NAHEP
EVENT - 50

WESTERN SYDNEY UNIVERSITY

IDP-NAHEP and College of Technology, GBPUAT, Pantnagar in association with WSU, Australia

presents

International Webinar on the occasion of WORLD ENVIRONMENT DAY

"Managing the India's Invisible Resource- The Role of Participatory Groundwater Monitoring and Management at the Village Level"

Speaker:
Prof. Basant Maheshwari
Faculty of Water, Environment and Sustainability
Western Sydney University, Australia

Inaugral Address | **Introductory Remarks** | **Introductory Remarks**

Dr. Tej Partap
Vice Chancellor, GBPUA&T

Dr. S. K. Kashyap
Dean, College of Agriculture

Dr. Alaknanda Ashok
Dean, College of Technology

Date: 5 June, 2020
Time: 11.00 AM onwards (IST)
Venue: Zoom Cloud Meeting

Note:
Open for all faculty members as well as students
For Registration the link is as: https://forms.gle/PVRnFnnCgK11uoub7
The meeting IDs will be mailed to registered participants

Contact Us:

Dr. S. K. Guru
Nodal Officer (Academic)
+91-9411195441
skguru123@yahoo.com
IDP-NAHEP, Pantnagar

Prof. Jyothi Prasad
Department of Civil Engg.
+91-9410119571
ProfJyothiPrasad@gmail.com
College of Technology

Prof. H. J. Shiva Prasad
Department of Civil Engg.
+91-8449859593
h.j.s.prasad@gmail.com
College of Technology

ग्रामीणों को भूजल संरक्षण के लिए जागरूक करें

पंतनगर कृषि एवं प्रौद्योगिकी विवि में हुआ अंतरराष्ट्रीय वेबिनार

संवाद न्यूज एजेंसी

पंतनगर। राष्ट्रीय कृषि उच्च शिक्षा परियोजना (नाहेप) के सहयोग एवं विवि कुलपति की अध्यक्षता में शुक्रवार को पंतनगर कृषि एवं प्रौद्योगिकी विश्वविद्यालय के प्रौद्योगिकी महाविद्यालय में विश्व पर्यावरण दिवस पर अंतरराष्ट्रीय वेबिनार हुआ। मुख्य वक्ता वेस्टर्न सिडनी यूनिवर्सिटी आस्ट्रेलिया के प्रो. बसंत माहेश्वरी ने भूजल संरक्षण एवं संवर्धन पर जोर देते हुए इसे ग्रामीण स्तर पर विस्तारित किए जाने एवं ग्रामीणों को इसके लिए प्रशिक्षित करते हुए जागरूक बनाने पर जोर दिया।

कुलपति डॉ. तेज प्रताप ने पर्यावरण एवं मनुष्य जीवन के संबंधों सहित पर्यावरण संरक्षण पर जोर दिया। उन्होंने जल संरक्षण, वन संरक्षण, प्रदूषण में कमी आदि पर जोर देते हुए कहा कि पर्यावरण की शुद्धता हमारे लिए बहुत महत्वपूर्ण है। अधिष्ठाता प्रौद्योगिकी महाविद्यालय डॉ. अलकनंदा अशोक ने महाविद्यालय स्तर पर पर्यावरण संरक्षण एवं जल संरक्षण में किए जा रहे कार्यों से अवगत कराते हुए इसके महत्व एवं मानव जीवन पर इसके प्रभावों का उल्लेख किया। कार्यक्रम का संचालन वेबिनार समन्वयक डॉ. ज्योति प्रसाद एवं डॉ. शिव प्रसाद ने वेब मॉडरेशन किया। नाहेप के नोडल अधिकारी डॉ. एसके गुरु के साथ ही वेबिनार में विशेषज्ञों सहित करीब 300 प्रतिभागियों ने ऑनलाइन प्रतिभाग किया।

वेबीनार में विचार रखते कुलपति डॉ. तेजप्रताप सिंह।

INTERNATIONAL WEBINAR On The Occasion Of World Environment Day

Managing the India's Invisible Resource - The Role of Participatory Groundwater Monitoring and Management at the Village Level

Prof. Basant Maheshwari

Western Sydney University, Australia

b.Maheshwari@westernsydney.edu.au

Groundwater & Environment

Groundwater		Surface Water
Groundwater		Rivers, wetlands, rivers and lakes
Groundwater		Trees and vegetation

Groundwater is an essential part of the Environment.

Surface water vs. Groundwater

- The underground flow can not be controlled;
- Pumping is hard to monitor and control in a country like India
- The problem is the excessive use of groundwater
- Decentralised resource use and ineffective management
- So far, a relatively low level of investment by the government

Groundwater Use

- India - 60% of irrigated agriculture and 80% of drinking water rural areas; >50% urban drinking water; >50% of Industry water needs
- Denmark – nearly all of water supply; Mexico City, Kabul and many other cities largely depend on groundwater
- Green revolution of 1970s – Food security but affected water security
- Pumps and drilling technologies

Groundwater Challenge

- We often ignore it or take it for granted.
- We realise the problem when the well runs dry;
- No water coming out from the handpump;
- Polluted due to human activity
- Quality is not suitable due to natural processes (Fluoride, Arsenic, Uranium etc) or aggravate the situation due to its over-pumping
- It is a replenishable resource and we need to balance use and

Groundwater Challenge

- Invisible resource
- When something is invisible – it is hard to communicate
- This is one of the challenges with groundwater science and management.

Groundwater Challenge

Needs:

- Drinking
- Industries
- Environment
- Agriculture

https://neurohealthchiro.com.au/your-balance-age/

Groundwater Challenge

It is a replenishable resource and we need to balance groundwater use and recharge.

Groundwater Recharge

Groundwater pumping

MARVI

Managing Aquifer Recharge and Sustaining Groundwater Use through Village-level Intervention

Partnership

Project team during the visit to the Meghraj Watershed.

Nine organisations:

- Western Sydney University
- Development Support Centre
- Arid Communities and Technologies
- MP University of Agriculture and Technology
- Vidhya Bhawan Krishi Vigyan Kendra
- CSIRO Land & Water
- International Water Management Institute
- Mekong Region Futures Institute
- Carnegie Melon University, South Australia Campus

>30 Researchers + 35 Farmer Researchers (BJs)

Running for the last eight years

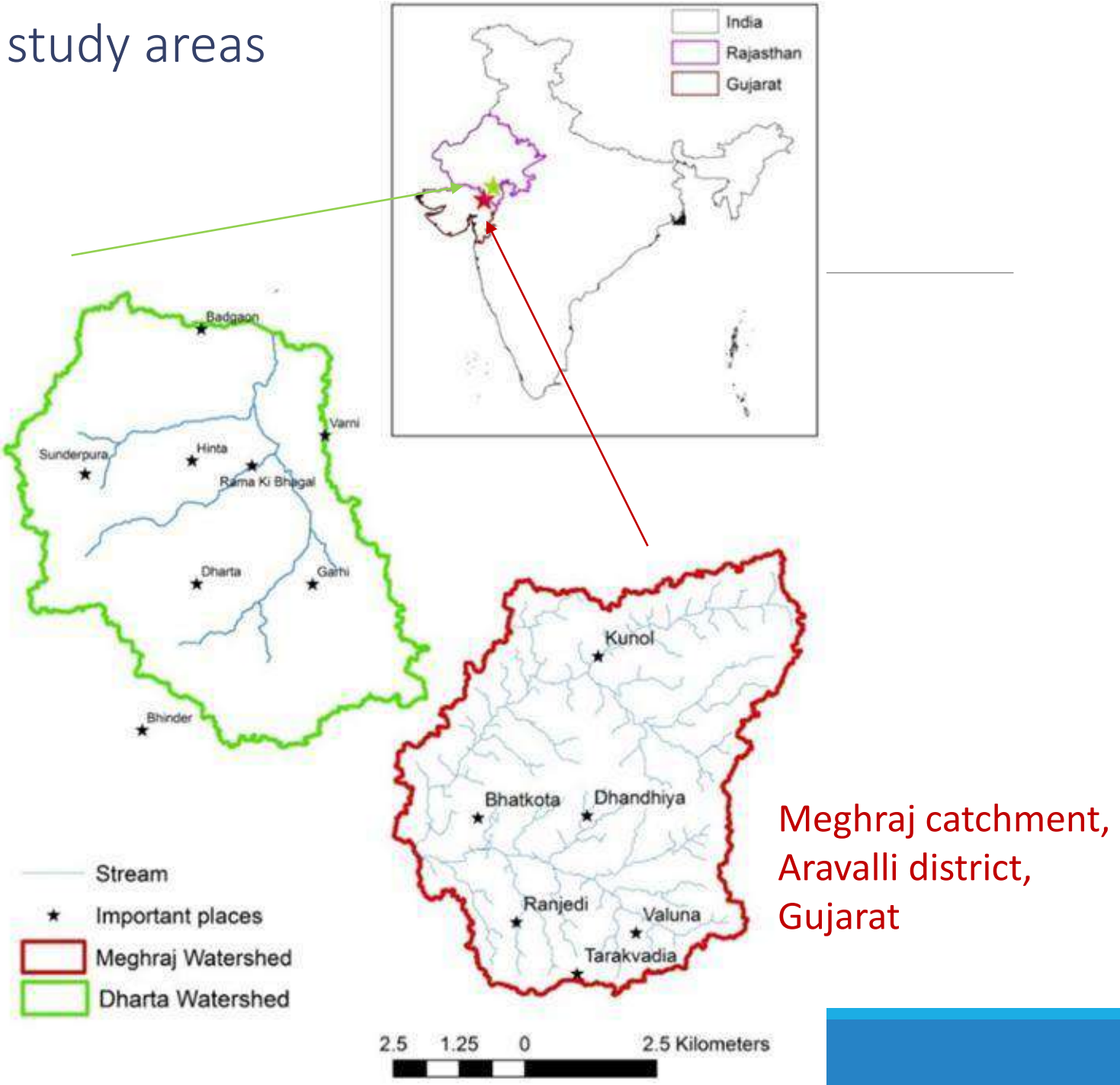
MARVI project – Key Activities

1. Participatory data collection;
2. Sharing information and building understanding;
3. Engaging with policy makers, government agencies, GW users and other stakeholders.

… see Maheshwari *et al* (2014) MDPI J Water

Location of study areas

Dharta catchme
Udaipur distri
Rajasth

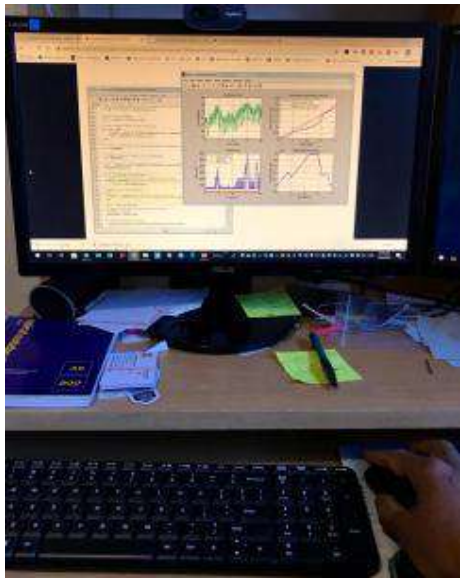


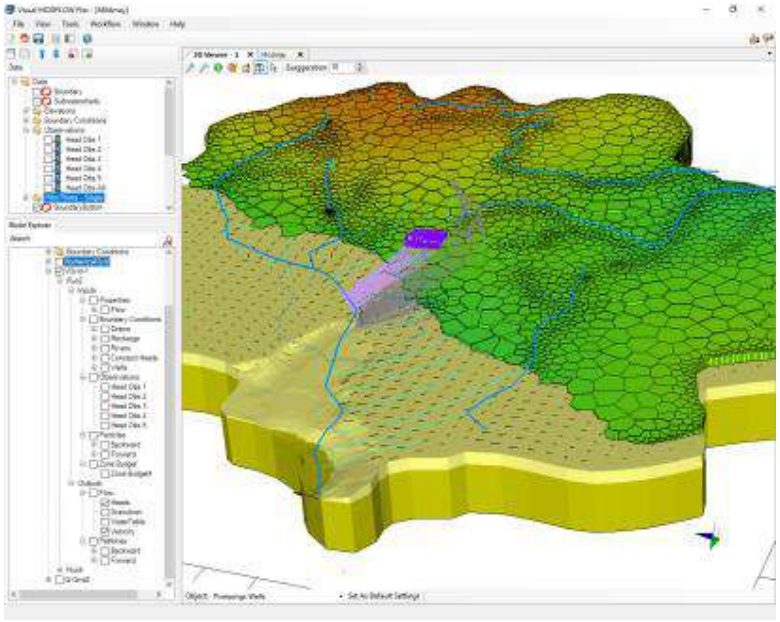
Meghraj catchment,
Aravalli district,
Gujarat

MARVI project had two options

Option 1:

Data collection, modelling and development of scenarios and recommendations





https://www.waterloohydrogeologic.com/wp-content/uploads/2019/05/Flex_60_withGUIs.png

MARVI project had two options (contd.)

Option 2

- Bring people together to own the problem;
- People monitor groundwater and learn together
- The develop their own science and strategies and ways to act together

MARVI project had two options (contd.)

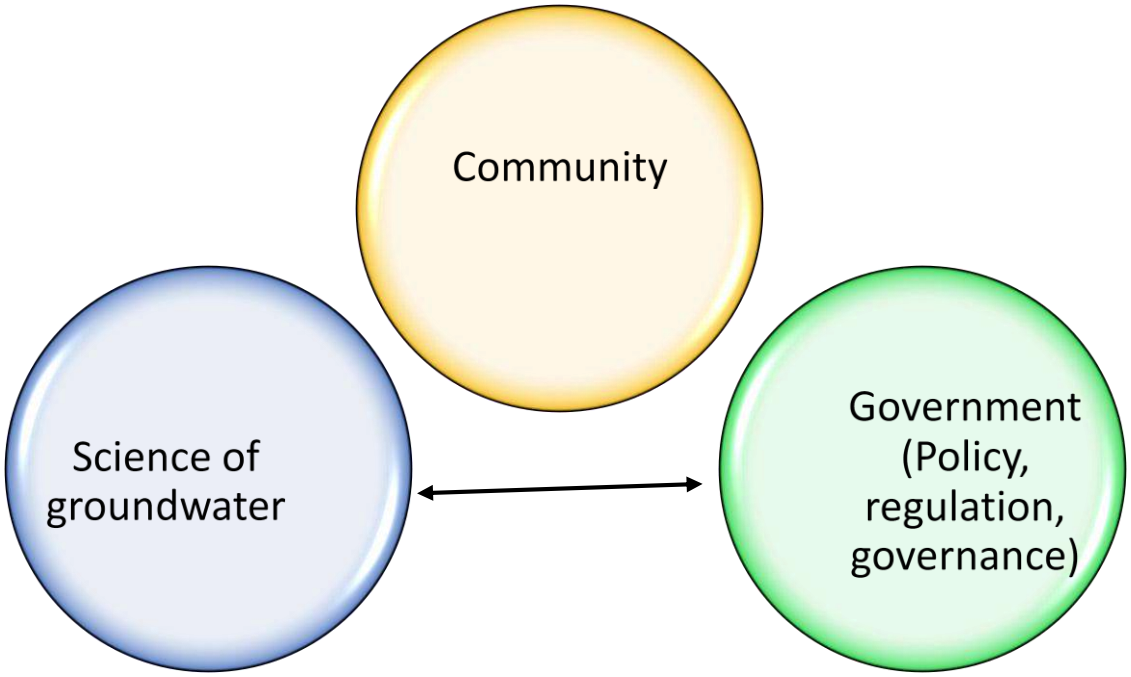
Option 1 was easier but the project would have ended a long time ago.

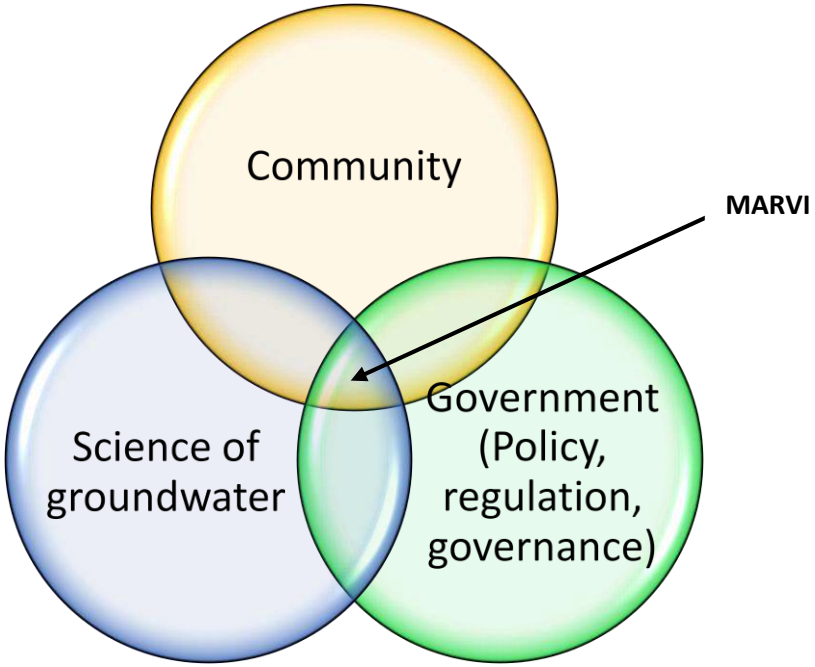
Option 2 was time consuming, requiring patience but has really led to actions by the community. Also, the work is on-going and will get replicated to new areas.

For example: Atal Bhujal Yojaya (Jal Shakti Ministry and the World Bank)

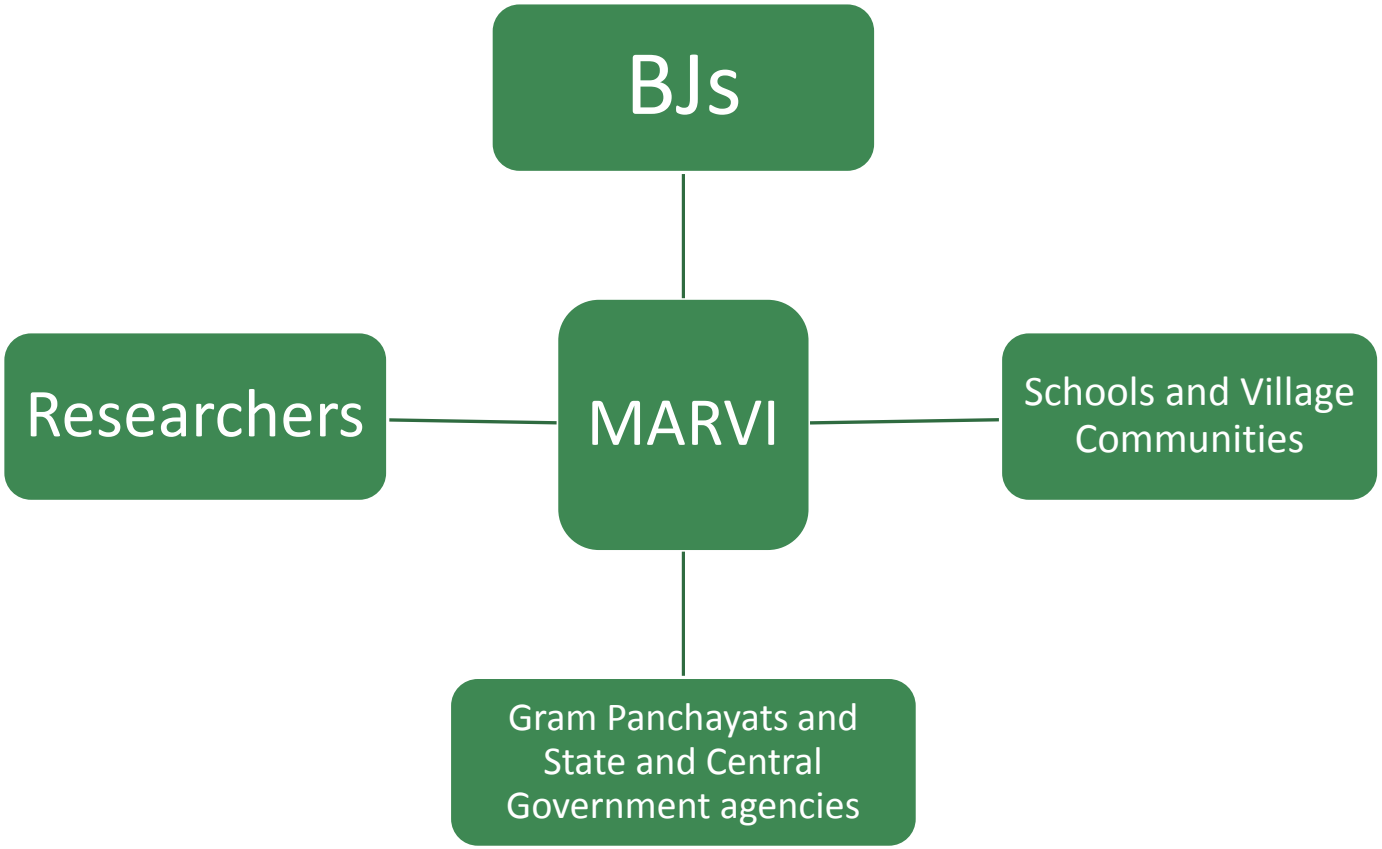
The MARVI Approach

Complexity of groundwater management




Community
MARVI
Science of groundwater
Government (Policy, regulation, governance)

Actors in MARVI



MARVI =

Local management of groundwater, Improved livelihood and Groundwater Sustainability

Aquifer Recharge

- Understand recharge dynamics with rainfall and pumping
- Effective planning and design of recharge structures
- Performance of recharge structures, maintenance needs

Groundwater Use

- Demonstrate agronomic practices that save water
- Select crops that use less water
- Irrigation methods that use less water (e.g., drip)

Village Engagement and Ownership

- Involve farmers and schools to monitor rainfall and water levels in well and check dams
- Village groundwater cooperatives (VGC)

What did we really do in the MARVI project?

Trained BJs and worked with them on on-going basis;

Collected groundwater depth, rainfall amount, water quality, check dam water level and socio-economic data;

Worked with local schools and community groups;

Worked with Gram Panchayat and State Government agencies;

Developed tools and resources for data collection, analysis and capacity building; and

Connected with policy makers at the State and Central Government levels

Bhujal Jankaars (BJs)

- Engaged local volunteers, called Bhujal Jankaars (BJs); Groundwater Informed' (25 +10)
- Trainings: basic hydro-geologic concepts, mapping, watertable and water quality measurements;
- Local champions and interface between research team and community
- Empowered and felt valued

Knowledge Transformation Processes for BJs

Base Map

- Beginning of understanding of village
- Superimposing of topographic and revenue information on one map
- Identification of land mark on map with villagers

Land Use Map

- Mapping of grazing land, source wise irrigation etc.
- Area calculation form the map

Surface Geology Map

- Identification of rocks especially aquifer rocks
- Mapping of surface exposures of aquifer rock

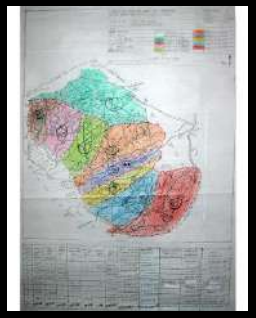
Water Resource Map

- Mapping of existing surface water resource development
- Well inventory
- Beginning of sub-surface
- Understanding of water depth and quality (TDS pH)

Land Foam Map

- Identification of land foam conducive for water resource development

Watershed Map



- Mapping of micro-watershed
- Water demand in each micro-watershed
- Run-off calculation

Strategic Planning Map

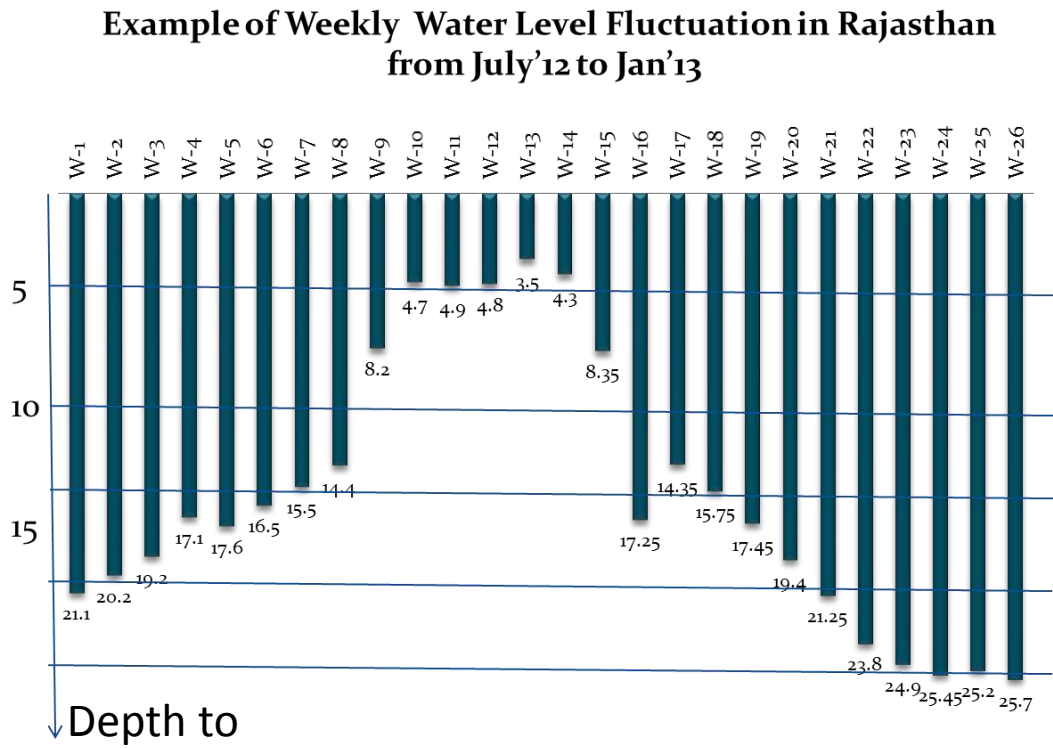
- Specific strategy for each micro-watershed
- Identification site and activit

Tasks Performed by BJs

Bhujal Jaankars (BJs) were trained in making field measurements and in reporting back to communities

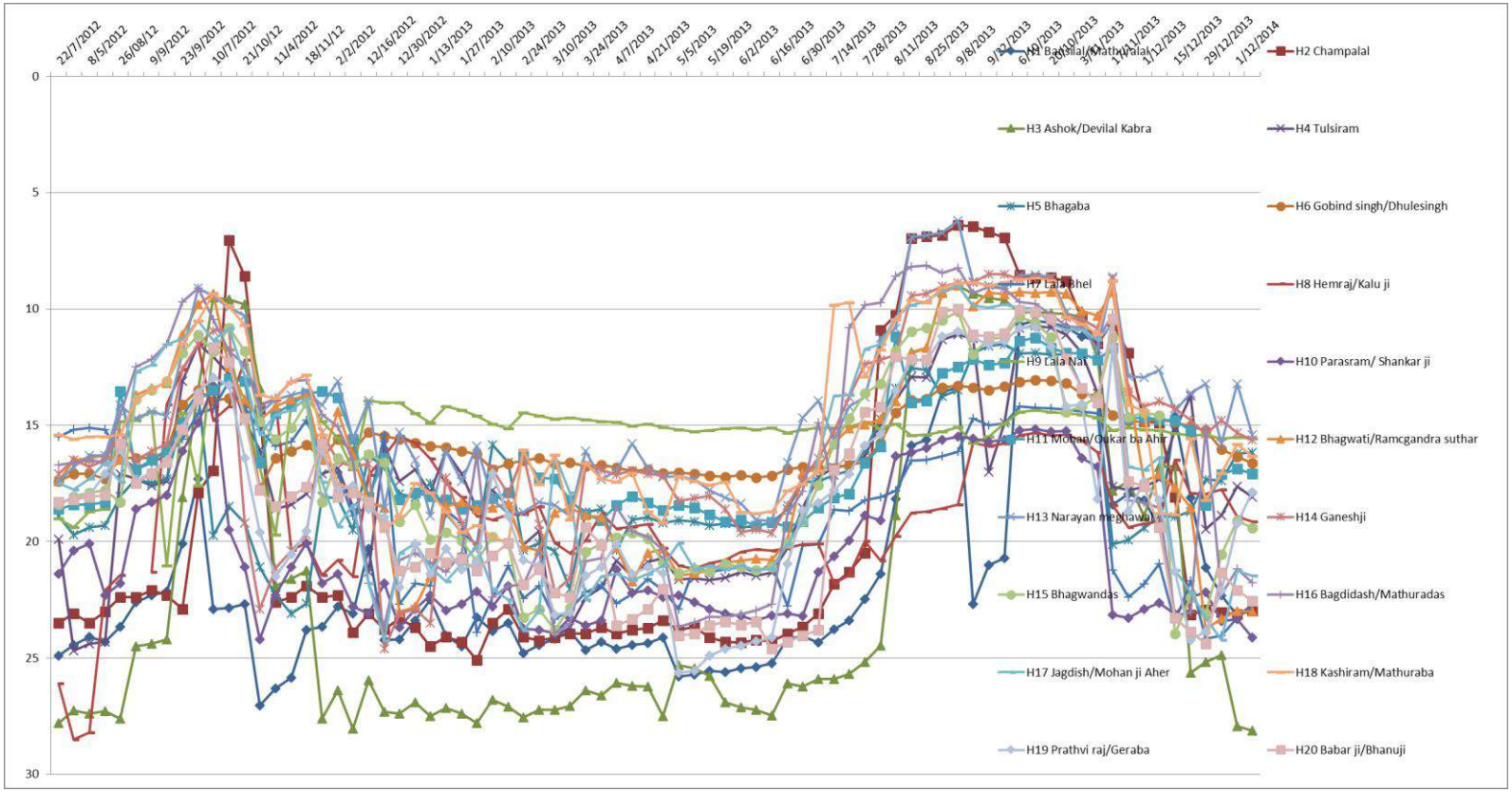
Kookana et al (2016) – gender and education; Packham et al

Groundwater monitoring by BJs



Hinta village hydrographs -20 wells

Depth to watertable in 20 wells, July 2012-Dec 2014



Checkdam monitoring and recharge analysis

Hydraulics of checkdam

Water Balance Equation

$$\Delta V = V_i - V_{i-1} = Q_{in} - Q_{out} - 0.5 * (A_{i-1} + A_i) * (R_i + E_i - P_i) - U_i$$

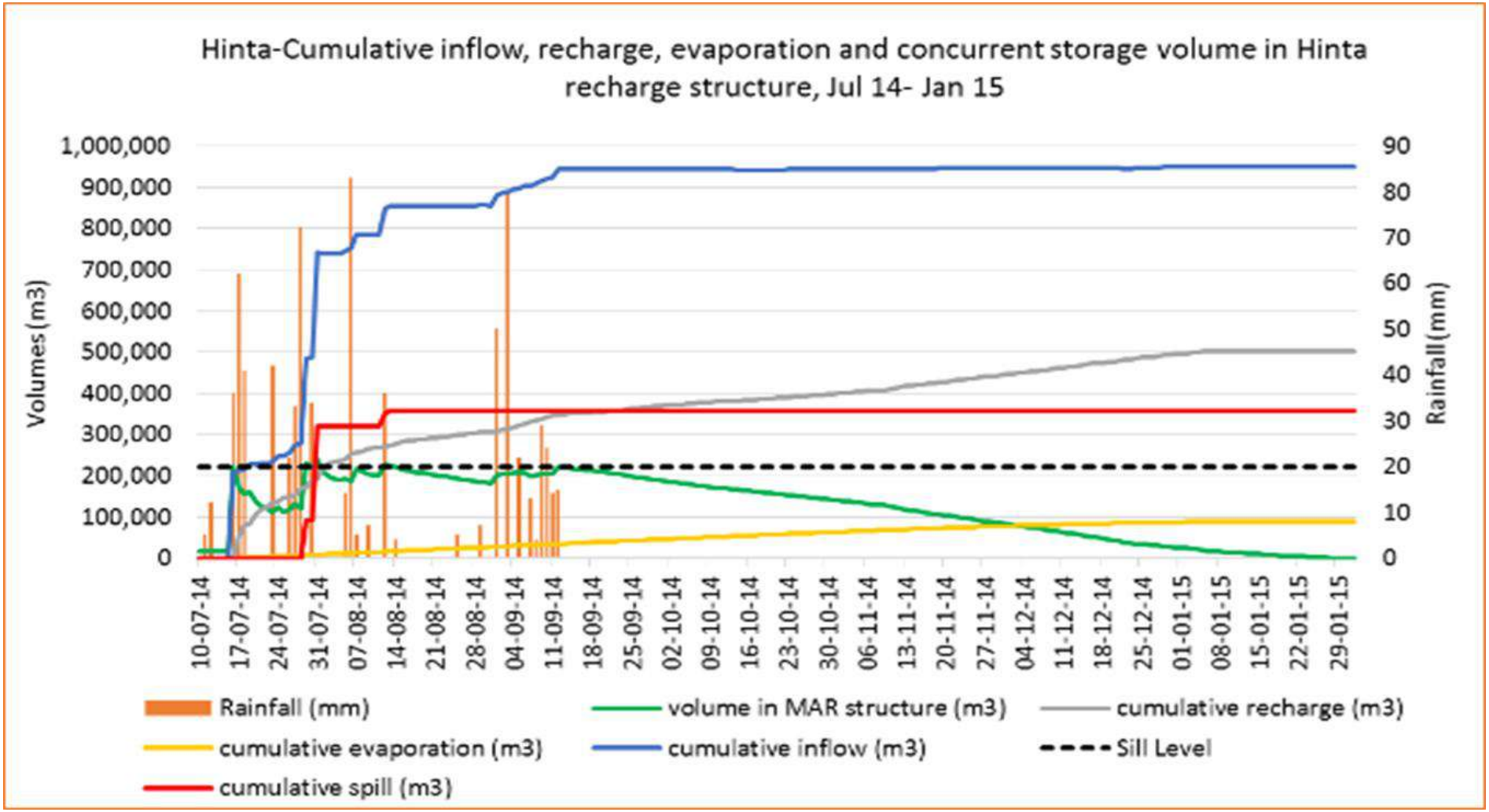
Dry weather Infiltration rate

$$R_i = h_i - h_{i-1} - \bar{E}$$

Spill

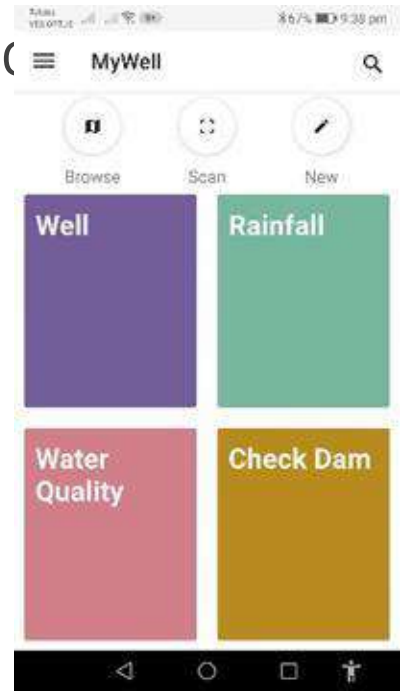
$$q_{out} = C_d \, B \, H^{1.5}$$

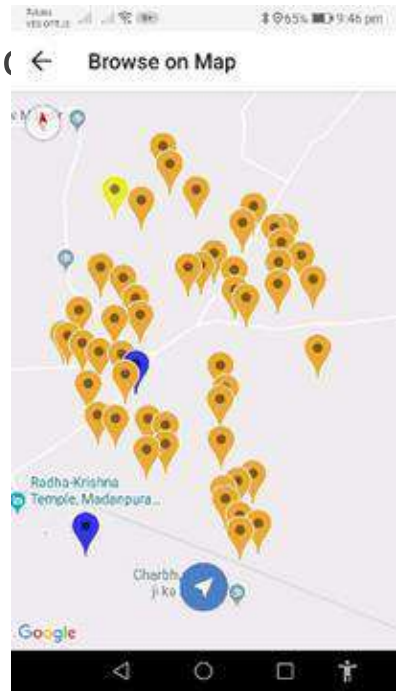
Hinta 2014

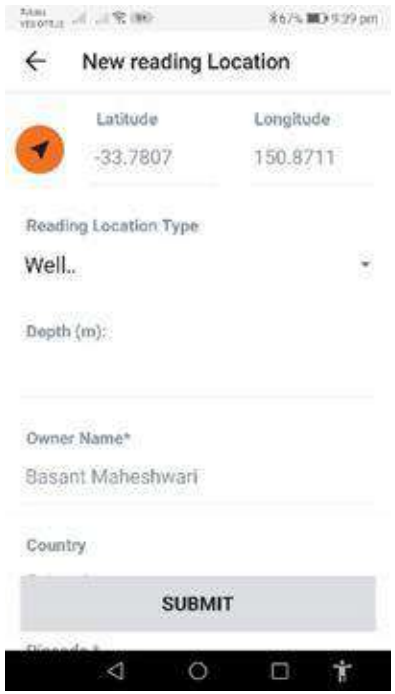

Hinta-Cumulative inflow, recharge, evaporation and concurrent storage volume in Hinta recharge structure, Jul 14- Jan 15
Volumes (m3)
Rainfall (mm)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
90
80
70
60
50
40
30
20
10
0
10-07-14
17-07-14
24-07-14
31-07-14
07-08-14
14-08-14
21-08-14
28-08-14
04-09-14
11-09-14
18-09-14
25-09-14
02-10-14
09-10-14
16-10-14
23-10-14
30-10-14
06-11-14
13-11-14
20-11-14
27-11-14
04-12-14
11-12-14
18-12-14
25-12-14
01-01-15
08-01-15
15-01-15
22-01-15
29-01-15
Rainfall (mm)
volume in MAR structure (m3)
cumulative recharge (m3)
cumulative evaporation (m3)
cumulative inflow (m3)
Sill Level
cumulative spill (m3)

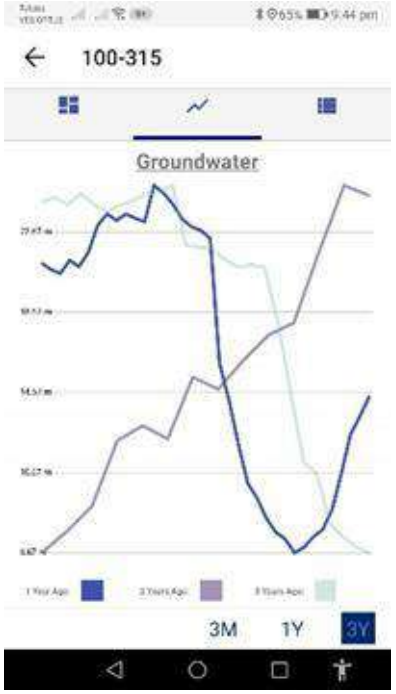
MyWell

Crowdsourcing rainfall, groundwater levels, checkdam levels and water quality data to support VGCs; Android version 2;

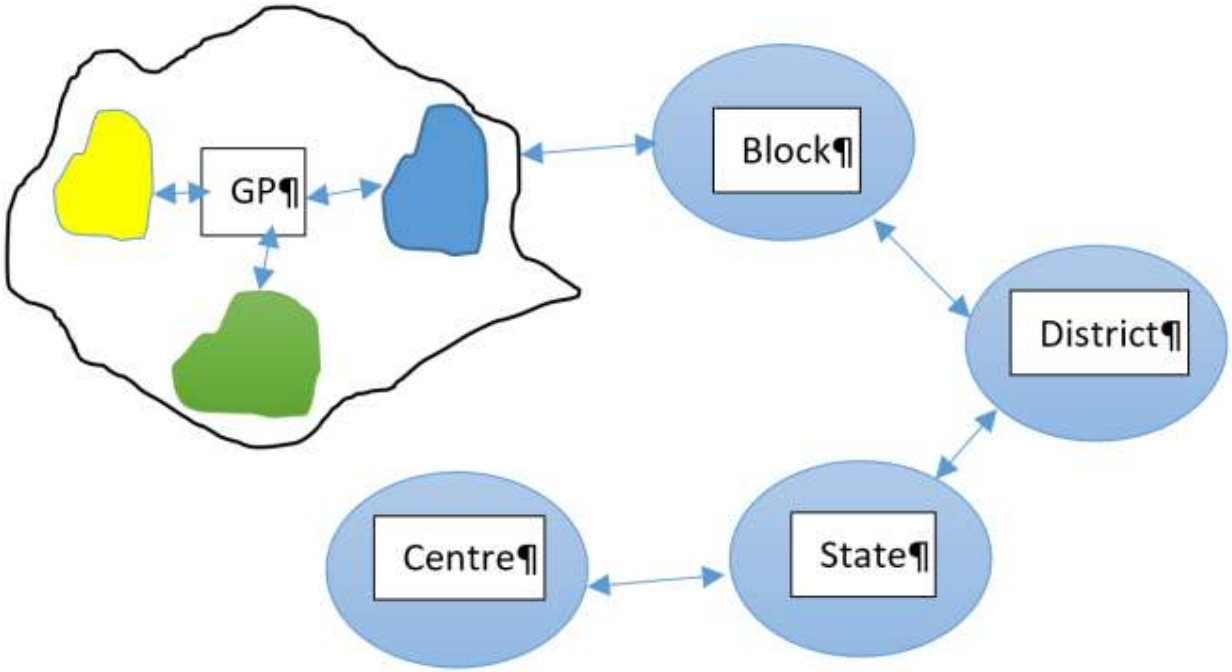




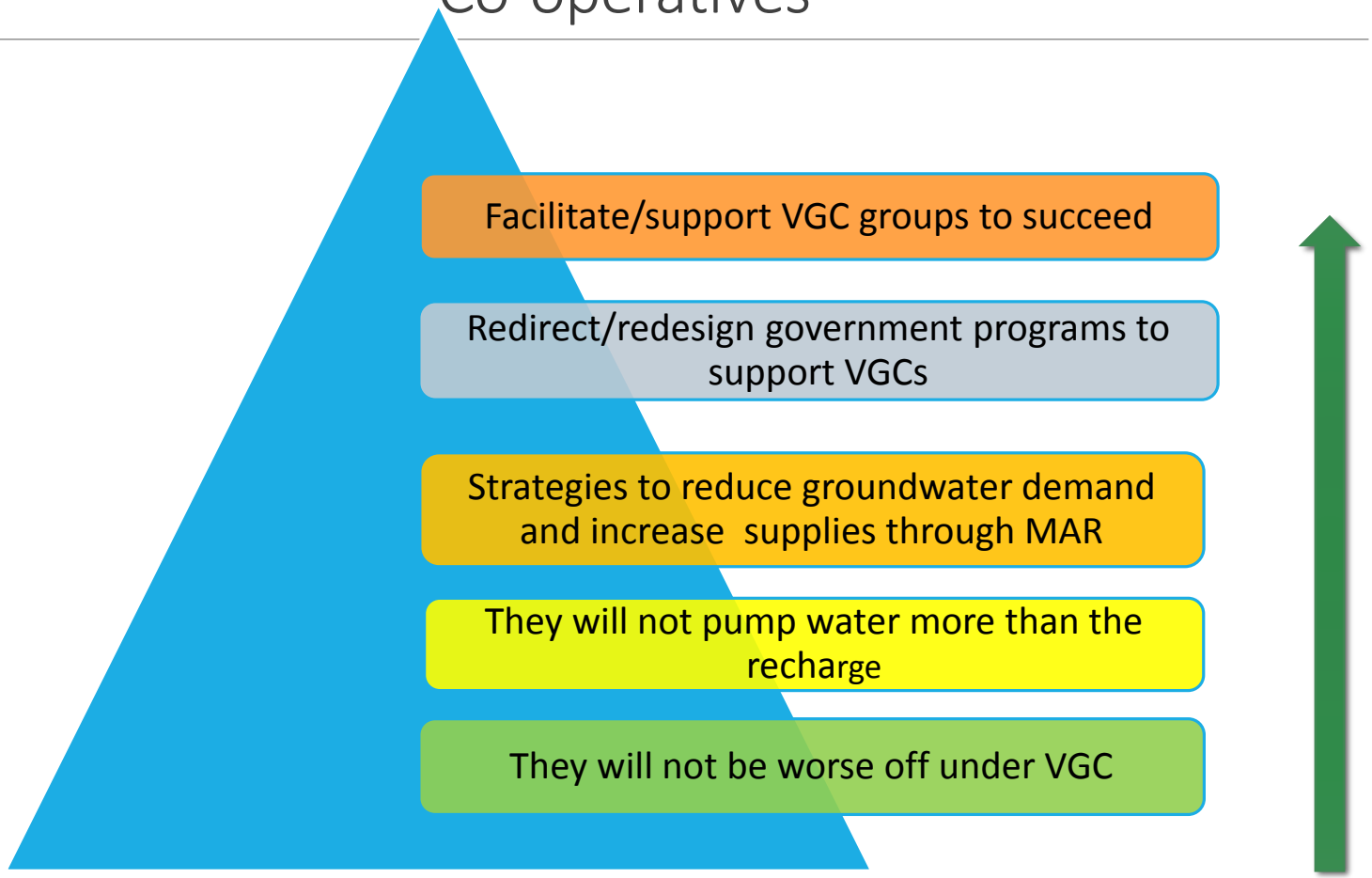




Village Groundwater Cooperatives



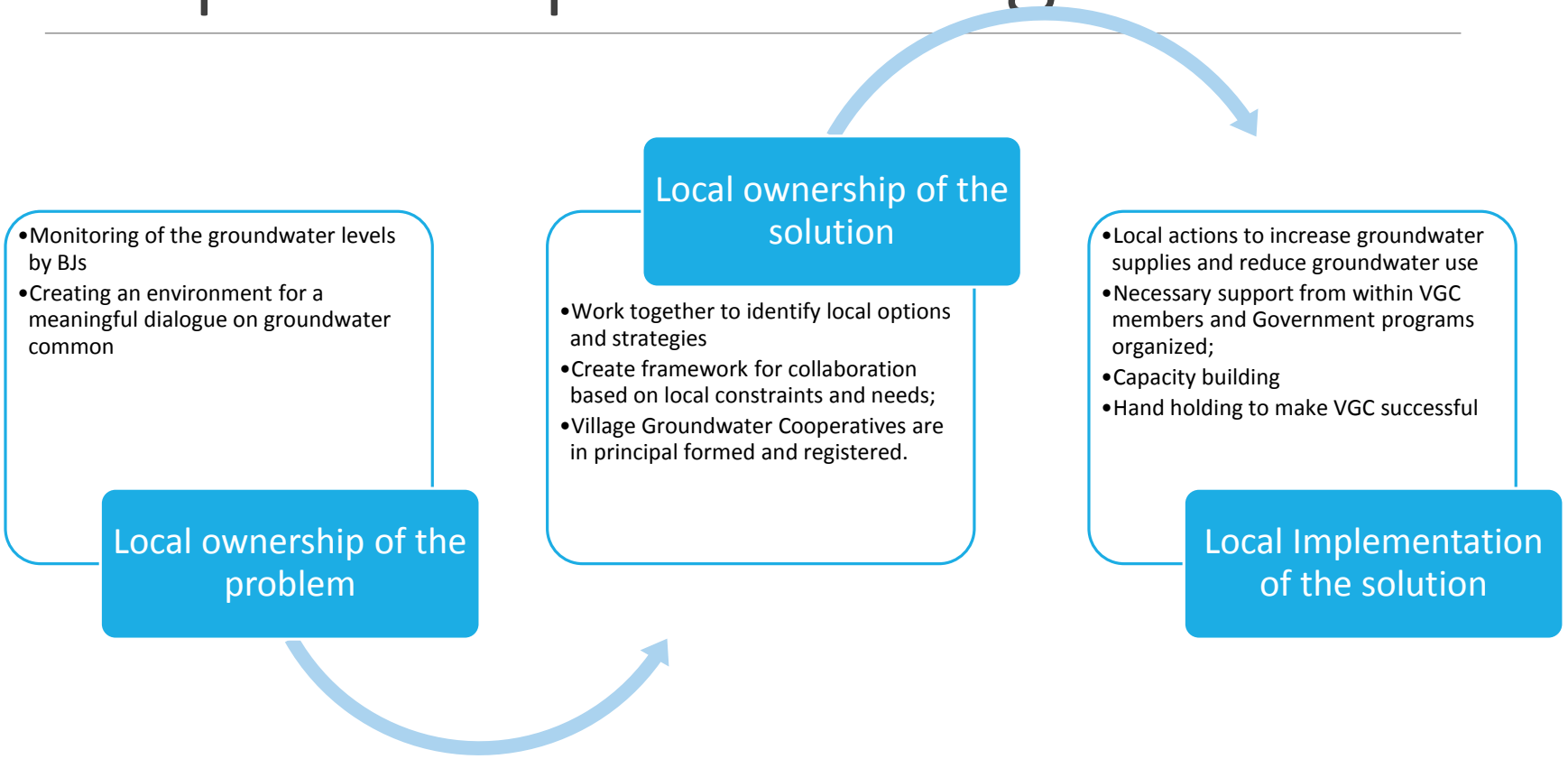
Key considerations for forming ‘Village Groundwater Co-operatives



Key practical challenges during the initial dialogue

- Convincing farmers to share and manage groundwater as common resource is the hardest task.
- Farmers who have groundwater – why should I share? How will it benefit me?
- Those who do not have groundwater – they are not clear as to what will they have to contribute for sharing to take place.
- Some farmers are selling water to a neighbour farmer but this is not the same thing as sharing and managing the resource from commons point of view.

Steps in implementing VGCs



The Journey to Village Groundwater Cooperatives

- Initially the farmers believed that if they can drill deeper, they can access more water and didn't care about their neighbours;
- The MARVI project and Bhujal Jaankaars (BJs: Groundwater informed volunteers) engaged the village communities
- Farmers realise → they are pumping from a common pool resource;
- The on-going dialogue → Villagers started working together.
- The concept of the Village Groundwater Cooperatives is born!

Achievement so far in forming VGCs

- Three VGC have been formed in-principal in Rajasthan and one in Gujarat through the farmers' own initiatives. The dialogue for another one in Gujarat is currently underway.
- The hard work is about to begin to operationalise these VGCs

1. Resources for capacity building developed for farmers, BJs, Schools and policy/decision makers
2. MyWell app for collecting and disseminating water data in real time (crowd sourcing of groundwater level, rainfall and check dam water level data)

Understanding Co-op formation and governance

State	Village	Cooperative status	Membership (n)
Gujarat	Meghraj	Proposed	≈ 20
Gujarat	Meghraj	Registered	21
Rajasthan	Hinta	Registered	17
Rajasthan	Badgaon	Registered	15
Rajasthan	Dharta	Registered	21

Workshop during April – May 2019

From coming together → Learning together

We moved from our simple idea of training of farmers in monitoring their wells and capacity building for citizen science to ‘self realisation’.

We were able to engage farmer for ‘social learning’

- Learn collaboratively, and
- Learn to collaborate in their own social setting

MARVI resulted in change in attitudes of farming communities

Realisation that they needed to ‘act in concert’ to protect ‘their commons’

The final point

Groundwater Commons can do better with effective practice of communication → that comes through learning together and acting together.

Conclusions

- Complex problems often require simple solutions. This is very much true for groundwater management.
- The participatory, village level monitoring approach developed in MARVI can empower local community and help develop their own groundwater management dialogue and strategies.
- Communication about what is happening, what can be done and how it can be done is the key with a common pool and invisible resource such as groundwater.
- We need to develop and simplify groundwater science that can be used by farmers and implemented by government agencies.

Conclusions

- BJs can collect highly reliable information for groundwater level, rainfall and recharge estimation.
- BJ collected data can be used for communicating village scale groundwater balance analysis and modelling
- Villagers can find their solutions if they are supported and nurtured.

The MOU signing between MARVI and Jal Shakti Ministry

MARVI Publications

Available for download at http://www.marvi.org.in/books

Thank You

More information:

www.marvi.org.in