

Participatory Groundwater Monitoring and Management at the Village Level – enabling technology and people to work together for sustainable groundwater futures

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The Groundwater Problem



Groundwater levels have fallen too deep - from 10-15 m deep 50 year ago to now up to 500 m or more in some places;



Water scarcity for agriculture, drinking and industry needs



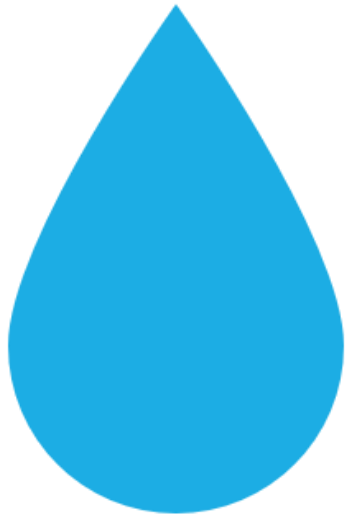
Solution to Groundwater Problems



- ❖ Some people suggested control the groundwater use by enacting some law and criminalise if someone breaks the law
- ❖ Some people have come up with technical solution – such as have a pump that operates when you insert a smart card and allows you to pump out allocated amount and stops when you have reached your limit.

Are the above solutions workable in reality and sustainable?

What kind of technology and technical solution will work?



Why do we have groundwater problem?

- Greed
 - Limited knowledge
 - Lack of understanding of what we are doing?
-
- ✓ So it is a people related problem.
 - ✓ So, we need people-friendly technical, social and policy solutions.

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

Partnership

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 Mellon University, South Australia Campus

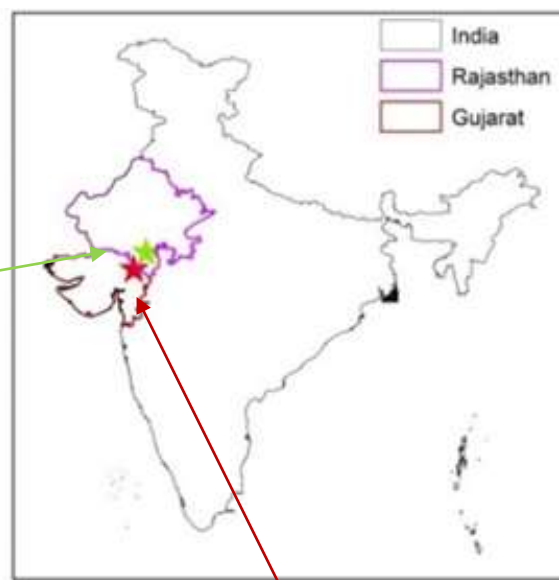
>30 Researchers + 35 Farmer Researchers (BJs)

Running since 2012



Project team during the visit to the Meghraj Watershed.

Location of study areas



Dharta catchme
Udaipur distri
Rajasth



Meghraj catchment,
Aravalli district,
Gujarat

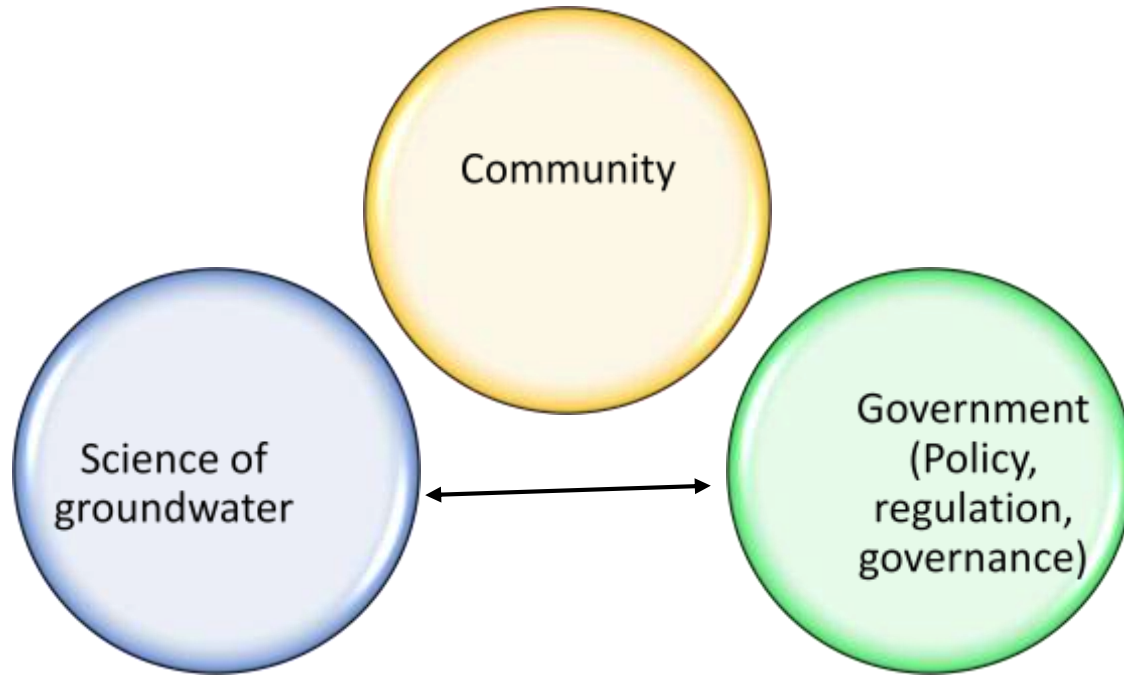
- Stream
- ★ Important places
- ▭ Meghraj Watershed
- ▭ Dharta Watershed

2.5 1.25 0 2.5 Kilometers

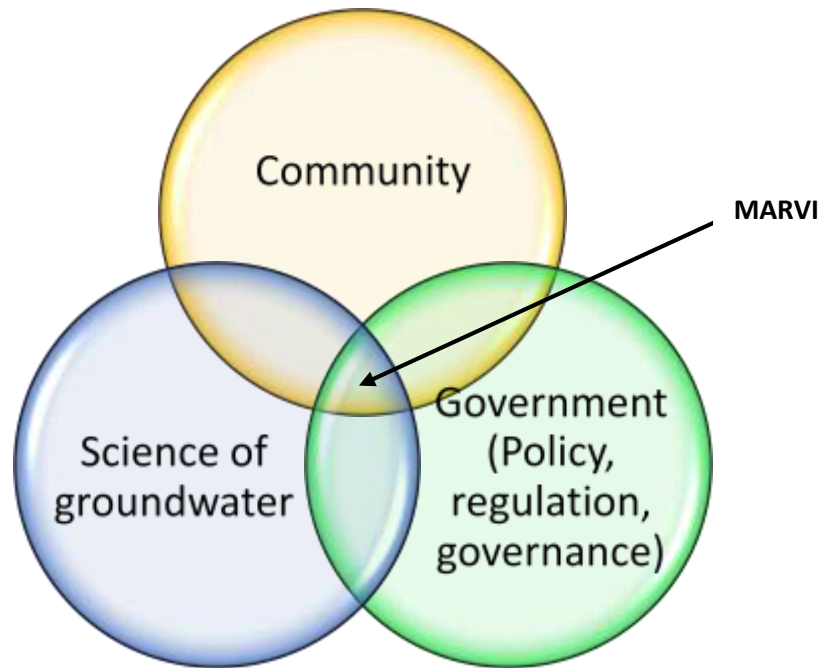


The MARVI Approach

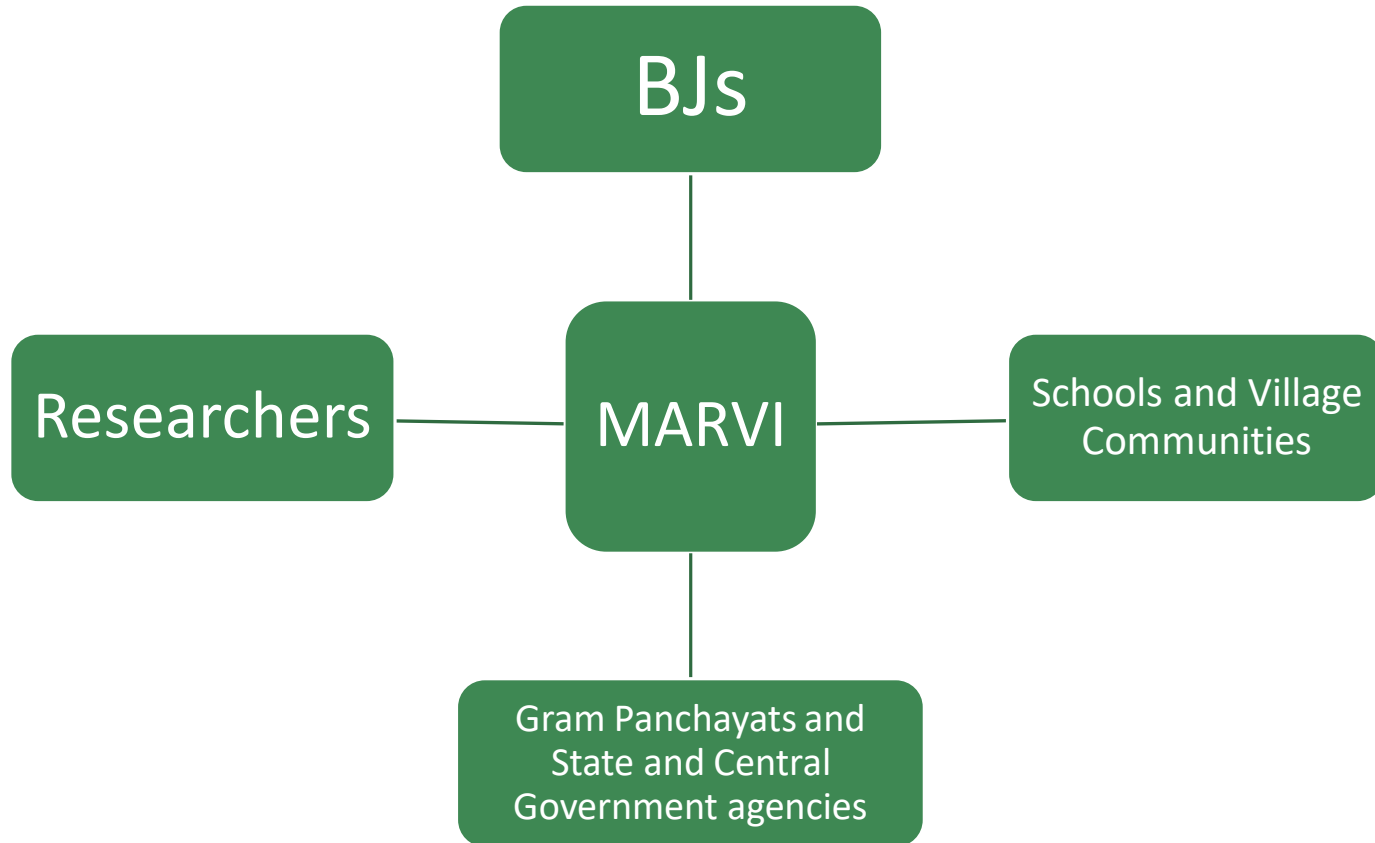
Complexity of groundwater management



The role MARVI played



Actors in MARVI



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 from 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



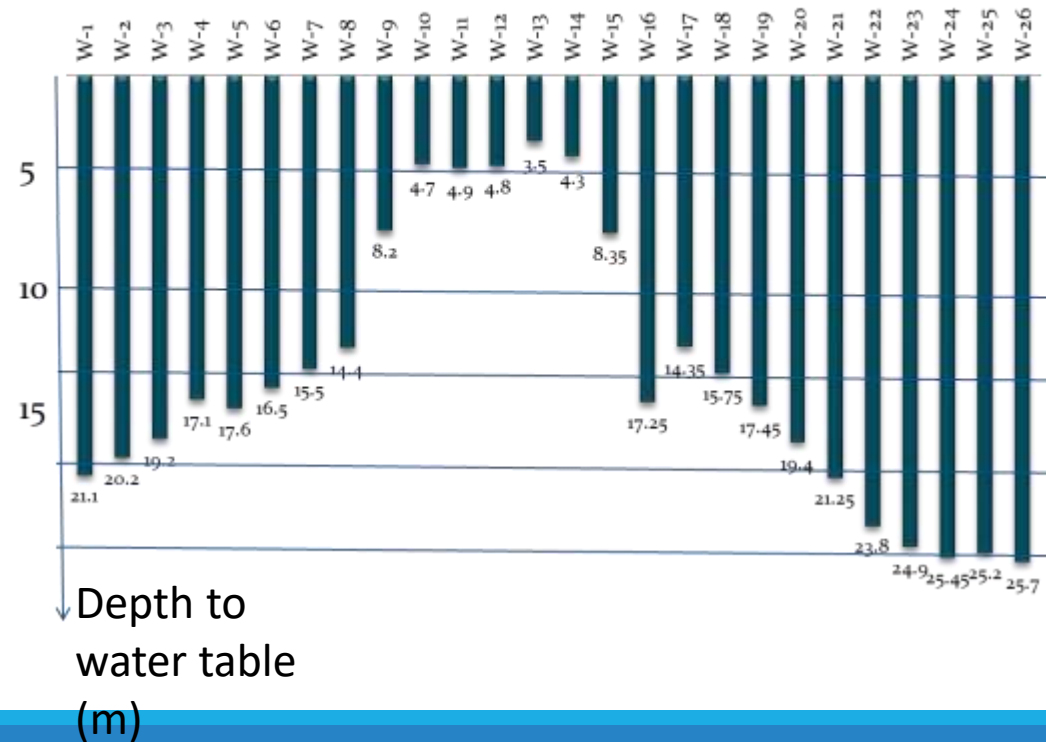
Bhujal Jaankars (BJs) were trained in making field measurements and in reporting back to communities



Groundwater monitoring by BJs



Example of Weekly Water Level Fluctuation in Rajasthan from July'12 to Jan'13



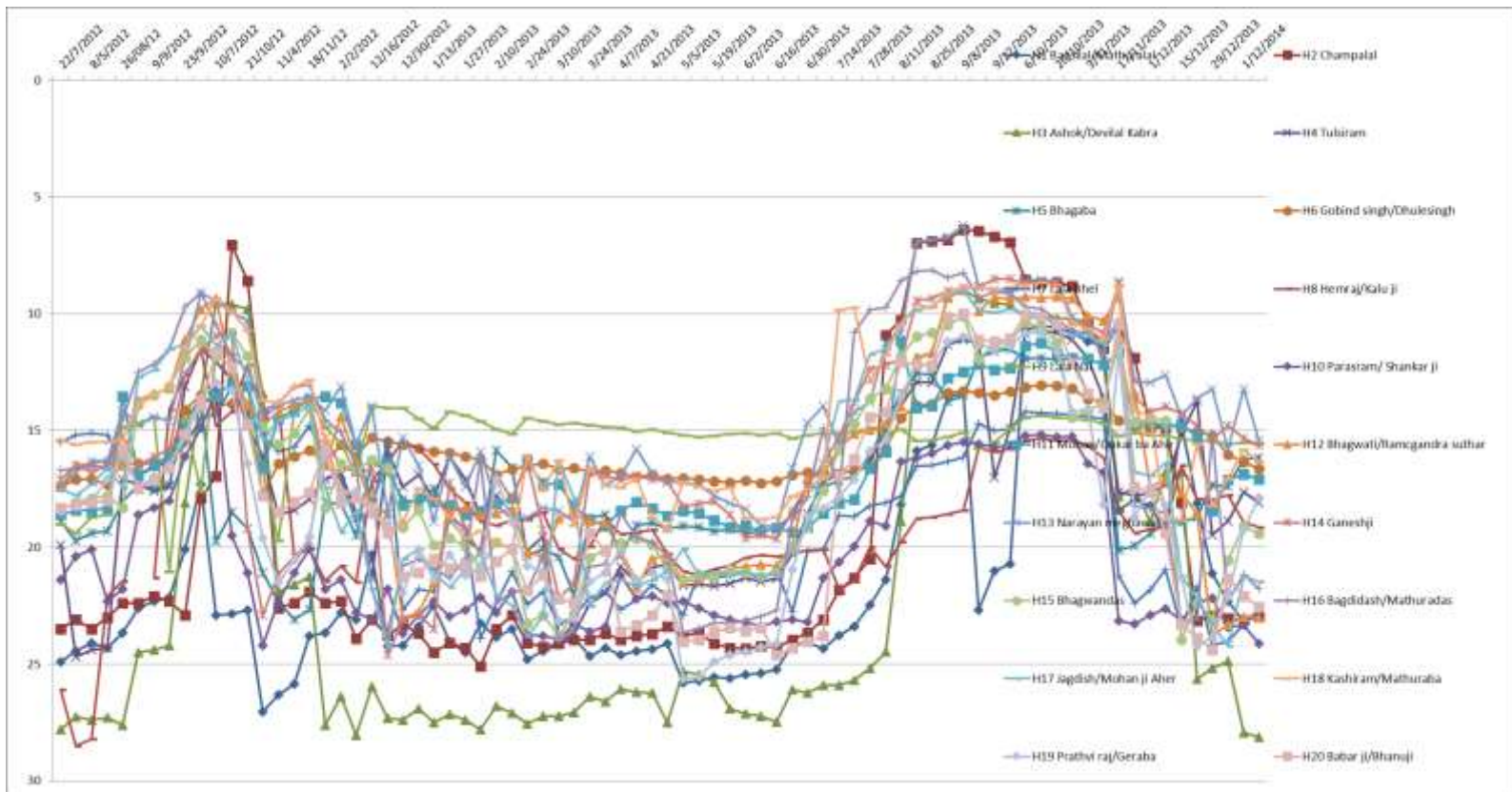
Hinta village hydrographs -20 wells

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

0

10

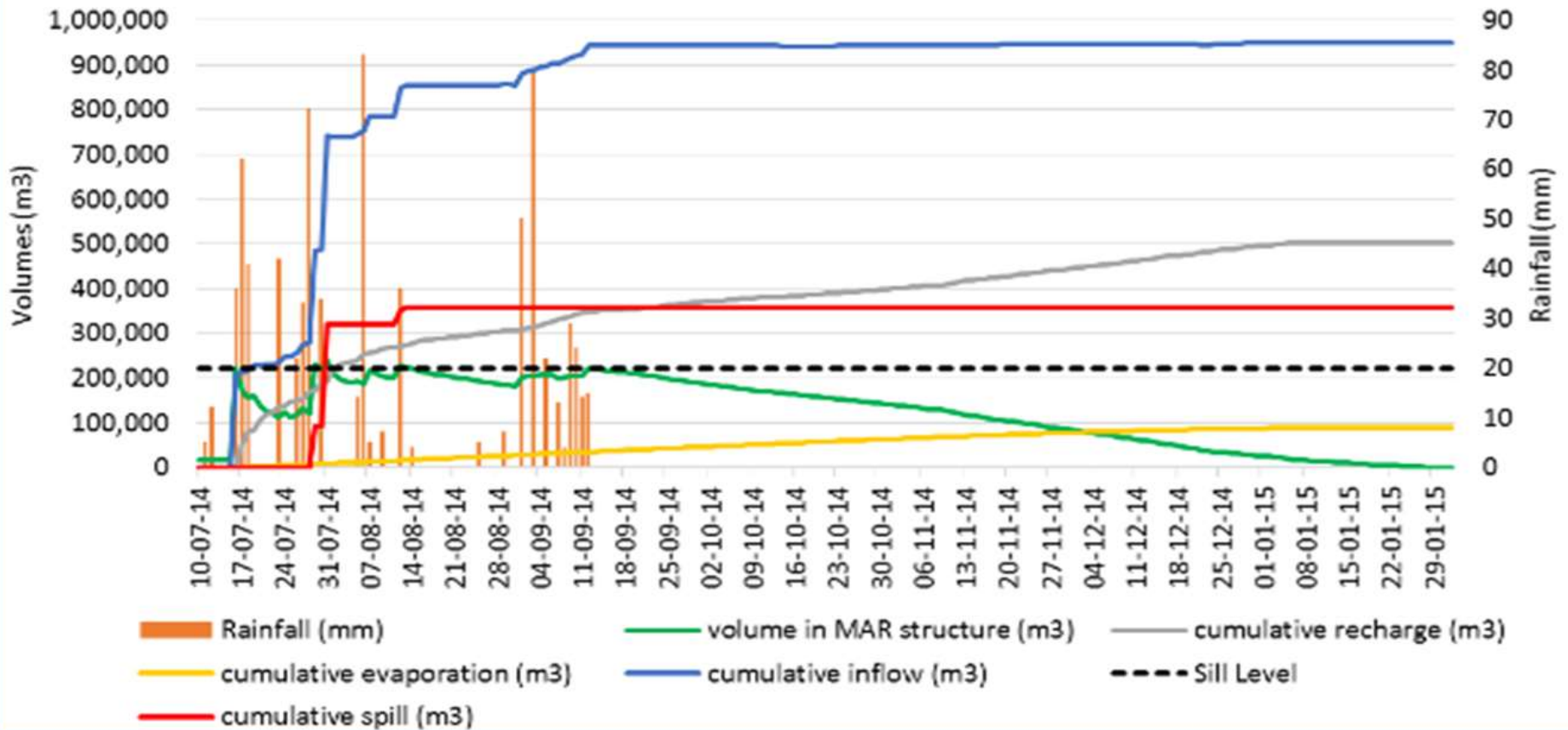
20



30 metres

Hinta 2014

Hinta-Cumulative inflow, recharge, evaporation and concurrent storage volume in Hinta recharge structure, Jul 14- Jan 15



Monitoring groundwater levels

Simply measuring and wooden float



Monitoring groundwater levels

Installation of depth sensor





Measuring rainfall

Measuring rainfall

Simple rain gauge; <\$5



Measuring weather

Automatic weather station

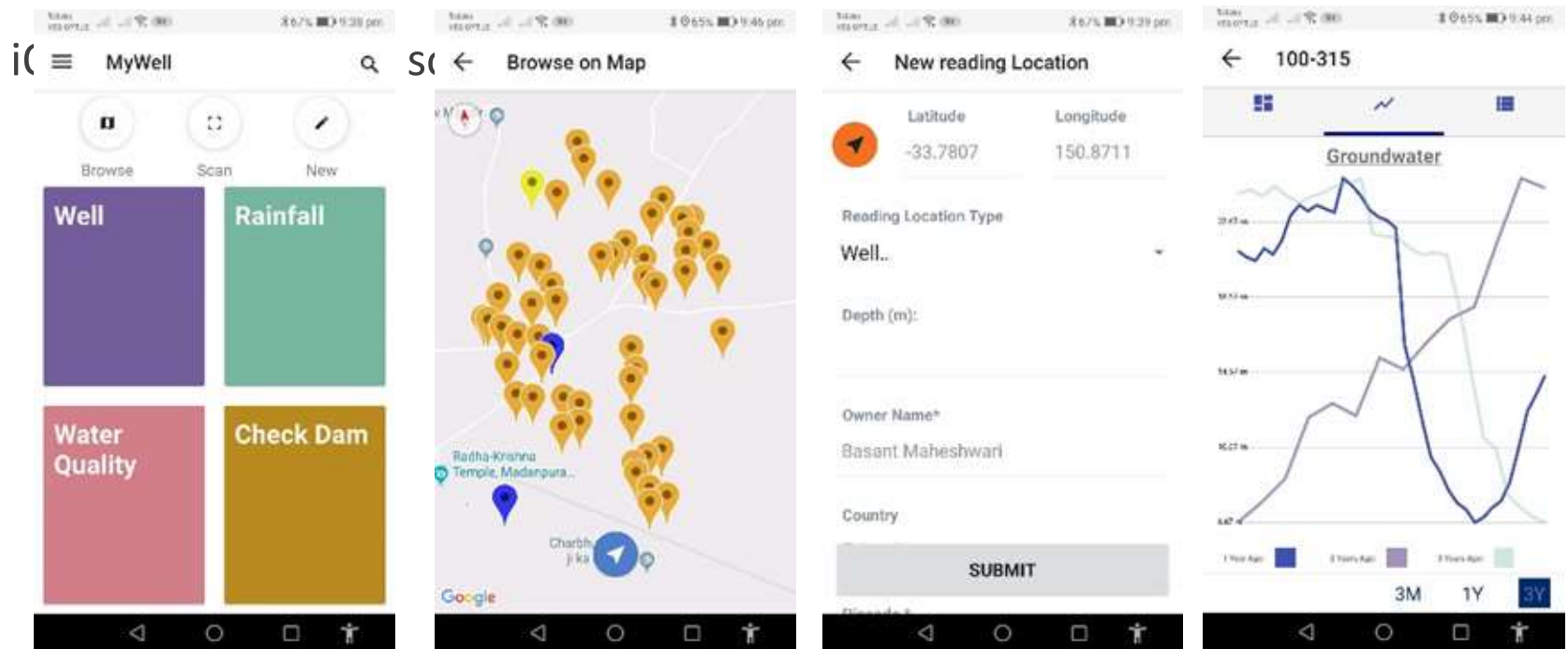


Checkdam monitoring and recharge analysis



MyWell

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





HISTORICAL READINGS

- Historical readings for 1 month, 3 month, or year long intervals
- Compare today's readings with the trends over the last 2 years



Storing and sharing groundwater data

Farmer using MyWell



Enabling technology needs to help people to work together for sustainable groundwater futures

For managing and sustaining groundwater, we need information on four aspects:

1. Groundwater Levels
2. Rainfall
3. Water quality
4. Checkdam water level

If we have the above information, we can understand what is happening in terms of groundwater use and recharge.

It is important to remember that we are solving the problem that was created by people and any good solution needs to involve them.

Any use of technology should work with people; not remove them from the scene and alienate them.

Also, technology can be used for training and capacity building → e-Learning through short video; online platform for specific self-paced learning etc.

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 with simple technology.
- 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.

MARVI Publications



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



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THE
 AUSTRALIAN
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