives to collectively manage the groundwater resources over 115 acres of micro-watersheds.
2. Change in cropping decisions based on water availability.
3. Area under drip irrigation increased from 3% earlier to 30% post the project.

Most of the BJs trained are now proficient in developing different maps and graphs. Atleast 5-6 BJs have acquired proficiency in their field and are now providing knowledge-based support to programmes/ schemes in other villages. The BJs trained have formed a company, which will act as an interface between villagers and planners and provide consulting services. This will enable BJs to earn income and livelihood from their skills.

National Scale up

Western Sydney University, Australia which is leading implementation of MARVI project, signed an MOU with the Central Groundwater Development Board and the Jal Shakti Ministry for technical collaboration. Under the aegis of this MOU; DSC and ACT will be responsible for recruiting village youth and training them as 'Jal Doot' or para geohydrologist across the country. The ministry plans to replicate the best practices of Participatory Ground Water Management implemented under MARVI action research project to the rest of India under the Atal Bhujal Yojana.

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MANAGING WATER COMMONS THROUGH FISHING COOPERATIVES

RATIONALE - THE WHY

The total area under reservoirs, tanks (taalabs) and lakes in India is 7 million hectares. Of these, tanks and ponds cover an area of 2.9 million hectares. (Ministry of Jal Shakti, 2017). Tanks have traditionally been part of village landscape, and these multiple use structures have great significance in a village as a common source providing for sustenance as well as livelihood of rural communities. Outstanding engineering, geohydrological, managerial and social skills of our ancients led to creation of an extensive system of rainwater harvesting structures throughout the country, which were built and maintained by people for centuries.

Most of these tanks are today in a state of disrepair and decay. After British arrived in India, they systematically destroyed the tank culture of our nation through shift in ownership of tanks to state thus alienating the community from the resource, After independence too, the use of tank systems has seen a decline due to continued government ownership.

Taalabs or Tanks are a common property resource and need to be managed by community as a collective to restore them to their ancient glory. Common vested interest in the use of the resource can ensure its protection and sustainability. Along with provision of irrigation services, tanks have traditionally also been used for fishing in tribal-dominated belts and South India. Both irrigation and aquaculture have greatly declined due to poor maintenance, leasing to private contractors, and general neglect of these resources.

RELEVANCE FOR THE CENTRAL TRIBAL BELT

Four states of the central tribal belt; namely Madhya Pradesh, Bihar, Jharkhand and Orissa have a total of 39,740 tanks with an area of 1.5 million hectares (Ministry of Water Resources, 2001). As many as 75 districts in these states are tribal districts. The rejuvenation of these tanks and their use to augment livelihoods and health through fishing cooperatives thus presents tremendous potential.

FISHING COOPERATIVES - THE WHAT

The management of smaller tanks of less than 100 hectares has been handed over to Panchayats (0-10 hectares) and Nagar Panchayats (10-100 hectares). Their use for sustenance still continues, but due to improper maintenance, the multiple livelihood options offered are often curtailed and used sub-optimally.

The panchayats have the power to lease the taalabs under its jurisdiction to Fishing cooperatives. These cooperatives facilitate the overall fishing operations; from procurement of fish seeds, to equitable distribution of produce amongst community, to the eventual profit distribution. Participatory processes can ensure community-led governance, which is crucial for the success of the fishing enterprise. Along with additional income, fish also provide food and nutritional security to tribal communities.

IMPLEMENTATION PROCESS - THE HOW

This section shares the process to set up and operationalise community-based aquaculture in village taalabs and ponds through fishing cooperatives.

1. General Meeting to elicit interest
2. Assessing condition of village taalab/pond and undertaking necessary repairs
3. Formation of the Fishing cooperative
4. Formation of byelaws of the fishing cooperative
5. Leasing of village tank and initiating fishing
6. Harvesting of produce
7. Profit sharing

General meeting to elicit interest

A common village-level meeting is held by a facilitating organisation to initiate dialogue on management of common water resources in the village and to understand their current status and usage. The dialogue on undertaking fishing in the taalab is initiated to understand community's views and interests. If found desirable, the community decides upon initiation of a community fishery enterprise.

Assessing condition of Village taalab/pond

The condition of the taalab is assessed by a physical visit to the taalab site. Based on the observation and discussion with the village community, appropriate actions are taken to restore the taalab to its optimum state. A rough estimate of repairs and desilting is prepared, if these are needed. The community contributes labour required to desilt and repair the taalab. Efforts are made to raise the monetary support needed for repairs from Panchayat funds.

SAMPLE BYE-LAWS OF A FISHING COOPERATIVE

1. The harvest of fish will be done collectively. Individual members not to harvest/hunt fish. If seen indulging in such activity, fine of Rs.3000 will be levied on such members.
2. Each member household will get 2 kgs of fish after harvest.
3. Members are eligible to purchase fish from cooperatives at lower prices.
4. After purchase by members, the remaining fish will be sold at market rates.
5. Member households to guard the village taalab in rotation and if any unlawful hunting is noticed, it will be reported to the committee.
6. The taalab can used for bathing, domestic purpose and livestock. Washing of clothes will not be allowed in taalab waters. A fine of Rs.1000 will be levied if any member is found violating this rule.
7. The taalab can be used for surface flow irrigation given that the water level of the taalab is more than 7 meters.

Formation of Fishing cooperative

A Fishing cooperative is formed of the interested households by collecting a fixed membership fee per member household. The paperwork for registering the cooperative is facilitated by the intervening NGO. An executive committee is selected comprising 10-12 members, who are given the responsibility of operationalising and managing the fishing cooperative. Efforts are made to represent members of all castes and hamlets of the village. Women representation is also ensured on the committee. The selection of a President and Secretary are also undertaken in the same meeting.

Formation of byelaws of the fishing cooperative

The registered cooperative forms its byelaws which take into account membership fees, sharing mechanisms, roles and responsibilities of the committee, meeting frequency, profit distribution, etc. Sample bye laws are represented here:

Leasing the village taalab and initiating fishing

An application is submitted to gram panchayat to undertake fishing operations in the village by the committee of the fishing cooperative. After the lease is received, a general meeting is held to decide collectively, various aspects such as; the fish species to be introduced, quantity of fish to be introduced in the taalab, timing to introduce fish seeds, sourcing of fish seeds, breeding and growth duration, sourcing of fish feed, harvest time, etc.

Harvesting and profit sharing

The fish are usually harvested 4-6 months after their introduction depending upon the species type and rate of growth. Another general meeting is organised to decide upon collective harvest norms. A team of interested and specialised people is selected from the members to harvest the fish. A small portion of the harvest is provided as an incentive to these people. The sharing mechanism is decided to allow for equitable distribution of benefits. Each member household gets a minimum quantity of fish harvested for free. If some members want more quantity of fish, they have to buy the fish from the cooperative society.

The rates for member households are, however, lower than the market rates. The surplus fish are sold in the market. The record of rates at which fish is sold, quantity of fish sold along with date are maintained by the committee. Out of the total profit earned through the sale, a part is retained to buy fish seeds for the next season, while the remaining is distributed equally among all members.

Ensuring Sustainability

Regular desilting, while important for ensuring optimal storage and recharge doesn't allow for growth of aquatic plants, which are crucial for growth and thriving of fish. If the taalab is not used for irrigation, waiting for 4-5 years before desiltation may be the appropriate strategy. Sowing aquatic plant species in the tank bed every year before the rains when the water level of the tank is low, can be undertaken for proper growth of fish.

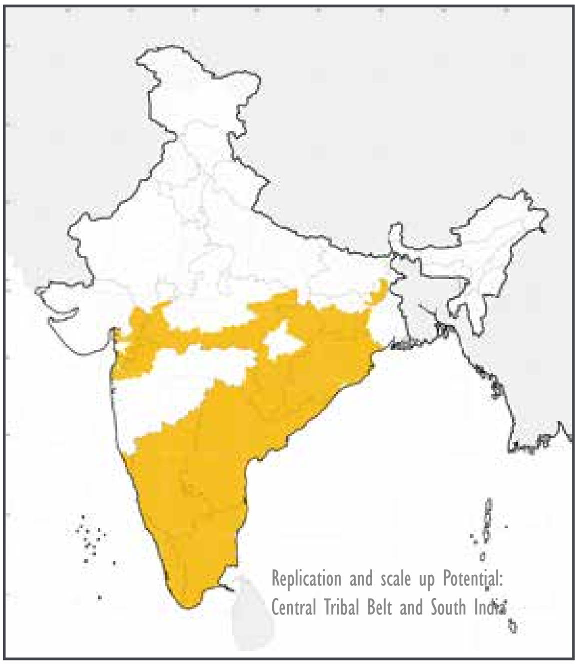
IMPACT

1. Ensured maintenance of the village taalab by the village community.
2. Optimal water storage in the village taalab, optimum recharge of groundwater and optimum use of the resource by the community.
3. Ensured nutritional security for atleast some months.
4. Enabling purchase of fish at lower rates than market.

REPLICATION AND SCALE UP POTENTIAL

Inland fisheries in small reservoirs, tanks and water harvesting structures; both traditional as wells as those created under MGNREGA, holds tremendous potential (Mishra, 2012). Freshwater aquaculture accounts for 55% of total fish production in India and the country is the second largest producer of inland fish in the world. (Food and Agriculture Organisation, 2018). This is when the Indian inland fisheries, is working on scant capacities. 2.36 million hectares of ponds and tanks have potential for fisheries development as they account for the prime resources for fresh aquaculture in the country,

The preferred regions for scale up and replication are the tribal belts of the country, chief among them, the central tribal belt, as it has plenty of tanks and south India.



Replication and scale up Potential: Central Tribal Belt and South India

LESSONS FOR REPLICATION

1. The effective functioning of a Fishing cooperative depends upon active community participation and strong leadership.
2. Training and capacity building of community on operational aspects such as selection of quality fish lings/seeds, appropriate fish feed, quantity and timing of introduction in pond, growth and breeding cycles, optimum harvest period, etc. need to be regularly conducted.
3. Conflict resolution procedures need to be clearly defined in bye laws of the cooperative so do the profit and benefit sharing rules.
4. Replication will be relatively easy in regions where fish forms part of the staple diet of the community members.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

The present case is based on the experience and learnings of Foundation for Ecological Security (FES),

Location and Context

The project was implemented in Mandla district, which lies in the South-east part of Madhya Pradesh. The district is a predominantly tribal district with 58% of the population falling under Scheduled Tribe. Economy of the district depends upon forest and agriculture-related activities. Fisheries is practiced as a traditional livelihood by the tribal population. There are 743 farmer-owned ponds, 17 village tanks and 50 reservoirs under fisheries and the water spread area under freshwater sources is 2543 hectares.

At a Glance	
Intervention	Community fishery enterprise through Fishing Cooperatives
Location	Mandla district, Madhya Pradesh
Implementation	Foundation for Ecological Security (FES)
Period	2012 - Ongoing
Unit Cost	Rs. 90,000/pond (removing 360cum silt) Rs.4,000/pond for operationalizing fishery

Intervention

FES initiated work on Water Commons in Mandla in 2012. The control and management of community on the common water resource was found to be rather weak. In most cases, the control of the taalabs rested with the Panchayats, but hardly any money was spent upon their maintenance.

This had led to multiple issues such as; heavy siltation, breaching of the taalab weirs, loose embankments and other structural damage. Small ponds and taalabs were used by community for domestic and livestock purposes while the bigger sized tanks were also additionally used for irrigation. Fishery was also a common activity, however, the activity was undertaken by either small groups or individuals. In many cases, the panchayats had leased the fishing rights to private contractors.

FES initiated dialogue on 'commoning' of water resources to improve the community stake in decision making, re-examine the tenurial arrangements of water and also to communize the use and benefit sharing from the resources. The organisation also worked with the village leaders, who wanted to retain control of the common taalab in some cases.

The community members were facilitated to register Fishing Cooperatives. As a result of the organisation's efforts to commonise water governance, 51 villages of the programme area have initiated community fishery, where the entire village community is involved and is entitled to a share of the fish catch and profit. Regular general meetings are held before release of fish seeds in the taalabs and before harvesting to collective decide various nuances and benefit sharing mechanisms. The average profit from fishing activity for community-based fisheries is Rs 5000/year and the average yield of fish can be around 300kg/ hectare is protected and managed well.

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REVIVAL OF A TRIBAL PRACTICE FOR WATER RESOURCE DEVELOPMENT

RATIONALE - THE WHY

There are over 705 ethnic groups, which are recognized as Scheduled tribes in India (International Work Group for Indigenous Affairs, 2020). These groups have their own unique Gods, beliefs, rituals, practices, and social systems. The Indian subcontinent is known for the rich cultural heritage and vibrancy, a distinction, which has been earned due to the rural and tribal folk arts, crafts and traditions.

The tribal lands of the country abound, not only in their many distinct art and craft forms, but also traditional practices and systems, which make them stand apart from the caste system. Tribal societies have an inscrutable bond with mother nature, which enables a deeper understanding of surrounding environs and an inherent urge to protect and conserve natural resources. Their cultural ethos and practices resonate this bond, as these practices promote collective action to promote sustainable usage, protection and conservation of resources.

One such tribe is the Bhil tribe. According to Census 2011, Bhil is the most populous tribe in India, constituting 37.7% of the total tribal population. The bhil tribal community lives in the mountainous regions of Western and Central India in Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh and Maharashtra. Bhils, also known as the 'brave bow men of India', have a rich culture and various practices aimed at protecting their environment. The tightly knit tribal society also advocates community action for solving issues and problems facing them.

HALMA - THE WHAT

The basic tenet of Halma is collective action to solve problems. When any member of the Bhil community finds that he/she is unable to solve an issue or problem despite his/her best efforts, he/she calls upon the village community for help. The village community collectively surmounts the challenge which the individual member was unable to (Sahasrabuddhe, 2020). Halma calls for collective action to achieve a common goal.

One of the most pressing issues faced by the tribal communities residing in central India is water scarcity both for drinking and livelihoods. As most farming is rainfed, crop failure is a common phenomenon.

Construction of water harvesting structures, watershed works and plantations are the most obvious solutions, but the gap lies in the funds needed for implementation. Most of these structures are implemented under MGNREGA, the process of planning is arduous and the gap between planning and implementation is huge. Halma is, thus, a perfect solution in this situation, as it removes the funding constraint and calls for collective action for water resource development.

IMPLEMENTATION PROCESS - THE HOW

There is a well-laid down process on how to call a Halma, in whose presence can it be called, etc. Halma was devised by the bhil tribal community in a way, so as not to cause embarrassment to the person seeking help. The Halma is called in front of a deity in a village-level meeting. There upon 'notras' are sent out to individual households of a village detailing the venue, date and time of the Halma, along with the details of the help sought.

While the scale of Halmas called upon by tribal community are mostly village-level, these can be scaled up to mass-level movements by a facilitating NGO with the wherewithal to mobilise tribal communities from many villages. The process for implementing huge watershed works through Halmas is described below:

1. Preparation of a cadre of village volunteers and village engineers
2. Village-level meetings and Invite
3. Arranging logistics
4. Halma Management
5. Performing the Halma

Preparation of a cadre of Village volunteers

The facilitating organisation develops a fleet of village volunteers, to mobilise the tribal community members at a large scale. Rapport building and engagement with community is key, so local volunteers are preferred.

A cadre of village-level engineers referred herewith as Gram engineers is also developed. This is done, so as to make the community familiar with the technical aspects of water structures. At least 2 volunteers from every village are trained as 'Gram Engineers' through the delivery of an objective-based course module of 14-days. This course has been designed in collaboration with technical experts from prominent institutes such as Shri Govindram Seksaria Institute of Technology and Science (SGSITS), Indore. The Gram engineers serve the crucial role of making the community self-dependent in terms of structure design and planning.

Village-level Meetings and Invite

Several village-level meetings may be required in one village to elicit interest and build trust. Post the village meetings, 'Notras', or invitations; carrying details of the event, along with the date, time and venue of Halma are delivered to individual households and interested members from the households are requested to join the mobilization drive.

Arranging logistics:

As tribal community members from many villages congregate at a single place to undertake the Halma, the community attending from distant villages is provided a transport facility. Stay arrangements are made by villages in the vicinity of Halma site. They act as hosts to distant community members. The tools needed to undertake the manual labour to perform Halma are usually brought by attending tribal community, however, the organisation arranges for spare tools. Food arrangements are made for the attending community members and visitors.

Halma Management

The Halma day sees congregation of tribal community in large numbers. Detailed planning and scheduling of activities is done by the intervening NGO to allow for smooth operations of the event. The tribal community led in groups headed by village-level volunteers arrive at the pre-decided venue where the purpose of the Halma and its significance in community-led water management is reiterated. This is followed by a procession to Halma site.

Performing the Halma

The construction of physical works such as excavation of contour trenches on denuded hillocks, construction of water harvesting structures, plantations, desilting of existing structures, etc. is undertaken by collective contribution of physical labour. The activities to be undertaken are planned in advance along with structure nuances, dimensions, land slope, depth, etc. On the Halma day, excavation activities on the site, are supervised by Gram engineers and watershed experts.

IMPACT

1. Increase in water harvesting and recharge potential
2. Increase in forest cover
3. Reduction in runoff and soil erosion
4. Ensured irrigation and drinking water security
5. Shift from rainfed to irrigated landholdings
6. Collectivisation leads to the development of huge social capital

REPLICATION AND SCALE-UP POTENTIAL

Bhils are the largest tribal group in India (Census 2011) and are also the most widely dispersed tribal group (Williams, 2020) .This presents a good scope of replication of the intervention. The bhil tribal community live in the mountainous regions of Western and Central India with dispersed presence in East India too.

The districts with a good presence of Bhil tribal community are:

- Dungarpur, Banswara, Pratapgarh in southern Rajasthan;
- Ratlam, Jhabua, Alirajpur, Dhar, Khargone of Madhya Pradesh,
- Panchmahal Godhra, Dahod, Narmada, Tapi, Dang, Navsari, and Tapi of Eastern Gujarat
- Nashik and Dhule in northern Maharashtra

The potential to scale-up the Halma is huge; as can be witnessed from the experience of Shivganga Samagra Vikas Parishad (shared in the next section). A single organisation with its presence in merely two districts mobilized more than 20,000 tribal community members in a single event.

Grassroots movements of people should not only be seen as reactive acts of resistance against oppression but as tools for socio-economic development. These movements have the power to set-up new institutions, construct massive structures and device new and novel techniques to be freed from poverty.

LESSONS FOR REPLICATION

1. Rapport building with the community is a must. It is recommended that in the initial phase, replication be undertaken in tribal districts with an established NGO, which has already built its trust with the tribal community.
2. Building a cadre of village-level engineers is a must to ensure long-term sustainability, They possess the knowledge and skills to design the water harvesting structures required, and as such can play the role of planners.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

The present case is based on the experiences of Shivganga Samagra Vikas Parishad, a Jhabua based NGO.

Location and Context

Jhabua, a tribal-dominated district with more than 85% population belonging to ST, is an agrarian district. Water security is, thus, a crucial element for its agriculture-based livelihood economy. Deforestation in the last 70 years, has converted this district, which had thick forest cover in pre-British India, to a denuded landscape. The average rainfall of Jhabua district is 900 mm, which is a decent amount, but however, the district has lost its ability to harness the rainwater. It is due to this reason, that the district has one of the highest rates of outmigration in the country.

Intervention

In 2008, Shivganga, which consisted of local leaders, called for youths in 'Vananchal Youth Empowerment Camps' to recall and recognise the pains of their villages. The persistent water crisis emerged as the most stressing one, and hence the youth started a movement for water conservation.

Various rounds of discussions were held with the community, regarding the probable course of action to solve the water crisis. During one such discussion, 'Halma' emerged as a possible way to collectivise the community for water conservation efforts.

At a Glance	
Intervention	Halma
Location	Jhabua and Alirajpur districts in Madhya Pradesh
Implementation	Shivganga Samagra Vikas Parishad
Period	2009 - Ongoing
Unit Cost	Rs. 1,00,00,000/annual halma (Rs.30,00,000 - mobilisation cost)

The Bhil tribal community members suggested that, the organisation call for *Lord Shiva's* Halma to satiate the thirst of the earth, based on Bhagirath's story of bringing Ganga river on the Earth. This instantly connected with the community. Shivganga was officially named after this mythological tale.

Since 2009, the organisation has been calling for an annual Halma every year. Tribal community participates in huge numbers in the annual congregations. Men and Women throng in large numbers, carrying their 'geti' (pickaxe), 'phawda' (spade) and 'tagari' (pan). The annual Halma is organised on Hathipawa hills; one of the most important hills of Jhabua, where community members gather in huge numbers and collectively dig contour trenches on the hills and dig pits for plantation.

In the last ten years, the annual Halmas have grown into mass movements with over 20,000 tribal community members participating from over 500 villages in the latest Halma of 2020. It also saw attendance of 500+ visitors from academia and the corporate world. A total of 40,000 contour trenches were dug by the efforts of the participants, which have created a capacity to conserve 360 crore litre water in the next five years.

HALMA
IMPACT NUMBERS

Water

Talaab: **65**

Water storage capacity:
450 crore litre

Contour Trenhces:
1,41,000

Other Water harvesting structures:
4,500

Forest

Mata nu Van: **120**

Plantation:
1,10,000
Saplings

People

Gram Engineers trained
12,000

Women trained
900

The annual Halmas organised by Shivganga, led the tribal community to revive and revisit their own tradition. These events gave rise to small-scale inter-village Halmas, called by the tribal community members to create water harvesting potential in their villages. Halmas are called by community members from March through June to enhance water harvesting potential of the area by construction of earthen check dams, gully plugs and taalabs.

During the monsoons, the tribal community members call for yet another Halma drive, to plant saplings on community sacred groves. These sacred groves known as, 'Matavan', (community-protected forest areas), are another tradition of the bhil tribal community, which calls for protection of the forest ecosystem. Each Bhil village has atleast one such Matavan with an average size of 5 acres. During the monsoon Halmas, saplings are planted at Matavans in huge plantation drives. Tribal villagers take the responsibility to nurture every planted tree. If a sapling planted dies, the villagers replace it, increasing the survival rate manifold.

120 such Matavans have been revived by the tribal community-managed Halmas.

Over the last 11 years of work, Shivganga has successfully facilitated the construction of 65 water harvesting structures; including 10 earthen check dams and 55 water reservoirs (taalabs), 1,41,000 contour trenches, plantation of 1,10,000 saplings and skill development of over 12,000 empowered youth. The organisation has been successful in extending its reach to 1320 villages in Jhabua and Alirajpur districts.

The rise of community-led Halmas, was the ultimate aim of the organisation and it evolved organically as the community saw the power of its own tradition to solve the water crisis. The reason that Shivganga was successful in its efforts is the adoption of **'Involve and let Evolve'** strategy. Thus everything, from recognizing the problem, to designing the solution to the eventual execution, is done by the community themselves; the organization merely acts as a facilitator.

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REHABILITATION OF TRADITIONAL TANKS

RATIONALE - THE WHY

In ancient and medieval India, the water management was undertaken by the community themselves, the kingdoms were responsible only for providing monetary support (Centre for Science and Environment, 2001).Grand water harvesting structures were built across the country funded by different kingdoms. 8000 Chandela and Bundela Tanks were built between 800 to 1200 AD in the Bundelkhand region (IGG & BIWAL, Baseline Report, 2020).

Similarly, Keres tanks in Karnataka, Eri tanks in Tamil Nadu, and Chevuru tanks in Andhra Pradesh and Orissa were erected during ancient and medieval India Bihar had the famous Ahar Pynes to store water and Gond Kings funded huge Katas; three-sided reservoirs, in Gondwana (Agarwal, 1997) comprising Madhya Pradesh, Maharashtra, Orissa and Andhra Pradesh. According to official estimates, there were 15.13 lakh tanks in India in 1986-87 (Centre for Science and Environment, 2001).

However, the arrival of British signalled a death knell for such tanks and other traditional structures due to the shift from produce-based rent to fixed rent system. Post Independence too, tanks took a back seat as most of the public investment was used for development of major and medium canal irrigation projects.

During the 1960s, the contribution of three major sources of irrigation; the canal, tanks and wells was 36%, 38% and 24% (Asian Development Bank, 2006). By 2013-14, the scenario had greatly shifted and skewed towards groundwater resources. The contribution of the major sources stood thus; Canals 24%, Tanks 3% and Wells 62% (MOSPI, 2017).

Some reasons for the decline in the tank-irrigated areas are; the siltation in feeder channels, encroachments in tank bed, interruptions in catchment, lack of maintenance of tanks and development of well irrigation in the command area of the tanks. (Gomathinayagam, Sakthivadivel, Sundarsen, & Sophia, 2005). However, the key reason behind the derelict condition of traditional tanks is the disappearance of village-level tank management institutions (Asian Development Bank,2006).

RELEVANCE FOR THE CENTRAL TRIBAL BELT

In the central tribal belt, the Gond Kingdom had a practice of encouraging the construction of water harvesting structures. The Gondwana land abounded in Katas; three sided reservoirs, and their intricate system of channels (Agarwal, 1997). Similar such structures called the Mundas and Bandharas were also built in the region to harvest rainwater. Most of these water harvesting structures lie in a state of disrepair today. The rehabilitation of these tanks has a lot of potential as they are multi-use assets and can be used to ensure livelihood security in the tribal belt.

TANK REHABILITATION - THE WHAT

Tank rehabilitation majorly involves desiltation of the tank bed and feeder channels to allow for optimization of storage capacity and recharge of groundwater through infiltration. It also includes repair of waste weirs, feeder channels and embankments, removal of accumulated waste, and removal of encroachments in tank beds. But the most important component in rehabilitation of tanks is not the physical works, it is the establishment of strong community-led institutions, which will eventually manage and maintain the restored infrastructure.

IMPLEMENTATION PROCESS - THE HOW

This section shares the process to rehabilitate traditional tank systems.

1. Tank Identification and selection
2. Participatory Planning process
3. Removal and transportation of silt
4. Capacity building of Tank Rehabilitation Committee (TMC)
5. Handover of tank to TMC

Tank Identification and Selection

The most important considerations for the selection of tanks for revival are; a) the community around the tank be interested in repair of the structure and b) the community be willing to take up the tank maintenance responsibilities post rehabilitation.

It is recommended that in the initial phase, single-village structures of manageable size, and those under the jurisdiction of Gram Panchayat be selected. Priority should be given to multipurpose tanks and also such structures which are relatively free of encroachments.

Source: Process Documentation: for BIWAL: Atal Bihari Institute of Good Governance and Policy Analysis (2020).

The tank selection is finalized and formalized in the form of a Memorandum of Agreement signed by the Sarpanch and Secretary of the panchayat. In the same meeting, a Tank Management committee (TMC) is constituted to enable participatory planning of rehabilitation works.

Participatory Planning process

After the tank selection, detailed problem analysis is conducted to identify problems with the tank. Based on the findings, an action plan is prepared which includes list of interventions to be carried out.

Removal and transportation of silt

The silt is removed with help of excavators selected in consultation with the TMC. TMCs also play an important role in silt transportation to farmer fields. Decisions regarding hiring tractors for silt transportation, deciding upon timings and shifts of silt removal, development of norms to ensure equity in silt distribution, etc. are undertaken by the TMCs.

Capacity building of TMCs

Trainings are provided to community members and TMCs on tank maintenance, water distribution, water-use planning, well-water monitoring, maintaining records, book-keeping and conducting meetings.

Handover of tank to TMCs

Post the rehabilitation and capacity building of the TMC, the tanks are handed over to the community. The village community members form a cooperative society for ease in undertaking livelihood operations such as fishery or irrigation. This is done as only a cooperative can apply for lease to panchayat incase a collective fishing enterprise is to be initiated. Registration as a cooperative is also required by various government departments, such as; the electricity department, if commercial connection is sought for electricity to install a lift irrigation pump house.

The TMC organises a general body meeting of all member households to decide upon the livelihood use of the tank. Both Fishing and irrigation operations need to undertaken in a collective manner to ensure sustainability of the structure. The TMC acts as the overarching body to lead the collective decision making and to manage operations.

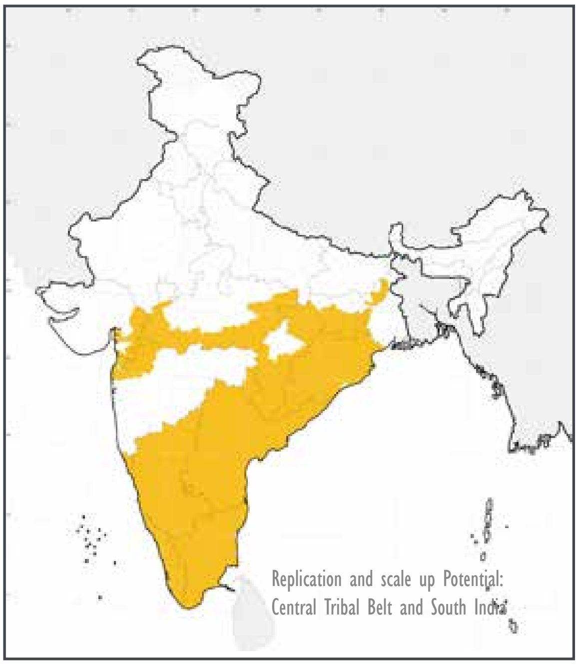
The functioning of irrigation and fishing cooperatives has been detailed in separate cases of this document. Please refer page 32-37 and 50-53 for more details.

IMPACT

1. Increase in storage capacity and groundwater recharge.
2. Increase in area under flow irrigation coverage and increase in well-based irrigation in catchment areas.
3. Increased cropping intensity in the tank command.
4. Additional income from fishery enterprise.
5. Enhanced nutritional security due to agriculture diversification and fishery activity.

REPLICATION AND SCALE UP POTENTIAL

Given the large number of tanks spread all across the country, revival of these structures could unleash a stupendous water harvesting potential and reduce the pressure upon groundwater resources. The most important consideration for taking up revival of tanks is however, not the revival of the physical structure of the tank but restoring of tank management and control in the hands of local community members.



Replication and scale up Potential: Central Tribal Belt and South India

LESSONS FOR REPLICATION

1. Tank rehabilitation programmes have been previously undertaken by state governments in South India on a large scale. However, most of these programs focus upon physical works rather than institutional strengthening. This has led the tanks to fall into a repetitive loop of rehabilitation- poor maintenance- deterioration- rehabilitation. The most crucial factor towards success of tank rehabilitation is, thus, the community ownership of the tanks.
2. Capacity building of the TMC members on various managerial as well as operational aspects of tank management is a must.
3. Alternate livelihoods such as fishing require capacity building on technical aspects such as; selection of appropriate quality of fish seed, fish feed, growth cycle, optimum harvest time and other nuances.
4. A strong leadership at the village level is a must for the success of tank rehabilitation.
5. The bye-laws of the fishing and/or irrigation cooperatives must include water distribution, benefit sharing, and conflict resolution norms.

GRASSROOTS IMPLEMENTATION: LESSONS FROM THE FIELD

This case is based upon the learnings from the implementation of BIWAL (Bundelkhand Initiative for Water Agriculture and Livelihood) project by various implementing NGOs. The initiative was launched in 2018 to revive traditional Chandela and Bundela tanks in the Bundelkhand region.

Location and Context

The Bundelkhand region, comprising of thirteen contiguous districts; seven located in Southern Uttar Pradesh and six in Northern Madhya Pradesh, has a recorded history of droughts and severe water scarcity. The region is bereft of any river systems and adverse geological conditions lead to suboptimal recharge. Conversant of the geohydrological context, the ancient kingdoms understood that water security could only be ensured, if rainfall was efficiently harvested. Chandela and Bundela kings financed huge tanks to harvest rainwater, which over the years, have fallen into disrepair due to shift of ownership from community to government. This has led to the over dependence upon groundwater resources and severe water scarcity in drought years.

At a Glance	
Intervention	Rehabilitation of Traditional Tanks
Location	Bundelkhand region, Uttar Pradesh and Madhya Pradesh
Implementation	SRIJAN, CARD, Haritika, Bundelkhand Sewa Sansthan, Yuva Koushal Vikash Mandal, Arunodaya, Akhil Bhartiya Samaj Sewa Sansthan and Jal Jivika
Period	2018 - Ongoing
Unit Cost	Rs. 7,00,000/Tank | Rs.2,50,000/Tank Community Contribution

BIWAL was launched in 2018 to revive Bundelkhand to its ancient glory, by reviving the traditional water bodies through community engagement.

SRIJAN and other CSO partners namely the Centre for Advance Research and Development (CARD), Haritika, Bundelkhand Sewa Sansthan, Yuva Koushal Vikash Mandal, Arunodaya, Akhil Bhartiya Samaj Sewa Sansthan and Jal Jivika initiated rehabilitation works with grant support from Hindustan Unilever Foundation (HUF) and convergence support from governments of Uttar Pradesh and Madhya Pradesh.

In the first phase, 54 tanks have been desilted, resulting in an excavation of 4.24 lakh cubic meter of silt. This has led to creation of 42.49 crore litres water storage potential. Of the 54 tanks desilted, 28 tanks were desilted in Madhya Pradesh and 26 in Uttar Pradesh.

All the tanks rejuvenated were multipurpose tanks. The major purposes served by the tanks(28 of MP) are listed below:

- Water for Livestock (28 tanks)
- Groundwater recharge (28 tanks)
- Fishery (24 tanks)
- Aquaculture – Singhara or Makhana cultivation (2 tanks)
- Lift Irrigation using private pumpsets (10 tanks – rabi, 24 tanks – summer)
- Drinking and domestic use (4 tanks)
- Flow irrigation through canal (4 tanks)

The total cost of reviving 54 tanks was Rs. 3.43 crores, out of which Rs.1.08 crore was spent upon excavation. A notable aspect of the programme is that the local community mobilised Rs.2.35 crore which is 68.5% of the total works cost.

This cost was incurred for transportation of silt from tank site to beneficiary fields and to apply silt to the fields. 2841 farmers applied to their fields covering an area of 1352.27 hectares.

Another important cost component was mobilisation and capacity building of the community. The project was implemented through participatory development processes by keeping the community at the forefront. Tank management committees were formulated for each revived tank. This was done at the beginning of the programme itself, so that the community could be involved in all matters of planning and implementation.

Initial Impacts

As the works got recently completed, the timescale for calculation of impact is quite small. Data of one year post completion of works reveals the following impacts, based on evaluation of the 28 tanks revived in Madhya Pradesh.

1. Increase in net storage capacity of the 28 tanks revived in MP was 230.2 Thousand Cubic Meters (TCM) which is 7.8% of original storage capacity.
2. While it is too early to accurately estimate the groundwater recharge; initial estimates show a groundwater recharge of 621 TCM or 19.6% of the present storage capacity of water bodies.
3. Flow Irrigation increased from 380 hectares to 462 hectares (21.6%) in 4 tanks, lift irrigation from 392 to 443 hectares (13%) and well irrigation from 2322 to 2698 hectares (16.2%) in 22 tanks commands.
4. A total of 3923 farmers were directly benefitted due to provision of irrigation facility.
5. Additional food production of 29,247.79 tonnes due to improved agricultural practices promoted by SRIJAN, and as a result of silt application.

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CONCLUSION

This document presented a few successful interventions undertaken by CSOs and NGOs to ensure drinking water security as wells as water for livelihoods to the inhabitants of the Central tribal belt. A commonality among all the best practices is the crucial role of community-led water resource management; which is the key to the success and sustainability of all the interventions. Reinstating of water control back to the communities will enable the country to overcome the looming water crisis. The need of the hour is to reduce the excessive dependence on groundwater sources. This can easily be achieved with a combination of rainwater harvesting techniques and revival of the traditional water harvesting structures spread over the breadth of our nation. To ensure a water secure future, we need to learn from our past. Ancient Indian civilization was one of the most prosperous in the world, and one major reason for the prosperity was food security; which was a direct result of efficient water resource development and management. Arthur Cotton, known for reviving the Grand Anicut; the oldest checkdam of India, built during the Chola dynasty in the second century, had this to say about our ancient water harvesting wisdom, 'it was from them (Indians), we learnt how to secure a foundation in loose sand of unmeasured depth. The Madras river irrigations executed by our engineers have been from the first the greatest financial success of any engineering works in the world, solely because we learnt from them.'

Two best practices detailed in the document share the merits of successful restoration of traditional tanks and existing water harvesting structures. One of them ensured irrigation to rainfed landholdings and another complemented livelihoods by initiating community fisheries in the common taalab/tank. Two case-lets share the experience of undertaking water harvesting and land treatment works in a saturated approach by covering entire blocks and districts. The change in the lives of communities is remarkable in both cases, apparent from the quadrupled incomes of communities. The case on Doha shares the experiences of stream rejuvenation through digging pits in the stream bed, which brings crucial water to rainfed landholdings in undulating tribal terrains. Another caselet shares the experiences of developing village-level water security plans to rationally estimate the extent of water deficit due to demand-supply imbalance and ways to correct the same by regulation of groundwater use, pooling of groundwater-based irrigation systems and water harvesting. The case on Participatory Irrigation Management shares the experiences of farmer-managed canal irrigation systems, which not only increased efficiency of the canals from 30% to greater than 90%, but also resulted in equitable distribution of water to all reaches of the canal. The case on Spring-based water supply systems shares the potential of tapping springs to provide drinking water security to tribal community living in undulating terrains. Finally, the experience of reviving a traditional practice is shared as it led to a social movement for ensuring water security.

FURTHER READINGS

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AGA KHAN RURAL SUPPORT PROGRAMME (INDIA)
A PROGRAMME OF THE AGA KHAN DEVELOPMENT NETWORK

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