

# Groundwater Game Practitioner's Manual version 2.0

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## Contents

1. Introduction	8
2. The manual	12
3. Preparation	14
4. The game	20
5. Community Debrief	32
6. Case Study	40

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## Informative Video on the Groundwater Game

We have prepared a three-part video which explains about the process of facilitation of the Groundwater Game. This video will help user to understand the process of facilitation of the Groundwater Game. The three-part video is available via the following:

- Part 1: [Background and structure of the game](#);
- Part 2: [Instructions on facilitating the game](#); and
- Part 3: [Facilitating the game](#).

### Groundwater Game

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### Practitioner's Manual

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## Foreword

It is well known that India, as in a number of other countries around the world, is undergoing a severe crisis of shortages in surface water as well as groundwater, which is resulting in scarcity of drinking water, and acute hardship to farmers and livestock keepers.

The severity of the challenges has brought the issue due attention at various policy and decision-making levels, and from the research community. Though measures have been initiated at the national and state levels for improving regulations around groundwater, as well as recognising it as a common pool resource, there are limited examples of policies advocating and enabling self-regulation at local level involving village communities and other users.

Foundation for Ecological Security has been engaged, over the last few years, in trying to address the complexity at the local level, beginning with the mapping of groundwater aquifers and efforts to bring considerations regarding the finite nature of water availability into the decision making processes of village communities. This was followed up with exercises aimed at comprehending the mental models of local communities by improving a collective articulation of the various interconnections across ecological, social and economic dimensions, through exercises on 'Community Based Systems Dynamics'. Besides the articulation of their mental models, it also helped bring to surface the 'cause-and-effect relationship' linking water consumption patterns to their land use choices.

In the last couple of years, we have partnered with Arizona State University and International Food Policy Research Institute (IFPRI), to develop the Experimental Games to help build the debate on groundwater consumption and trigger discussions around viewing water as Commons rather than as individual property. Conducted in villages in Karnataka and Andhra Pradesh, the Experimental Games have opened up discussions wherein village communities are debating on each others' crop choices within the threshold limits of water availability. This manual has been developed to outline the process in which such exercises are conducted, with the aim of helping fellow practitioners undertake such exercises in other geographies.

It is our belief that while governments at national and state level are involved in framing policies and regulatory mechanisms, and rightly so, it is also equally important to build a debate at the local level to challenge the consumption behaviour of local communities, so as to develop self-regulatory mechanisms, and importantly, a realisation that groundwater is a finite resource and best managed as Commons.

**Jagdeesh Rao**

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## Foreword

The governance of common resources is critical for the well-being of humanity. For decades academics have been debating the best way to govern the commons. Should the common resource be privatized, controlled by the state, or self-governed by the local community? Elinor Ostrom, who won the 2009 Nobel Prize of economic sciences for her study of the commons, argued that there is no simple blueprint for the best solution.

Social science provides us substantial insights in-group dynamics. Self-governance by local communities can be very effective and sustainable. However, imposing solutions to groups can backfire. This leads to an opportunity and a challenge. How do we stimulate and facilitate communities to improve their self-governance without imposing solutions?

The groundwater game presented in this manual is a tool that aims to stimulate self-governance of groundwater use, and engage the community to improve the governance of their common resources. The protocol in this manual describes a set of activities that allows practitioners working with a community to explore the challenges of groundwater management in a safe environment. The protocol also recognizes the importance of local knowledge and the capacity of communities to solve their own collective action problems.

The groundwater game is not a solution, but a tool that complement existing participatory activities in order to empower communities to self-govern their common resources. IFPRI and FES have been using the groundwater game since 2012 to test it's potential. The evolved manual is a reflection of the experiences of applying the game in different places in India. The research has demonstrated that communities do improve their understanding of the groundwater problem and come to solutions tailored to their own situation. By sharing the experiences via this manual, we hope that more practitioners will explore it's potential and share your experiences with us via the practitioners section of [www.gamesforsustainability.org](http://www.gamesforsustainability.org).

### **Marco Janssen**

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## 1. Introduction

Groundwater is a shared, common pool resource that has proved difficult to manage in many places around the world. The dispersed, mobile nature of the resource, combined with the difficulty in observing flows and extractions have posed challenges for both state and community regulation. The result is seen in falling groundwater levels in many areas of India, particularly in hard rock aquifers.

Community groundwater management projects have made considerable strides, but evaluations indicate that gains are not sustained once the projects end. One reason is a lack of understanding of the inter-linkages between individual and collective cropping patterns, water extraction, and groundwater levels. Even where understanding exists, collective action dilemmas don't assure individuals if they limit water use others will too.

Recent action research indicates that collective action “games” can be used to improve understanding of groundwater interconnectedness, and provide a catalyst for collective action in local groundwater management. These games adapted from an economic experimental game provide an experiential learning environment which can help local communities and other actors appreciate the connections of individual decisions on shared resources such as groundwater, and triggers discussions on possible solutions to effectively manage shared resources.

The theory of change (Figure 1) explains how the groundwater games can be used as a facilitation tool by civil society organisations and other agencies to improve understanding of different factors influencing groundwater conditions.

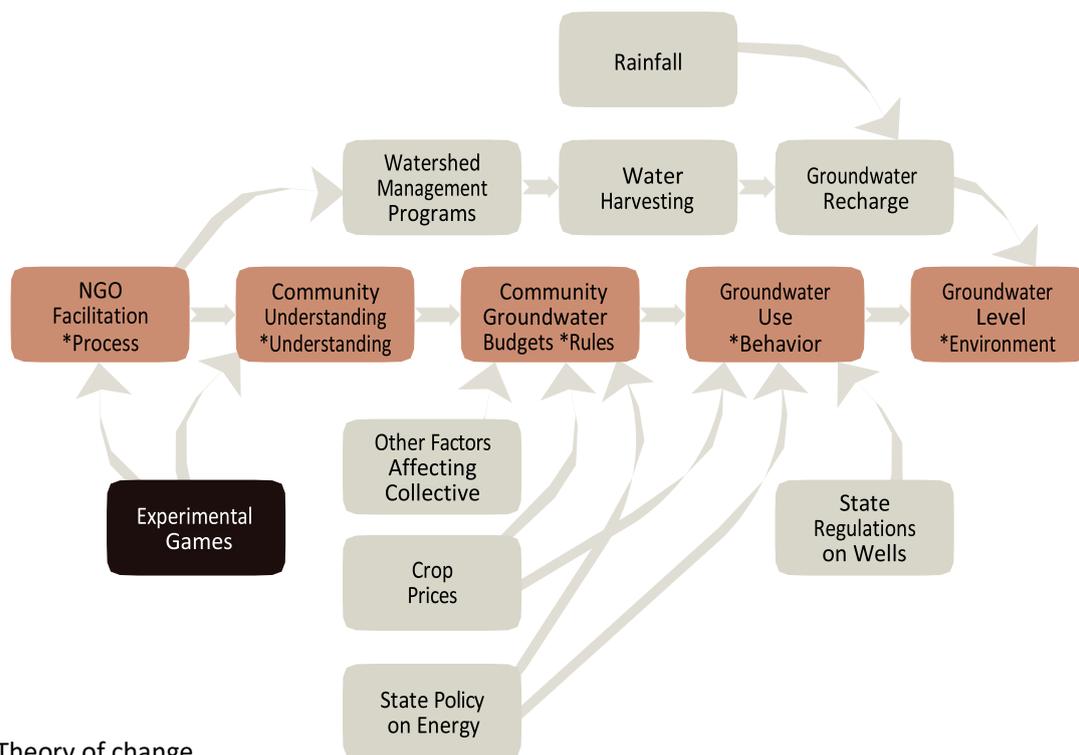


Figure 1. Theory of change

The game acts as a catalyst to trigger discussions on possible rules and regulations which can be formulated at the local level and strengthens self-governance leading to improvement in groundwater use and in the long term improvement of groundwater conditions. While noting that groundwater levels and usage behaviour are influenced by biophysical conditions, state policies and market incentives, the game helps local communities analyse endogenous sources of factors impacting groundwater behaviour and explore methods to regulate or better use groundwater. The games may be followed by other methods such as crop water budgeting which provides local communities a more technical understanding of how different crop choices impact groundwater levels. It enables them to take a more nuanced decision regarding crop combinations based on the availability of groundwater and formulate groundwater budget rules based on the annual rainfall and local recharge conditions.

Results from playing the game in combination with crop water budgeting include:

- \* voluntary shifts in cropping patterns (from water intensive crops like rice paddy to water conserving crops like groundnut),
- \* village-level institutions banning new bore wells from being dug, and
- \* villages banning continuous planting of the water intensive crop rice paddy.

This manual provides step-by-step instructions of how to facilitate the groundwater game as a learning tool that helps farmers link crop choice with groundwater levels. For the economic experimental game protocol, please visit: <http://gamesforsustainability.org>.



Farmers need to have access to water for survival and income, but this resource is declining at an unsustainable rate. Groundwater games equip farmers with knowledge of groundwater processes and empowers them to work together to manage this resource. Playing the Groundwater Game, farmers experience long-term processes in a few hours and can experiment with possible solutions.

# Groundwater Games: Improving Community Engagement and Strengthening Collective Action

## Why?

Decreasing groundwater levels: Groundwater levels throughout India and in many other parts of the world are decreasing at unsustainable rates. Increasing proliferation of deep bore wells along with injudicious water use and shift towards water intensive crops are some of the main reasons. While groundwater is a part of an aquifer system and is a shared resource, households accessing groundwater for irrigation, drinking and cooking tend to believe it as a private resource.

Invisible nature of groundwater: Groundwaters mobile nature and dispersed flows that are 'invisible' to individuals and communities make this one of the most challenging natural resource to manage around the world. Where understanding exists, individuals are not assured that if they limit their water use, others will too, a common collective action dilemma that hampers government and community regulation.

## What?

Use a participatory method to strengthen community engagement and empower local communities to self-govern their shared natural resources.

Improve community understanding of the linkages between crop choice and groundwater levels and how groundwater is a shared or common resource.

## How?

The Groundwater Game is played with a group of five people from the same village. It takes them through multiple dry seasons where they can experience in a short period of time how choosing between a Crop A (low water use, low income) and Crop B (high water use, high income) influences groundwater levels.

Players initially make anonymous planting decisions individually without talking to each other.

In the second game, players are encouraged to talk about their cropping decisions and coordinate with one another to plan and understand groundwater as a common pool resource.

The game is followed by a community debriefing, where the whole community and the players link the game with real life experiences and explore potential ways to improve groundwater levels.



2. The manual
  - 2.1 Reading the manual

## 2. The Manual

The manual has been developed as a facilitating guide for practitioners, trainers and government officials who are involved in community groundwater projects.

It includes the following sections:

1. Preparation: This section describes the groundwater game kit, the roles of the facilitation team, preparation regarding site selection and conducive time to play the game. It also explains the necessary preparation for understanding the context, cropping systems, mobilizing local community and selection of participants for the game.
2. Playing the game: This section provides step-by-step instructions on how to facilitate the game. Firstly, it describes the game without any communication followed by a game with communication. It contains a script and broad guidelines for facilitators. It also provides examples of different variations which may be made in the game, based on the context or as per situation requirement.
3. Community debriefing: This section describes the follow-up action on the game to engage the larger community and facilitate a community level process to explore solutions to groundwater problems. It includes exercises on 'Groundwater Trend Line' and 'Crop Water Budgeting', to facilitate group reflection and shared learning and further reinforce community cooperation.
4. Case study: An illustration of how the game fits into the field context as an intervention and highlights the potential of the games to trigger discussions and subsequent changes that have happened in the community.

The facilitation game has been modified to suit populations who may not have formal education. Throughout the manual, approximate times are given for each activity so that facilitators allocate times accordingly and prevent unnecessary deviation during the game.

### 2.1 Reading the Manual

For clarity, the manual uses groundnut as the less water demanding crop, Crop A, and rice as the water intensive crop, Crop B, to illustrate the game, these are indicated by: groundnut (Crop A) and rice (Crop B). These are underlined and only examples as facilitators will use locally grown crops instead.

Actions and Explanations: Regular font Script: Bold and italicized font

Possible Responses from Players: [brackets]

#### For example:

Ask the community: ***What was the difference between the first and second***

[The groundwater level dropped quicker when we played without talking.]

The Facilitator does most of the speaking, so when you see lines of script, assume it is the Facilitator unless otherwise noted.

Throughout the manual, look for the following heads that offer additional help:

#### Tip!

Look here for advice based on experiences playing the game in communities

#### Why?

Explains the importance of why the game is played a certain way.

#### FYI

#### (For Your Information)

Based on experience, these are common reactions when playing the game.



### 3. Preparation

#### 3.1. Toolkit

#### 3.2. Facilitation team roles and responsibilities

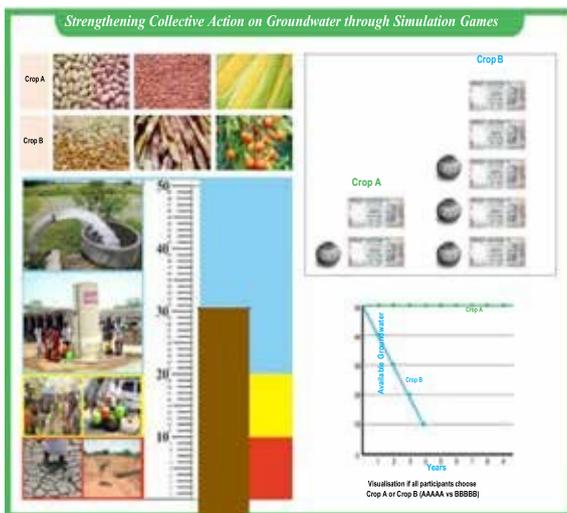
#### 3.3. Organizing the game

- a. Understanding the local context
- b. Mobilizing the community and selection of participants
- c. Selection of game site, timing and other logistics

### 3. Preparation

#### 3.1 Groundwater Game Toolkit Checklist

- a. Groundwater Game Flexi (Ex: 5 feet x 4 feet)
- b. Rope and strong tape to hang flexi up in the village
- c. Groundwater Marker/ Flexi Strip for moving water level on flexi
- d. Good double-sided sticky tape that will re-stick when water marker is moved
- e. Crop Images: 3-4 options of local crops that use less water. 6 copies of each crop
- f. Crop Images: 3-4 options of local water intensive crops. 6 copies of each crop
- g. 2 dice with the side with 6 dots covered, in the game, this represents 0.
- h. 5 Envelopes - one for each player to make their crop choice and receive money
- i. 200 Currency Notes or tokens representing money (this includes extras)
- j. Blank Groundwater Record - enough spaces for up to 25 years total, or 12 years each game
- k. Blank Groundwater Graphs
- l. Crop Choice Records - 1 per game
- m. Writing Pad for Crop Choice Record
- n. Ink pen for Crop Choice Record
- o. Assorted Colored Markers for Groundwater Record and Groundwater Graph - the best colors to use are: black, brown, red, blue, purple. (Orange and yellow are often hard to see)



a. Groundwater Game Flexi (Ex: 5 feet x 4 feet)



e. Crop Images: 3-4 options of local crops that use less water. 6 copies of each crop



f. Crop Images: 3-4 options of local water intensive crops. 6 copies of each crop



b. Rope and strong tape to hang flexi up in the village



c. Groundwater Marker/ Flexi Strip for moving water level on flexi



d. Good double-sided sticky tape that will re-stick when water marker is moved

#### Why 6 Crop Images?

One will go to each of the 5 players and one will be taped to the flexi for a total of 6.

#### Tip!

Laminate crop images for repeated use.



g. 2 dice with the side with 6 dots covered, in the game, this represents 0.



h. 5 Envelopes - one for each player to make their crop choice and receive money

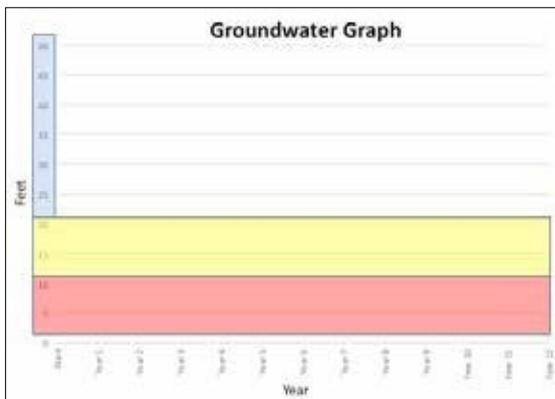


i. 200 Currency Notes or tokens representing money (this includes extras)

Year	Start Water Level	Crop A Water Use	Crop B Water Use	Household Use	Groundwater Use	Recharge	End Water Level
P1	50						
P2							
1							
2							
3							

*P1 and P2 are practice rounds. This graph will go to 10-12 years per game (not all lines may be filled in). Game 1 and 2 can go on the same Groundwater Record or two different sheets.*

j. Blank Groundwater Record – enough spaces for up to 25 years total, or 12 years each game



k. Blank Groundwater Graphs

	Crop A	Crop B
Practice 1		
Practice 2		
Year 1		
Year 2		
...		

l. Crop Choice Records - 1 per game



m. Writing Pad for Crop Choice Record



n. Ink pen for Crop Choice Record



o. Assorted Colored Markers for Groundwater Record and Groundwater Graph - the best colors to use are: black, brown, red, blue, purple. (Orange and yellow are often hard to see)

### 3.2 Facilitation Team Roles and Responsibilities

The facilitation team comprises of the lead facilitator and a record keeper. The facilitator guides the game and is primarily responsible for all the interaction with the players. The record keeper notes the crop choices, maintains the groundwater record, and also notes any observations /questions from players.

Facilitator	Record Keeper
<b>Skills Needed</b>	
<ul style="list-style-type: none"> <li>- Respect everyone – women, children, different castes, religions, etc.</li> <li>- Include all players (give everyone a voice, chance to speak)</li> <li>- Facilitate instead of lecture</li> <li>- Fluent in local language</li> </ul>	
<b>Individual Skills</b>	
<ul style="list-style-type: none"> <li>- Knowledge of factors influencing groundwater.</li> <li>- Ability to listen to community members and responding appropriately.</li> <li>- Encourage participation and discussion, avoid lecturing.</li> </ul>	<ul style="list-style-type: none"> <li>- Legible handwriting.</li> <li>- Ability to make a basic graph.</li> <li>- Ability to pay attention to detail and note it down simultaneously.</li> </ul>
<b>Roles and Responsibilities</b>	
<b>During Preparation</b>	
<ul style="list-style-type: none"> <li>- Work with local staff and the village institution to set a date and time to play the games.</li> <li>- Prepare the Game Kit, ensure all materials are available.</li> </ul>	<ul style="list-style-type: none"> <li>- Make the Groundwater Record and Groundwater Graph for the number of games that will be played.</li> <li>- Consider the best locations for everyone to see the game and props.</li> </ul>
<b>While playing the game</b>	
<ul style="list-style-type: none"> <li>- Lead introductions.</li> <li>- Explain the game and answer questions the community may have.</li> <li>- Move the Water Level marker as the Record Keeper announces water usage, recharge and final water level.</li> <li>- Announce the starting water level at the beginning of each year.</li> <li>- Ask questions as needed to facilitate group discussion</li> <li>- Decide when to change rounds.</li> <li>- Facilitate group discussions, prompt players to talk during the second game.</li> </ul>	<ul style="list-style-type: none"> <li>- Record the crop decisions for each player by marking how many players chose each crop for every round.</li> <li>- Announce how many acres of each crop were cultivated in the dry season.</li> <li>- Enforce the rules - limit decision making time and talking to 1 minute.</li> <li>- Take notes of anything new or interesting players say or do during the game.</li> <li>- Use the Groundwater Record to publicly calculate how many units of water were used for crops and domestic purposes.</li> </ul>
<b>During debrief</b>	
<ul style="list-style-type: none"> <li>- Introduce the debrief.</li> <li>- Facilitate players to explain the game.</li> <li>- Guide the 'Trend Line Exercise'.</li> <li>- Guide the community discussion in linking the game with real life.</li> </ul>	<ul style="list-style-type: none"> <li>- Take notes of what the community is saying when necessary.</li> <li>- Support the Facilitator by providing alternative explanations to the community to improve understanding.</li> </ul>

### 3.3 Organising the game

#### a. Understanding the local context:

To organize the games it would be important to understand the gender dynamics of the local context to determine whether a mixed group of men and women can be selected to play the game or if it would be more preferable to organize them in separate groups. The facilitator in coordination with local staff or representatives from the community should determine what is appropriate.

Understanding the local cropping pattern would also be important to better contextualize the game to the local situation. The facilitator by interaction with the local community and other development practitioners may identify different crops and classify them as less water requiring crops and water intensive crops. A list of 3-4 crops for each of these options should be identified and images of the same should be prepared for playing the game.

The facilitator may also interact with relevant people and organisations to have a larger overview of the bio-physical conditions prevailing in the village in terms of geology, soil type, forest cover and rainfall patterns to understand how they influence groundwater behavior. A historical understanding of changes in cropping pattern and its impact on groundwater and other water resources can also be understood to better engage with the local community.

#### b. Mobilizing the community and selection of participants:

The facilitator should coordinate with the local field staff, members of village institution or other influential members within the community to organize the local community members for the games. It may be helpful to also briefly share with some of the key members the approach of the game and some of the potential ways through which the tool may be useful to the local community to generate interest.

In the discussion with the community it should be clearly communicated that any member from the village or the habitation can participate in the game. To have a wider participation, efforts may be made to reach out to different social, economic, gender and age groups. Special efforts may be undertaken to have better participation of disadvantaged sections in the community. The table below provides an example of different groups who may be approached to play the game.

Different sections of the community	Why They are Important
Bore well owners and users	They can act on the results of the game and better coordinate among themselves for improved resource condition and economic outcomes.
Village Leaders and Key Decision Makers	These individuals have the most influence and they may help trigger village level discussion to craft rules and regulations to self-govern groundwater.
Representatives of different social groups (Caste, religious, political groups, women and youth)	Approach individuals from different social, economic and age groups to help trigger a wider discussion in the village and build an understanding of groundwater as a common resource. Bringing in representatives of different groups and households who may not be directly using groundwater, may help improve the understanding of how individual actions in the village indirectly impacts them. This may help reinforce the importance of collective action for groundwater management. Engaging youth and children may be useful in sustained use of such tools and methods to highlight complex issues, enrich the discussion at the village level and take informed decisions.

A minimum of 5 players are required to play the game. If the game is played where different players are rotated every few rounds, up to 50 people can play!

*Gender note:*

Based on the habitation, men and women may need to play separately. Ideally, they can play together so men and women learn from one another. This also provides women experience speaking publicly. This should only be done where possible to avoid harm.



### c. Selection of game site, timing and other logistics:

The facilitator in coordination with local field team and community members should identify the most appropriate location in the village to play the game and also the timings which are most suitable to different sections of the community. To improve participation of different groups it is useful to organize the game in a common place and arrange the timings so that it doesn't coincide with their working hours. Considering that women members have to cater to both household and agriculture & livestock related work, conducive timings should be worked out to enable their better participation.

Game site considerations	Time considerations
<ul style="list-style-type: none"> <li>● Distance from the village.</li> <li>● A place where everyone feels welcome.</li> <li>● A place which is feasible for women, aged and differently abled people to attend.</li> <li>● Enough space to accommodate players and other community members.</li> <li>● A place to display the flexi.</li> <li>● Common sites you may choose:               <ul style="list-style-type: none"> <li>- Under a large shade tree.</li> <li>- Shaded house veranda.</li> <li>- School room.</li> <li>- Community Meeting Hall.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Work in advance to select a good date and time of day for the game(s) and debrief when most people can attend.</li> <li>● Understand the daily and seasonal activities of the community which will be useful in determining a convenient time to play the game.</li> <li>● If the game is being played in the evening, care should be taken to have suitable lighting and the meeting should be in a central location of the village.</li> <li>● In the morning /afternoon, find a spot that will remain shaded, especially when it is hot.</li> </ul>



#### 4. Playing the game

##### 4.1. Setting up

##### 4.2. Introduction and building discussion

##### 4.3. Explaining the game using the flexi

a. Step 1: Explaining the crop choices, water use and returns

b. Step 2: Explaining the groundwater level

c. Step 3: Practice crop selection

d. Step 4: Practice round

Preparing the Groundwater

Graph

##### 4.4. Playing the game

Game 1: Without Communication-Cropping decision

Game 2: With Communication-Cropping decision

## 4. Playing the game

### 4.1 Setting up:



The facilitation team should arrive in advance to invite the local community and make necessary preparations in terms of displaying the groundwater flexi and public groundwater record in a place where it will be visible to community members.

The team should factor out additional time to organize the community, specially women and disadvantaged groups who may not have been informed or may be hesitant to play the game.

As the community members arrive the team should set up the flexi and public groundwater record using a rope or a strong tape. The team should make sure the flexi and public record are displayed in places that are easy for community members to see.

The sitting arrangements should be organised in a semi-circular fashion providing space for the players in the front and the community observers and other members who want to attend the meeting in the back.

### TIP!

The crop images and envelopes can be placed in places where the players will sit.

### 4.2 Introduction and building discussion

Welcome participants as they arrive so they feel comfortable with you. The facilitation team should enable an environment which makes the community open to ask questions and make suggestions and play the game in an informal setting. This will make the game more enjoyable and provides an enabling learning environment for the community as well as the facilitation team.

After most people interested in playing have arrived the facilitator may introduce herself/himself as:

***Good day. My name is \_\_\_\_\_ and I work with \_\_\_\_\_ (name of organization) in \_\_\_\_\_ (location). We came here to play the groundwater game.***

***Thank you for joining us to play a groundwater game today! Lowering groundwater levels that we use for household's consumption, livestock and crops is a major issue across India and in this area. Today we will play a game that resembles your real life. Later we will have a community meeting to discuss what we learned playing this game and what we can do as a village to manage groundwater levels.***

If the group is small, less than 15, have everyone say their names. Skip this step if the group is large. This should only take a few minutes.

To enable an informal discussion, understand the composition of the participants and finalize the crop choices, the facilitator may pose following questions:

***Who among you owns a bore well or use groundwater to irrigate crops in the dry season?***

Give some time to the community to respond. You may also ask them to raise their hand or informally discuss who all use groundwater to irrigate crops in the dry season. After the initial discussion you may ask,

**What crops do you grow during the dry season?**

As the community responds, pull out the crop images mentioned by them. It is okay if you do not have images for all the crops.

After the community has responded:

**Among these crops, select any two that you are primarily growing: one water intensive crop and a crop that uses less water.**

Once the group has picked one water intensive and one water conserving crop, tape one image on the flexi and hand out the rest to the players.

Invite 5 volunteers to play the first few rounds of the game. Have them sit in a semi-circle facing the flexi.

**TIP!**

Throughout the game, encourage women to speak. It helps in improving their participation and understanding their perspective on groundwater use and its impact. This also encourages men and women to work together to make cropping decisions, especially within the household.

**4.3 Explaining the game using the flexi (15 minutes)**

Before explaining the game, the facilitator may invite participants to share their understanding of the flexi. This would enable participation of the players and also gauge their initial understanding of the flexi. The facilitator may ask:

**What do you understand by seeing this flex? What is there in this? What do you understand?**

Encourage someone, preferably a woman, to come to the flexi and discuss what she sees.

**Why?**

Understanding the views of the community is important. By explaining to us what they see in the flexi, we learn what they understand about the game and they are more interested to hear the instructions, where they were right and what different things mean.

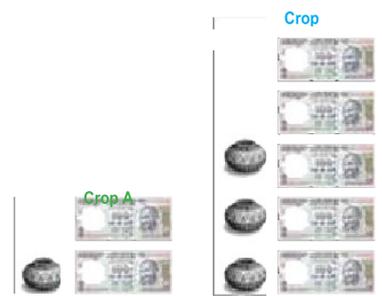
After hearing initial responses of the community, the facilitator would explain the game.

**a. Step 1: Explaining the crop choices, water use and returns.**

**In this game, Crop A uses less water. Three examples of crops that use less water: groundnut, millet and maize. Earlier, you selected groundnut (Crop A) as the main crop you grow that uses less water. We will play with groundnut (Crop A) in this game.**

**Crop B is water intensive. Our three examples include: rice paddy, sugar cane and tomatoes. Based on what you usually plant, you chose rice paddy (Crop B) to be your water intensive crop.**

**Here you see pots and currency notes. Each crop requires a different amount of water and fetches a different price in the market.**



**Water conserving crop - groundnut or Crop A requires 1 foot of water and in return gives Rs200.**

**Water intensive crop- rice (Crop B) it will use 3 units of water and gives Rs500.**

**In the game, you have to decide which crop you want to cultivate on an acre of land, Groundnut (Crop A) or rice (Crop B).**

**To repeat, groundnut or Crop A requires less water but also fetches less return, whereas, water intensive crop- rice (Crop B) will use more water but gives more returns.**

After explaining the crop choices and returns the facilitator should explain the groundwater levels and the meaning of the different colors on the flexi.

### **b. Step 2: Explaining the groundwater level**

**You have a common bore well that uses water from the same aquifer. The well starts with 50 units. You each have 1 acre to cultivate during the dry season. As you make your crop choices the water levels will fall. With rains the water level will recharge. However, if the use is more the water levels may not reach the initial 50 unit level. In the game there is a constant recharge of 7 units every year. To take into account the household use on drinking, cooking and other purposes, 2 units of water in each round or year will be deducted. We will explain this in detail later.**

**The groundwater from this bore well is for all uses. What do you use groundwater for besides irrigating?**

Listen for the following answers, including: Drinking, Bathing, Cooking, Cleaning, Caring for livestock

**We need groundwater for all of these reasons, including irrigation.**

**By mentioning the bore well photos, ask the participants, What do you think is happening at the different stages- what is happening in the blue, yellow and red zones?**

**After they answer explain the blue, yellow and the red zone. The blue zone is 50 to 20 units of water. In this zone, there is sufficient water for irrigating and domestic use. In the blue zone, there is constant recharge of 7 units.**

### **Tip!**

“Units” can be confusing for some communities, so translating ‘units’ to ‘feet’ or another common unit of measuring groundwater may help.

**The yellow zone is 20 to 10 units. In this zone the water level is low and groundwater is contaminated. While the water can be used for irrigation, it cannot be used for drinking. You have to pay Rs200 to get water from outside for household uses. There is still a constant recharge of 7 units each year.**

**In the red zone, the water is too low and cannot be used for irrigation. The soil is cracked. When we only have 10 units or less of groundwater, it means the well has dried up. At this level it is not possible to extract water for household use, irrigation and other purposes. Thus, if the marker gets in the red zone, the game ends.**



### c. Step 3: Practice crop selection

Pick up each piece as you name it and show the players how to make their crop choice.

***In front of each of you is an envelope, an image of groundnut (Crop A) and rice paddy (Crop B).***

Demonstrate the players how they will make their crop selection each year.

***When it is time to make your crop decision, you will place the image of the crop you want to choose into the envelop. Let's practice!***

***Everyone hold up the crop you want to plant or cultivate now. Place it in the envelope. We use envelopes because the crop you choose to cultivate is private, so this prevents others from seeing what you are choosing in the game.***

***This is how we will choose the crops in the game. While making the crop selection we have to take into account the groundwater levels and the returns on the crop. Let us now practice a full round of the game.***



### d. Step 4: Practice round

To demonstrate how the game will be played, the facilitator will explain how groundwater levels will change if all the players either choose Crop A or Crop B. This is only for illustration, so that players understand the range of options between which they have to make their crop choices.

***Let's practice! For the practice round 1 let us everyone choose crop A which is the groundnut. Everyone hold up groundnut (Crop A).***

Wait for participants to hold up the card.

***Okay. When all the 5 players have selected groundnut (Crop A), 5 units of water has been used.***

The Recorder writes this on P1 (Practice Round 1) of the Groundwater Record. The Facilitator moves the flexi marker from 50 to 45.

***How many units do we use for household purposes?*** Wait for audience to say 2 units, or if they don't remember say: 2 units. Move the flexi down 2 units to 43.

***How much do we get in recharge?*** 7 units. Move the groundwater marker up 7 units to 50.

***Since this is practice, we will only pretend to mark on the groundwater graph, but where should we put the mark at?***

The Record Keeper can help the Groundwater Graph marker to check that they know where the mark is to be made and the rest of the community understands this. Once done, point to the green line on the graph on the flexi.

***If all 5 farmers plant water conserving groundnut (Crop A), even though you are using water for irrigation and household purposes, water is recharging back to the initial level of 50 units every year.***

***Now, let us practice for one more round. In this round everyone selects crop B or rice. When all the 5 player's select crop B- Rice, everyone uses 3 units of water each and in total 15 units of water is used.***

***How much will the water level fall to?***

While waiting for people to respond, move the water marker to 35.

***How many units do we use for household purposes? 2.***

Move the marker down 2 units to 33.

***How much is the recharge? 7 units.***

Move the marker up to 40.

***Where would we put the mark on the groundwater graph this year?***

Again, the Record Keeper can check the point suggested on the groundwater graph.

***If we all plant crop A – groundnut, then the game will continue forever. If we cultivate rice -Crop B every time, then the game will reach the red zone and the game will end in 4 years. Between these two options there can be many other combinations.***

***When you decide which crop you want to plant, put it in the envelope. You do not need to reveal your selection to other players. The Recorder will come by and collect your envelope to write down your crop choice. The recorder will also pay you in dummy money the amount you will earn based on your crop selection. The recorder will not disclose your individual information to the group. The envelope is used to keep your crop choice secret so only you know what you've planted.***

## **Alteration!**

You can walk through the practice rounds - including how the Groundwater Record will be kept - during this explanation or you can wait until after the flexi explanation and have players do two practice rounds. Only practice during or after the explanation, do not practice twice.

## **Preparing the Groundwater graph**

An important component of the game is marking the groundwater level on the graph at the end of each year. This aims to continually provide information on changes in groundwater levels, which doesn't happen in many contexts in real life. The groundwater graph by better engaging the community, also gives them experience in basic water monitoring. The graph is also discussed at a later stage with the whole community to highlight how the game was played and the relation between crop decisions and the groundwater level.

To prepare the groundwater graph the facilitator may choose Method 1 or Method 2, explained below, based on facilitator experience and community setting.

Method 1: One Community Member marks Groundwater Graph

During the introduction, invite someone to volunteer to plot the groundwater graph. Explain that, ***this person will need to mark the final groundwater level each year and connect the dots at the end of the game. We will discuss the Groundwater Graphs during the debrief.***

Method 2: Community Members rotate plotting the Groundwater Graph

Explain during the game introduction, ***at the end of each year, we will mark the water level to see how it changes as we play the game. Everybody can take turns marking on the Groundwater Graph. We will discuss the Groundwater Graphs during the debrief.***

## 4.4 Playing the Game

The game is played in 2 parts- Game 1 without any communication or talking among the players, and Game 2 with communication.

In the first game (Game 1), players make their cropping decisions without talking to each other. They do not reveal their cropping decisions to any of the players. They play the game for 10 rounds or till the groundwater level hits the red zone. The facilitator does not need to disclose the number of rounds or the year upto which the game will be played.

In the second game (Game 2), players are allowed to talk to each other and discuss which crop they would consider suitable for cultivation. However, after they have discussed and made a decision, they have to make their individual cropping decisions without revealing it to other players. This variation is introduced to create a scenario, wherein, players may make their decisions collectively by considering the relationship between cropping decisions and groundwater levels.

In game 2, another variation is introduced after the third round, wherein, a dice is rolled at the end of each round to illustrate the unpredictability in rainfall which influences groundwater recharge every year. As in game 1, the players play the game for 10 rounds or till the groundwater levels reach the red zone.

The facilitator may shorten the number of rounds, if required. These alterations are explained in the last section.

### Game 1: Without communication -Cropping Decision

#### i. Revising game protocol with players:

***Let us play!***

***As practiced earlier, you now need to choose between two crops. In real life you may be cultivating many crops but we need to keep the game simple. So, imagine that you only cultivate two crops for the game.***

***On your acre of land, you can plant either– groundnut (Crop A) for Rs. 200 or rice (Crop B) for Rs 500 – that is your choice. But you can only grow one crop per dry season.***

***Crop choices are private so please do not talk when you are making your crop decision.***

***This is the game. Remember that both water and money are important so consider both when making your crop decision.***

***The game starts with 50 units of water. You each have 1 minute to decide the one crop you want to grow.***

***After you make your individual cropping decision, the record keeper will walk around and collect your envelope with your crop choice. She/he will write down your decision and I will put the dummy money in your envelope to pay you for the crop you selected. The record keeper will announce how many acres of each crop were planted in total by all the players.***

***We will then move the groundwater marker to signify the water used by all participants. We will also take into account 2 units of water for household use. After deducting the water used for irrigation and household use, we will add 7 units of water as recharge.***

***(Community members' name) will plot the groundwater graph, to signify the groundwater level at the end of each year.***

**Please again remember, the crop you choose to plant is a secret. Please, no talking while others decide what to plant.**

## ii. Players make cropping decision:

**Let's begin! You can make your crop choice now.**

And the game thus begins with players making their cropping decision.

Wait silently while participants make their crop selection by putting one of the images in the envelope. If they are taking longer than 1 minute, tell them time is up.

## iii. Recording crop choices and payment:

**Has everyone made their crop selection?**

**The Record Keeper will now walk around and collect your envelope with your crop choice. She/he will write down your decision and I will put money in your envelope to pay you for the crop you selected.**

Record keeper: Collect the envelope from the first person. Open the envelope. On a sheet of paper with the two crops written on top, mark which crop the player chose. Do not mark down which player chose which crop.

Facilitator: Follow the Recorder, looking at the crop image, pull out Rs200 or Rs500. Put the money in the envelope and hand it back to the player.

### Tip!

For privacy reasons, only facilitator and record keeper can know what crop each player has chosen.

Return the envelope back to the proper player. Allow them to look at the dummy money placed in the envelope, if they wish.



### Why?

Using fake money makes the game more real and is easier to connect to their experiences.

## iv. Calculating the groundwater level and illustrating it on the flexi with the groundwater marker:

The Record Keeper goes to the Groundwater Record, writes how many acres of each crop were planted and announces the crop results:

***This year, 3 acres of groundnut- Crop A were planted and 2 acres of rice-Crop B were planted.***

***3 acres of groundnut-Crop A uses how much water?***

Wait for the audience/participants to say: 3 units. You can give them the answer if they don't know.

Move the marker down 3 marks to 47 units. As the facilitator calculates the math, complete the Groundwater Record.

**2 acres of rice Crop B uses how much water? 6 units.**

Move the marker down 6 marks to 41 units.

**How much water do we use for household use? 2 units.**

Move the marker down 2 marks to 39 units.

**How much recharge do we get each year? 7 units.**

Once the audience says 7 units, move the marker up 7 to 46.



#### v. Announcing final groundwater level and plotting the groundwater graph:



Once the math is done, make sure the Groundwater Graph is properly marked.

**At the end of the year, we have 46 units of water. It's time to take the cropping decision for the next year.**

The Facilitator goes to the flexi to move the groundwater marker.

#### **REMINDER!**

After recharge, if the water level is in the Yellow Zone, 20-10 units, collect Rs200 from each player to pay for drinking water. Repeat this every year.

#### **Tip!**

If the math is too complex, the Groundwater Record is optional but it does show the community how to track groundwater levels. Focus on moving the groundwater marker and completing the groundwater graph

#### **Tip!**

After a few rounds, ask for someone to move the groundwater marker. When the community helps guide the game, they have ownership and understand better

#### **FYI**

Experience shows players making cropping decisions in the Yellow Zone make choice based on resource limitations and understand linkages better.

## vi. Ending game 1:

There are two ways to end the game:

### a. The well marker reaches the red zone

If the well marker reaches red zone (10 units of water), you may end the game by saying, ***Now the bore well has reached 10 units and is dried up. There is no longer any recharge for irrigating crops or drinking. Now what will you do?***

The above question allows the players to experience the impact of the well going dry and considering their options. There are no answers and should only take 1-2 minutes.

### b. It is the 10<sup>th</sup> round of the game

In some cases, the game continues above 10 units of water for 10+ years, because, communities will notice the trend of the crop choice influencing groundwater levels and they will plant groundnut (crop a) more. Up to 12 years can be played if the players are interested.

To end the game, you can ask them a question along the lines of,

***After 10 years you are still growing crops. Why is this happening?***

Wait for responses. You may also explain that, ***you are still growing crops because many people planted less water demanding crops. You are managing the water level. That is why you still have water.***

## Alteration: Rotate Players Throughout Game

After 2 to 3 years of playing the game, inform the players:

***We are changing players now. We want as many people as possible to play so every few rounds; we will change those that are making the crop decision. We will now rotate players and give other members of the community the experience of playing the game. Please pass your envelope with money and crop images to someone who is not playing the game. We hope you stay and continue to participate.***

After 2 or 3 more years, rotate the players again. If you rotate players every two rounds, then up to 50 people can play between the two games.

## Tip!

Consider the size of the group present when deciding how frequently to rotate players. For example, if there are only 15 people, you can rotate every 7 rounds, with the second group playing some of each game.

## Game 2: With communication-Cropping Decision

### i. Explaining the game

***Until now, you played the game without talking. You played like this was your land and your bore well. Without discussing anyone else's decision, you grew crops. But that is not happening in real life, everyone knows what crops you are growing because they can see your fields. You share your decision with other farmers and also consider other farmer's decisions while making your own.***

***So now all 5 of you can sit together and discuss. Take a decision together of what crops to grow and what crops not to grow.***

***In the first game, you're not sharing your crop images with others. This round, you can show your crop image while discussing with fellow players. No problem. After your discussion with the other players, just as the first game, you must not share your final decision with other players.***

**Now you have 1 minute to decide the crop so everyone can share their voice and arrive at a decision.**

**You all have your own requirements and water availability to decide which crop you want to cultivate. You will have one minute to discuss and take your cropping decisions.**



## ii. Playing the game

You may ask participants if they have any ambiguities regarding how they are to play the second game, after which you may continue playing the game as in the first game, recording player's crop choices, handing out money, announcing the results, moving the water flexi, and marking the Groundwater Record and Groundwater Graph.

### TIP!

From the first game, the community knows the 1 minute rule. They think about how they have to buy seeds, money for education, government subsidies, their daughter's wedding, etc. Sometimes they have good discussions that go beyond the game, so remind them they only have 1 minute by asking if all have made their crop decision yet, because time is coming to an end.

As the groundwater level lowers, they may start taking crop holidays - not planting at all. This is okay. Don't suggest it but if it happens, let them.

## iii. Using dice to determine recharge

Play the first 3 rounds with 7 units of recharge. In year 4, take the crop decisions and announce crop and domestic water use. And proceed to introduce the reason for introducing a dice in the game.

**Up to now, in our game, the groundwater recharged the same 7 units every year. Is this happening in your real life? Is the game correct?**

[Players may respond: No, it's not happening, this year we don't have good rainfall, we got that severe rainfall 4 years ago...]

**You're right - rainfall and recharge vary. I'll show you one thing.** Show dice to the community. **Have you used dice?**

**These two dice will determine the recharge now, to reflect your real life. The side with six dots is covered up. This is worth zero, where we receive no rains.**

Find someone not playing the game to roll the dice.

**She/he will roll the dice and whatever the dice says, we will recharge that many units. You can get anywhere from 0 to 10 units of recharge.**

Have the volunteer roll the dice. This recharge amount should be reflected on the groundwater flexi, groundwater record and groundwater graph accordingly.

**For the rest of game, the dice will decide your fate. You have 1 minute to discuss and take a cropping decision now.**

Year 5, after crop and domestic water use has been announced, ask:



**How many units of recharge do we get?**  
**We don't know. Again, time for the Rain God to roll the dice!**

### **FYI**

The community enjoys the unpredictability of the dice. Often, they refer to the individual rolling the dice as the 'Rain God'. If they only get two units of rain, they may joke, 'This rain god is no good.' People like children, so it's a fun way to engage them.

### **iv. Ending the game**

The game may end in two ways:

#### **a. The bore well has less than 10 units of water:**

If the bore well has less than 10 units of water (red zone), you may conclude the game by saying,  
***Now the bore well has reached 10 units and is dried up. There is no longer any recharge for irrigating crops or drinking. The game is over.***

#### **b. It is the 10<sup>th</sup> round of the game:**

If the game continues for 10 rounds you may conclude by telling participants,  
***You are still growing crops after 10 years because many people planted less water consuming crops. You are managing the water level. That is why you still have water. After 10 units we end the game but still you are continuing. We will end this game now.***

Finally, the game can be concluded by inviting community members to participate in the debriefing session.

***The game is over now. There will be a community debrief session. Please come to the session and share your views. We look forward to discussing the game and what you experienced. We will talk about how the game was played, what we learned and what we might do as a village. Thank you for your time.***

### **FYI**

The game can end a third way. Sometimes, community members, especially women, are busy, so they plant rice (Crop B) to end the game quicker. This is okay, it shows they understand crop choice influenced groundwater.

## **Alteration**

If the community is short on time, make all the changes into one game:

**3** Rounds with no talking

4th round: players can speak 5th round: introduce dice

If only playing one game, ensure that is played until there is no water left or players have at least spent a few rounds in the Yellow Zone where they have to pay for water.

Experience indicates that when players get to the yellow zone and have to pay for water, they play accordingly, either planting less water consuming crops or taking crop holidays. This is an important part of the game - how to make informed decisions when there is not sufficient water. The Groundwater Graph helps the community visualize the difference of water levels on how they chose crops. Only playing one game may be ineffective and should only be done with a facilitator who has played the suggested game many times and knows how to facilitate the key messages in a shortened game.



5. Community Debrief
  - 5.1. Groundwater Trend Line Exercise
  - 5.2. Discussion
  - 5.3. Crop Water Budgeting

## 5. Community Debrief

The community debrief is a very important component of the game. It provides a platform for both the facilitation team and village community to share their experiences, lessons from the game and discuss future steps which may be taken to strengthen local governance of groundwater. The debriefing by triggering discussion on the interconnectedness between cropping patterns and groundwater use, provides a setting, wherein, the community discusses ways and means to address groundwater related issues collectively.

There are two ways to structure the community debrief:

### Trend line Exercise and game discussion

1. Conduct Trend line Exercise so that the community considers the history of their groundwater and how they have come to their current situation.
2. In the Game Discussion, link the Trend line Exercise just completed with the Groundwater Game previously played.

### Game Discussion and crop water budget

1. Use the Game Discussion to help the community reflect on their experiences in the game and link the key concepts in the game with their lives.
2. Present the Crop Water Budget results to the community to reinforce the concepts in the game with actual data collected in their village.

The next few pages will discuss the three components - Groundwater Trend Line Exercise, Groundwater Game Discussion, Crop Water Budgeting. Depending on your approach, use the components that fit your situation.

### 5.1 Groundwater Trend Line Exercise

The trend line exercise is a participatory method to help the local community discuss the history of their groundwater resource. The questions asked during the exercise, helps illustrate how changes in bore well use and crop choices overtime has influenced groundwater levels. This tool helps to tangibly link the game with their real life experience.

The following table states the material required for the trend line exercise and also mentions the roles of the facilitation team members:

MATERIAL REQUIRED	ROLES
<ul style="list-style-type: none"> <li>• <b>If tracing the trendline on the ground</b> (e.g. under a tree, on a mat) Large sheet of paper with a straight line across the page and markers</li> <li>• <b>If tracing the trendline on floor</b> (e.g. House, school, local hall) chalk</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Facilitator</b> Guides the exercise by asking the community questions. Writes the community's simple responses on the paper (number of bore wells, depth, crops, etc.).</li> <li>• <b>Note taker</b> Writes down community explanations to why changes occurred. This learning document can help understand the communities' situation.</li> </ul>

When mobilizing the community, request elders who have a good knowledge of the village's history to attend the debrief.

Following is an illustration of how to conduct the trend line exercise.

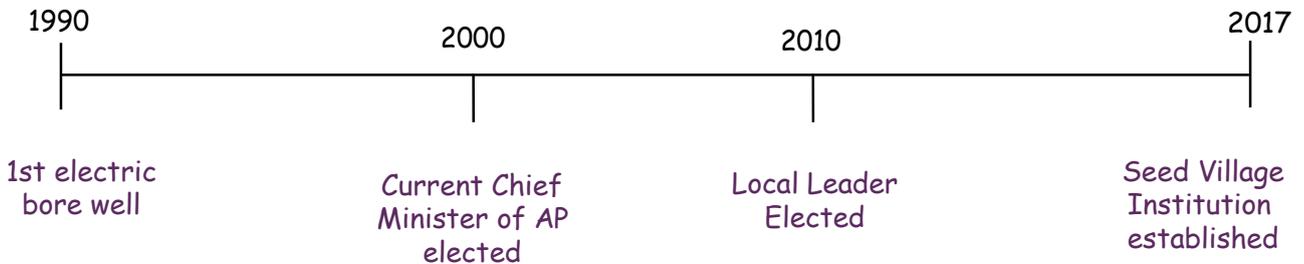
**Let's discuss your real life situation. We will go back over the past 30 years.**



Point to the Trend line on the sheet of paper. Write "30 years" on the left end of the line. Write "Now" or "Today" on the right end of the line.

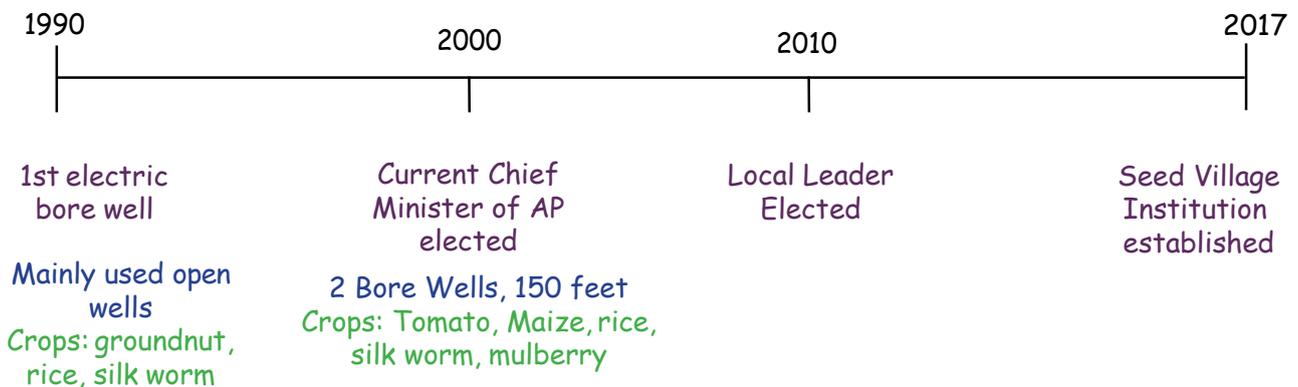
Ask the community for 3-5 key milestones in the community's history that highlight major events over the past 30 years. This helps with memory recall throughout the game. For example:

- **Who was the Sarpanch then?**
- **When was the school built? Tar road laid?**
- **When was the village electrified?**
- **When did you start to work with FES?**



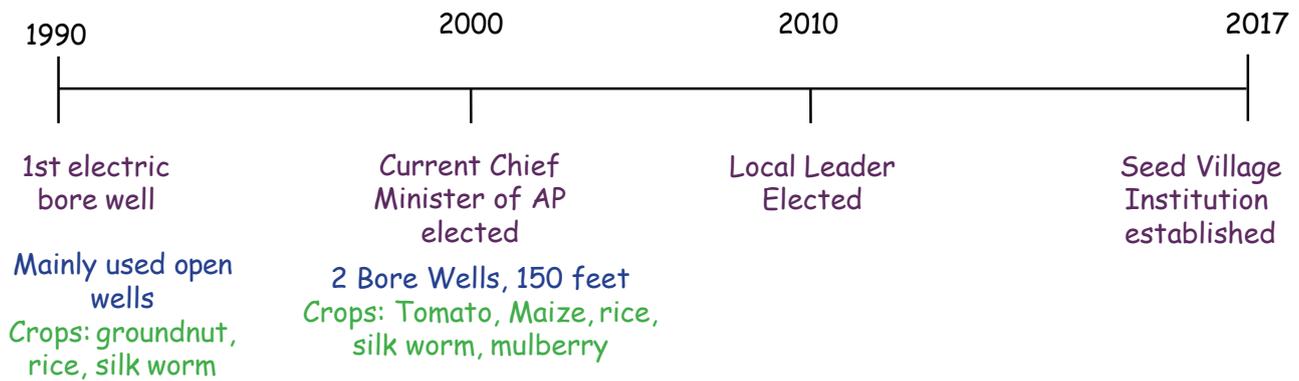
Ask a series of questions and write the response on the trend line. Start with the 1st electric bore well in 1990, ~30 years ago:

- **How was rainfall?**
- **How many bore wells were there?**
- **If there were bore wells, how deep were they?**
- **What crops were you primarily cultivating?**



Go to the next milestone, 2000, ~20 years ago. Ask the set of 3 questions again:

- **How many bore wells were there? If there were bore wells, how deep were they?**
- **What crops were you primarily cultivating?**
- **How was rainfall?**



If there were any changes from the previous points, ask: **Why?**

BORE WELL	CROPS	WATER
<p><i>Why did you start to dig bore wells?</i></p> <p><i>Why did you dig deeper bore wells?</i></p> <p>If relevant: <i>Why did you stop digging bore wells?</i></p>	<p><i>Why did you shift the crops you were cultivating?</i></p> <p><i>Why did you shift from <u>groundnut</u> to <u>tomato</u>?</i></p>	<p><i>Why was there a lack of water?</i></p> <p><i>Why is there a lack of water in the bore wells now?</i></p>

Continue this process until you have captured all the relevant information.

**FYI**

Some responses have included:

**Why change crop?** [There was good market demand so it sold for a good price.]

**Why dig more bore wells?** [We didn't have surface water so dug more bore wells. As groundwater levels dropped, we dug more and deeper bore wells. Now some bore wells go dry.]

**Why is there a lack of water?** [The rains have been poor. That is all.]

**5.2 Groundwater Game Discussion**

**Preparation**

Display the Flexi, Groundwater Record and Groundwater Graph such that it will be visible to the community during the debrief.

**Good day. Thank you everyone for coming. Today we are talking about the groundwater games we played. Can someone from the women's group please explain the game you played?**

As the person is explaining the game, make sure these points are made, or posed to the community after the review:

- \* The parts of the flexi: crops, how much water needed and currency received
- \* Bore wells are used to irrigate 5 acres, 1 for each player.
- \* Bore well starts at 50 units, 20-10 units is low water levels so have to pay for water, less than 10 units game ends.
- \* Get recharge of 7 units every year, then had a Rain God and rolled dice for recharge
- \* Game ended when reached 10 units in the well or we reached 10 years

**Tip!**

Try to get a woman volunteer, if no one is willing, ask a man who played the game. In the past, when the community was quiet, a child who observed the game was able to come up and explain the game.

## FYI

When discussing bore well depth and getting water, sharing Crop Water Budget data better clarifies this for the community, where the game and trend line may not be as effective.

***Can the community members who made the Groundwater Graph please explain what you drew?***

Give the community member a few minutes to explain the Graph. Ask the community:

***Did you find any difference between the two games? Why did you finish water sooner in the first game?***

[In the first game, our choice was private. The second round, we considered other farmer's opinions.]

***How did dice change the way you chose crops?***

***When the water level was decreasing, you took a crop holiday. Why was this?***

[If we don't have water for irrigation, at least we have water for drinking so we chose not to plant.]

***Was the game similar to your real life?***

[Yes, if everyone grows paddy, the bore wells will dry up.]

***What did you learn from this game?***

[Make cropping decisions based on water availability.]

***Why is your bore well depth increasing? Why are there more bore wells?***

[Less water available]

***If you dig a bore well at 1,000 feet, are you sure you'll get water?***

[No. It's like gambling. Who knows if water is there or not? But we have some hope that we may get water if we dig deeper.]

***Is this game useful for you?***

[Yes, this is how we plant crops and depend on water, so this is useful. We can use this information when choosing to irrigate our crops.]

***From the Trend line, you mentioned that you don't have as much water. Why are you still growing the same crops as before when you had more water, like tomato?***

Explain:

***In the game you had your own bore wells but level went down for everyone the same. Similarly, in real life everyone shares an aquifer. Suppose you have a bore well. I dig a bore well 5-10 meters away from you. Once I dig my bore well, yours dries up. That means we share the same aquifer, but nobody has the sole right to this resource. But everyone feels it is on their land so they have rights to it. Groundwater is not our own, we don't have any rights. Because of this, there is a law limiting how close bore wells can be dug to one another, but it is not enforced.***

***This is your situation. What can we do with this information? How should we take action?*** [Ideas: less bore wells, crop less water using crops, water harvesting structures, use sprinklers, etc.]

### 5.3 Groundwater Crop Water Budget

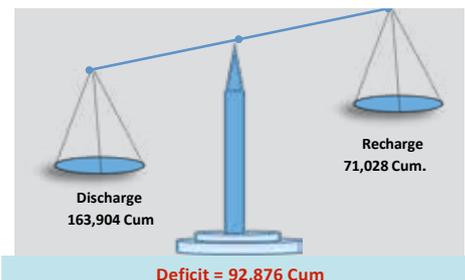
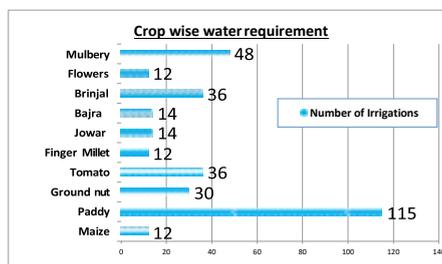
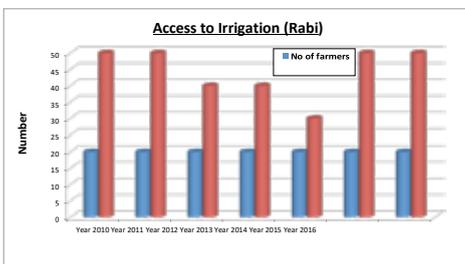
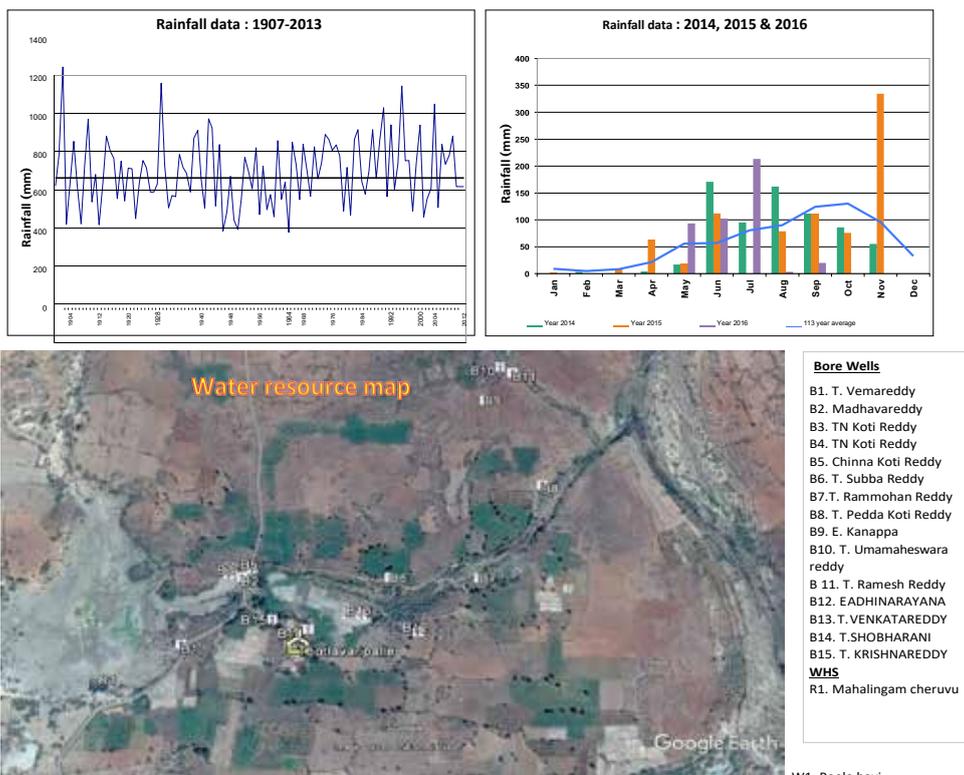
Crop Water Budgeting is a tool which assists communities towards sustainable use of water through highlighting the balance in demand and supply, such that water consumption does not exceed the limits of recharge through rainfall, stream flows and surface water storage.

An Excel-based Crop Water Budget tool has been developed and loaded onto Android-based tablets. It is used to calculate the surplus or deficit of water that may prevail during the Rabi (dry cropping) season. Water availability during this season is estimated based on the number of surface water bodies, open wells, bore wells, other water harvesting structures and also the rainfall during the monsoon period. This data once uploaded calculates the availability of water for crops during the dry cropping season. Presenting this information to the community can help trigger debate and discussion on water as a collective resource and the need for better governance.

The following image illustrates the Crop Water Budget Data of a village in Andhra Pradesh.

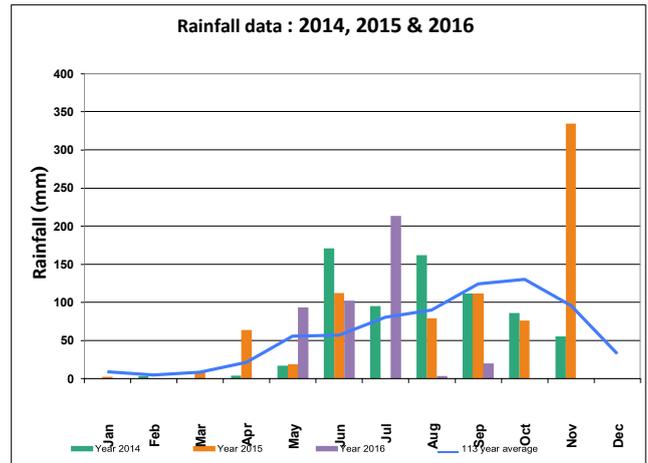
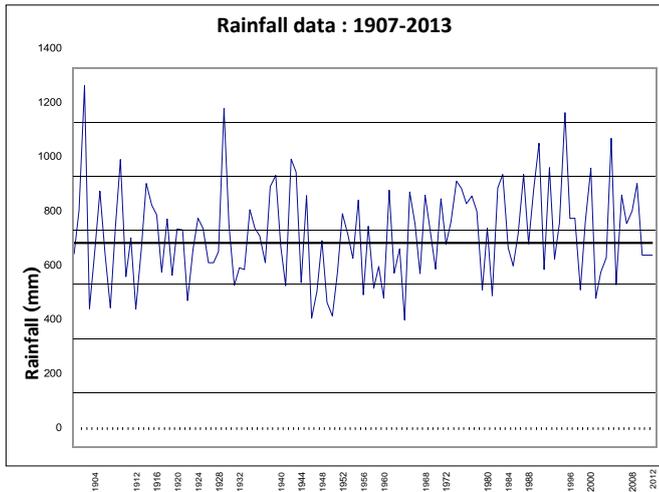
#### CROP - WATER PLANNING : RABI 2016

##### Thotlivaripalle village, RN Thanda GP



Village	: Thotlivaripalle
Mandal	: Thambalapalle
District	: Chittoor
No of Families	20
Total Area (Ac)	200
Agriculture land (Ac)	100
No of Bore wells	15
No of Open wells	1
No of WHS strcutre	1

**This Crop Water Budget was made from information for your village, \_\_\_\_\_ . This is the groundwater situation here. It explains how much water is available, how it is accessed, the crops you are growing and how much water they require.**



**This is historic rainfall data. As you can see, overall, we are getting more rain than in the past, but extreme weather events like floods and droughts are becoming more common.**

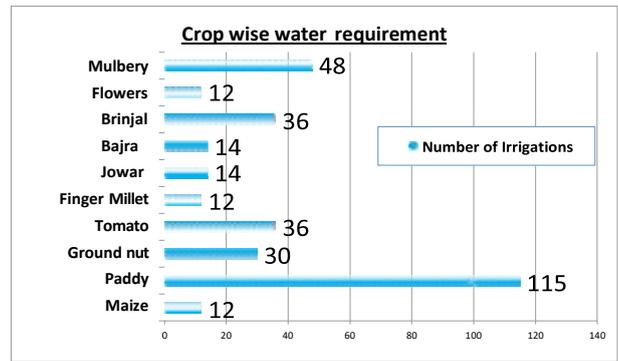
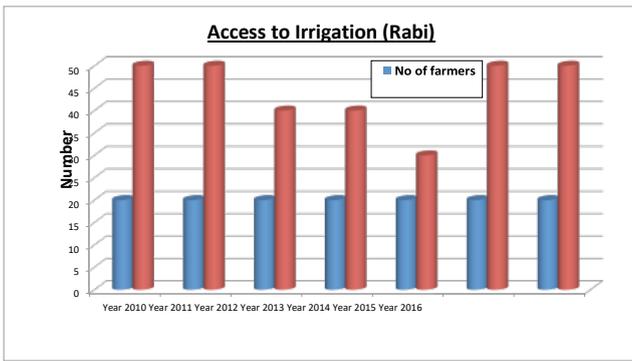
**This is the monthly rainfall your village received the past 3 years. This is the flood we had in 2015.**



- Bore Wells**
- B1. T. Vemareddy
  - B2. Madhavareddy
  - B3. TN Koti Reddy
  - B4. TN Koti Reddy
  - B5. Chinna Koti Reddy
  - B6. T. Subba Reddy
  - B7. T. Rammohan Reddy
  - B8. T. Pedda Koti Reddy
  - B9. E. Kanappa
  - B10. T. Umamaheswara reddy
  - B 11. T. Ramesh Reddy
  - B12. E ADHINARAYANA
  - B13. T. VENKATAREDDY
  - B14. T.SHOBHARANI
  - B15. T. KRISHNAREDDY
- WHS**
- R1. Mahalingam cheruvu

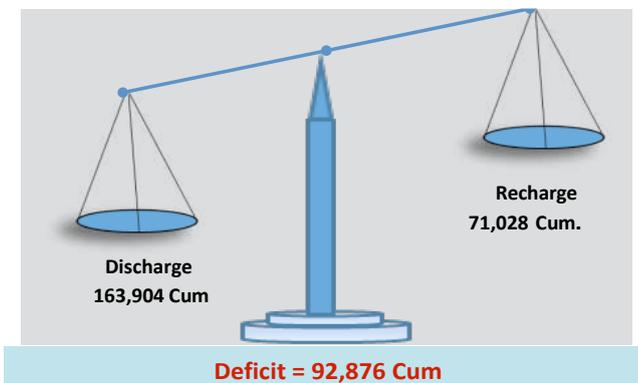
W1. Poola bavi

**This is a map of water sources in your village and the surrounding lands. There are 8 rivers, water harvesting structures, ponds or other surface water bodies. There are 3 open wells and 19 bore wells. You can see that some bore wells are close to one another, this can cause the shallower wells to dry up.**



*This shows how many acres of land were cultivated during kharif (rainy) and rabi (dry) seasons since 2010. Many acres were planted in 2015, the same year that it rained a lot.*

*Crops have different water requirements. Rice/Paddy requires 115 irrigations - everyday for 4 months. Groundnut requires 30 irrigations, etc.*



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*This is a balance. You shared with us the crops you want to plant next season. On the left side is how much water you will need. On the right side is how much water is available to you in your aquifer. As you can see, there is a deficit of 107,359 m<sup>3</sup>. This means there is will not be enough water to irrigate your crops during the entire rabi season. Without sufficient water, the crops may fail.*

*This is a summary of basic information collected during the crop water budgeting exercise. It includes the village name and location, number of households, acres of agricultural land, and water sources.*

*This is the situation in your village. How many bore wells were working 5 years ago? 19 How many bore wells are working today? 12*

**Why do you think this has happened?**

*If the community is not aware, explain: The bore wells that stopped working had newer, deeper bore wells dug near them. The bore wells are connected to the same aquifer, so the shallower wells go dry once deeper bore wells extract more water. But nobody has rights to groundwater - it belongs to everyone. What can we do to overcome this situation?*

## EXPLORING COLLECTIVE ACTION WITH A GROUNDWATER GAME IN RURAL INDIA

Thotlavaripalle, a village of 56 families in the semi-arid region of Chittoor District, Andhra Pradesh, India was characterized by cyclical droughts and lowering groundwater levels. Extensive extraction of groundwater was prevalent on account of digging bore wells over the years and cultivation of water intensive crops during the dry season. As more and deeper wells were dug, older ones began to fail, causing a debt trap that forced many to migrate.

The villagers in Thotlavaripalle were planning to cultivate 27 acres of paddy the year the groundwater game was played in the village. However, after playing the groundwater game and doing the crop water budgeting exercise, the villagers planted 23 acres of groundnut and left 4 acres empty to conserve water.

Jayaram Reddy a farmer from Thotlavaripalle said that, “Given the groundwater situation, if we had opted for paddy we would have exhausted groundwater completely. With the crop water budgeting exercise and groundwater game, we have got awareness as to which crops to grow to save water and which crops to select that require less water. When it rains, the water table pushes up and bore wells get recharged considerably well for subsequent crops. In our village, we have village institutions where we consulted each other and 20 households have collectively resolved to grow groundnut instead each one of us growing different crops. Because of this we got good returns and in addition animals have fodder to eat. The crop residue is good fodder and has increased milk yields, so we have increased dairy income too”.

Ramesh Babu Bethi, a FES Program Manager from the Papagni River Basin Regional Office, highlighted the impact of the game across, multiple locations by stating, “We were using both of the tools to get information to farmers in 21 villages. In a few villages, there was a ban on digging more bore wells. In a few villages, there was a ban on taking up the paddy in rabi season. In a few villages, farmers switched from paddy and tomato to finger millet and groundnut. This saves a lot of groundwater.”

Therefore, the groundwater game as a participatory tool, demonstrates the potential to trigger discussion within communities to improve the local governance of groundwater.

The game is being scaled up as FES works with the Government of India and IFPRI adapts the game to fit the Sub-Saharan Africa context.











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