Water Classroom 3-2(2) (version 2)

Water in Agriculture - part 2

Teaching plan for learning on water for middle school students

Under a project initiated by the Living Waters Museum, Centre for Water Research, IISER Pune and Research and supported by Transforming Education for Sustainable Futures, IIHS, Bangalore

3-2(2)-1 Proposed plan

Lesson Plan number	WC-3-2(2)
Topic	Water in Agriculture-part 2
Discipline	Social studies
Time	165 minutes (can be divided into multiple sessions)
Prior learning	important food crops, cropping seasons, Virtual water – Module 1, topic 1-4. Water in agriculture- prat 1 – Module 3, topic WC-3-1(1)
Learning objectives	● Students *appraise* farmers' stories from the perspective of environmental and economic sustainability, *examining* which crops they can grow based on the different levels of resources (land size, soil type, water availability, monetary capital, access to training) available to them ● Students *determine* some factors that can lead to successful community management of water, from a success story of community management of water in a drought- prone area ● Students *formulate* a plan for one of the case study villages, for successful community management of water, with

	particular reference to rural women
Learning outcomes	• Students *assess* the environmental and economic sustainability of a farmer's choice of crops from a case study, based on what they have learned about soil and water requirements of different crops, groundwater extraction patterns, and climate. • Students *determine* 3 factors that can lead to successful community management of water from a video clip about Hiware Bazaar village, Ahmednagar district, Maharashtra- a drought-prone area • Students *design* an action plan for one of the case study villages, *illustrating* how the village community can manage their water successfully, with particular reference to equal access to quality of life of rural women
Resources/materials	WC-3-2(2)-Activity-I • Worksheet • Slide with questions WC-3-2(2)-Activity-II • Maps of the case study villages (attached in this folder, see pdf file AgriWater1 and 2) • Worksheet with observation tables (either printed or students can make on in their notebook) and questions WC-3-2(2)-Activity-III • Video documentary on Hiware Bazar (selected 10 min of clips) • Worksheet with questions

	• chart paper • markers
Use of teaching time	**5 mins** Opening remarks and introductions *Refer to - appended ppt file – WC-3-2-2-ppt-WaterinAgri-2* **20 mins** Facilitator/educator will say "Let's think about what we know so far about agriculture and farmers." They will handout the worksheet associated with WC-3-2(2)-Activity-I and give instructions: ask students to take 10 minutes to think about the questions and write down their thoughts individually, then discuss with a table partner. The facilitator/educator will then pick 5 random students from different table groups to briefly present their main findings in 1 min each. The facilitator will address any gaps or confusion to wrap up. **45 mins** Assessing farmers' perspectives Quickly review important subsistence and cash crops in different cropping seasons by showing slides. Quickly provide an overview of the 3 cropping seasons, both subsistence and cash crops sown in each season, and water sources used in each season. *Refer to –* *-appended ppt file – WC-3-2-2-ppt-WaterinAgri-2* *-Background content for facilitators/educator from topic WC-3-2(1)*

	15 mins Facilitator/educator will briefly explain different irrigation methods followed by the groundwater crisis in India with slides, explaining diagrams that show the environmental and economic dangers of high groundwater extraction for cash crops like sugarcane in low rainfall areas like Maharashtra and Andhra Pradesh/ Telangana. -Highlight the role of politics- subsidised electricity in causing the lowering of the water table, and unequal access to electricity for running pumps in E. India. -Briefly explain market factors that affect the cropping patterns and hence the water extraction - cash crops, non-native crops, making seasonal agricultural products available throughout the year. *Refer to –* *-appended ppt file – WC-3-2-2-ppt-WaterinAgri-2* *-Background content for facilitators/educators – 3-2(2)-2a-c* **30 mins** Facilitator/educator will conduct activity - WC-3-2(2)-Activity-II - 'Understanding farmer's narratives' by analysing a case study of an individual farmer. Facilitator/educator can take the example of one of the farmers to help students understand how to read the map and farmer narratives.

	Refer to – - WC-3-2(2)-Activity-II - *appended ppt file – WC-3-2-2-ppt-WaterinAgri-2* Students individually assess environmental and economic appropriateness of a farmer's choice of crops based on what they have learned about matching crops to soil and water availability by completing a worksheet - WC-3-2-2-worksheet-Farmer case study They share their findings within each student group. Finally each group presents their findings to the class. There is a brief discussion on environmental and economic appropriateness of crop choices. *Refer to –* *- appended file WC-3-2-2-worksheet-Farmer case study* **30 mins** Facilitator/educator will divide students into new groups of 4 or 5. They will give each group of students a sheet of coloured chart paper and markers. They will show 10 mins of selected clips from video documentary on Hiware Bazar THE MIRACLE WATER VILLAGE Ask students to discuss in their group and write down 3 important factors that led to the success of the Bhiwade Bazaar community initiative- especially in terms of competition for water (especially groundwater)? Facilitator/educator will assign a village from WC-3-2(2)-Activity-II to

	each group. Students discuss what they have learned and write down 10 bullet points for an action plan for the village assigned to them on their chart paper, outlining how the village community can manage their water sustainably and successfully. They need to show at least 3 specific bullet points to improve access to productive farming resources of village women. OR the group can conduct a role play to discuss, prepare and present their action plan in the format of a village meeting with the following roles: ➔ sarpanch, ➔ woman farmer, ➔ small farmer, ➔ landless labourer, ➔ prosperous farmer with lots of land At the end of the session, we request the facilitator/educator to upload the photos of the groups' village design or video of their roleplay on a webspace (google drive) and share it with the Water Classrooms team using the email given in 'Contact Us'. **20 mins** Facilitator/educator will allow each group 3 mins to present their plan. **10 mins**

	Facilitator/educator will summarise and address any gaps and confusion to wrap up
Differentiation	Change level of scaffolding for individual students based on the age group and level of your class.
Additional activities	Research changing water requirements of the same crop for different soil types. Research changing water requirements at different stages of crop- growth, flowering, fruiting.
Anticipated challenges and solutions	Time constraints
Keywords	Crops, farmer, agriculture, land, well, irrigation, community, water-intensive, market factors, economic concerns, groundwater extraction

3-2(2)-2 Background content for facilitators/educators:s

3-2(2)-2a Irrigation practices

In non-monsoon seasons, farmlands need to be irrigated using water available in the dams or wells. Check dams, canals, percolation tanks are the surface water storages. Borewells and dugwells are the groundwater storage structures used for irrigation.

Water storage structures used in irrigation in non-monsoon months. (Clockwise from top) Check dam, canal, borewell, dugwell

Traditional practices - Farms were irrigated from the canal or well water through furrows made in the farm. Bullocks were used to extract water from wells.

Furrows used for irrigation

New/ non-traditional practices - nowadays water is fetched from sources using a pump. Instead of watering through furrows, sprinklers or drip irrigation is used.

3-2(2)-2b Change in water requirement at different stages of growth

Water requirements are different at different stages in the life cycle of the crop. More water is required at flowering stage and pod formation. Missing this watering leads to significant change in the crop yield and it further affects the net product. Also note that farmers cut the water supply for a couple of weeks to kickstart the flowering stage.

Non traditional practices of irrigation include sprinklers (left) and drip irrigation (right)

3-2(2)-2c Market factors i.e. economic constraints on agriculture

Why do farmers go for more water intensive crops when less water intensive ones are available? The reason is the market! Not all crop products are equally valued at the market. Cash crops like sugarcane and cotton can give more returns than food crops. At the same time non-traditional ways of farming increase the cost for farming. In order to sustain economically farmers choose hybrid varieties of seeds. These hybrid crops can guarantee more yield but they require much more water than the traditional seeds.

Have you ever wondered about the dragon fruits in the market? You may think that they are imported from foreign countries as they are not native to India. But you are wrong! Many farmers give priority to crops like colourful capsicums, broccoli, and dragon fruits which give high returns. But these non-native crops demand more water.

Some crops require more water but sell better in the markets. (Clockwise from top) Sugarcane crops, Cotton crop, different coloured Capsicum Peppers, Dragon Fruit, Broccoli

Have you wondered how seasonal fruits and vegetables are made available throughout the year? How will this affect water availability for other crops?

3-2(2)-2d Sustainability

Is water unlimited? What will happen if we constantly keep on extracting groundwater? At the same time, the economic equation of farming should also be balanced at the farmer level. For the economic benefit, farmers do want to extract more water. Because of this economic as well as hydrological sustainability should go hand in hand. Finding the ways to achieve the same is the next big challenge for humanity.

Water Classrooms WC-3-2(2)-ACTIVITY-I

1. Imagine you are a farmer. List 3 activities you do that require water.

2. If you were a farmer growing crops all year- round, name 3 possible sources where your water might come from? Answer in 2-3 words/phrases.

3. Would a farmer in Vidarbha depend on the same water sources as a farmer in West Bengal? Why or why not. If no, then can you identify 2-3 factors that are responsible for the difference?

4. What water sources would each farmer depend on during the Monsoon season? During the winter season?

5. Who is responsible for managing your farming water? Who is responsible for managing the water reaching your home? If your farming water supply and domestic water supply are managed differently, why? Explain your answer.

6. Are there any prosperous farmers in India? If yes, identify 2-3 factors that helped them to become rich? If yes, where in India can we find most of them? What gender are they likely to be?

Water Classrooms WC-3-2(2)-Activity-II

Understanding farmers narratives:

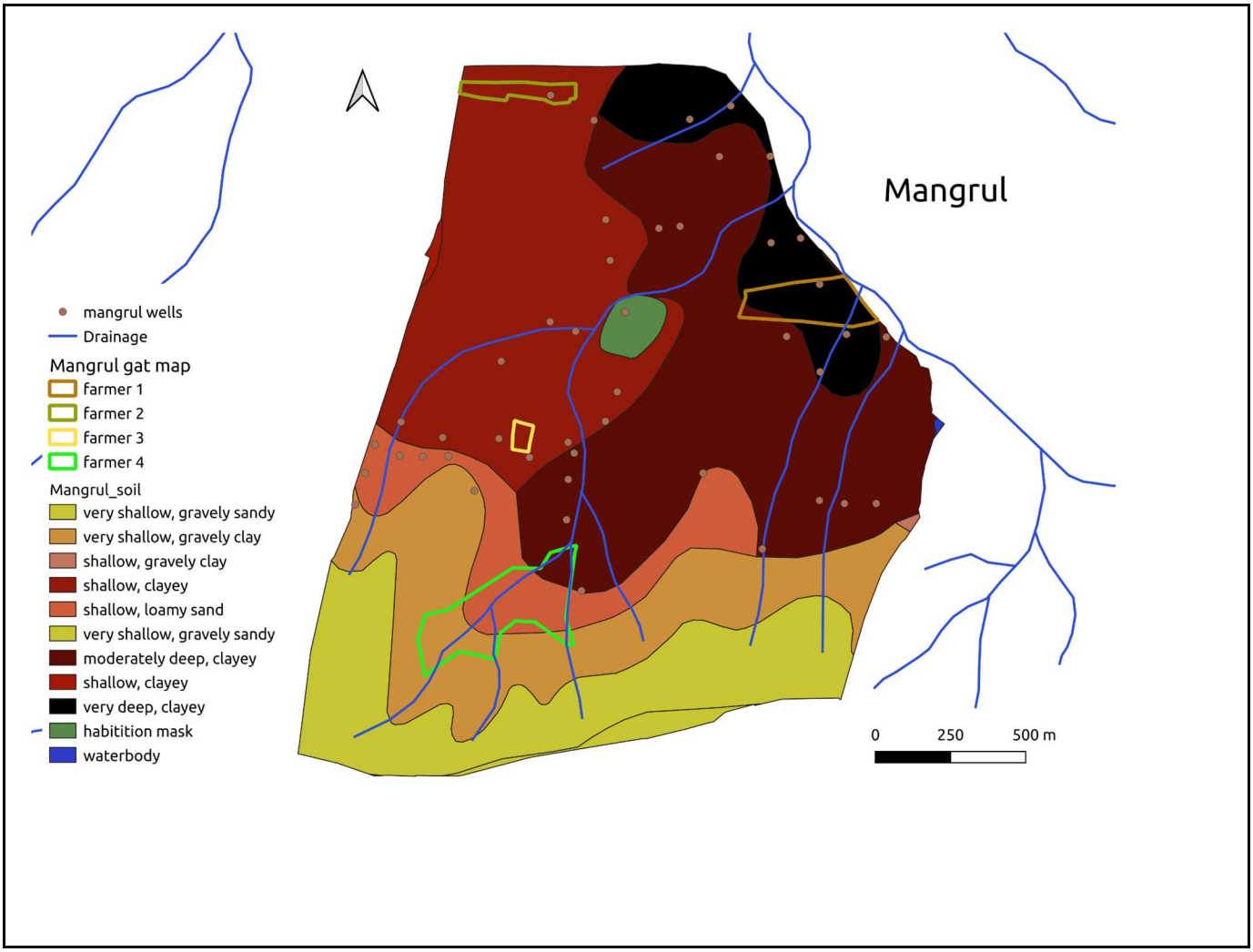
How do farmers decide which crop to sow? How do resources like soil, water, and weather affect farming? How do market factors change the cropping patterns? Let us understand the farmers' perspectives! Please note that the farmer's narratives presented here are a few representative cases, and do not speak for all farmers.

Instructions:

1. Students are divided into groups of 4-5.
2. Each group is given one village - Mangrul or Kekar Jawala.
3. Each student in a group will take up one farmer from the village allotted to their group. They will read the narrative of that farmer and understand it. They will use the map of their respective village to understand their land.
4. All students will individually fill out the worksheet – appended as file - WC-3-2-2-worksheet-Farmer case study
5. Students will first discuss within the group.
6. Each group will contribute to the follow-up class discussion

Village 1: Mangrul

Village Mangrul is in the Nanded District of Maharashtra state. This village is mainly rainfed and does not have any surface water storage i.e. percolation tank or check dams. The village does not get any irrigation from the canal networks as it does not lie in the catchment area of any dam. Here are some farmers in the village telling their stories. (the stories were adapted from the farmer narratives collected during the field visit in October 2021)



Farmer 1: **Story of Appa**

Appa has a farm in fertile land adjacent to the stream. His farm is large and well connected to the stream water. He uses a pump to irrigate his farm during non-monsoon time using stream water. Because of the perennial stream, he can farm throughout the year. In monsoon or kharif season he sows cotton on his entire 8 acres of land. In the winter or rabi season he sows 4 acres of wheat and 2 acres of jowar. Once jowar is harvested in the beginning of summer, he sows mung beans (green

gram). He has enough water for wheat (around 8-10 waterings) and jowar (6-7 waterings). So the yield for rabi and summer crops is good. Along with farming he also has cattle, which provide him with a supplementary source of income.

Farmer 2: **Story of Babloo**

Babloo's farm is medium-sized and is away from the river but he has a borewell. Because of the borewell he can grow crops during rabi season. If there is a dry spell during the monsoon, his borewell provides protective irrigation for cotton- his preferred kharif crop. In 2021 his cotton yield was 8 quintal/acre. In the past his main rabi crop was wheat. But nowadays many farmers are digging borewells, so there is competition for water. This has led to lower water availability for Babloo. In 2019, he wasn't able to provide the last two waterings for his wheat crop, which led to a reduction in crop yield. Because of the uncertainty of water availability in rabi season, he has shifted to gram which requires less water than wheat (wheat takes around 8-10 waterings whereas gram requires 5-6). In 2021, the yield of gram was good which gave him good monetary returns. Farming is the only source of income for Babloo. He wants his son to study hard and take up a job in the city. "Farming is no longer economically sustainable," he says.

Farmer 3: **Story of Champa**

Champa is one of the poor farmers in the village. Her farm is very small and does not have any water source other than rainfall. As her farm is rainfed, she cannot grow anything other than kharif crops. As the soil is poor, the yield of cotton is 6 quintals per acre. Her farm is 1.5 acre which means 9 quintal was her total yield for the year 2021. Champa cannot afford labour and hence she has to do most of her work by herself. She sometimes gets a medium yield, but in case there is a dry spell the yield is very poor. For non-monsoon seasons she works as a labourer on others' farms. She does not have any other income source.

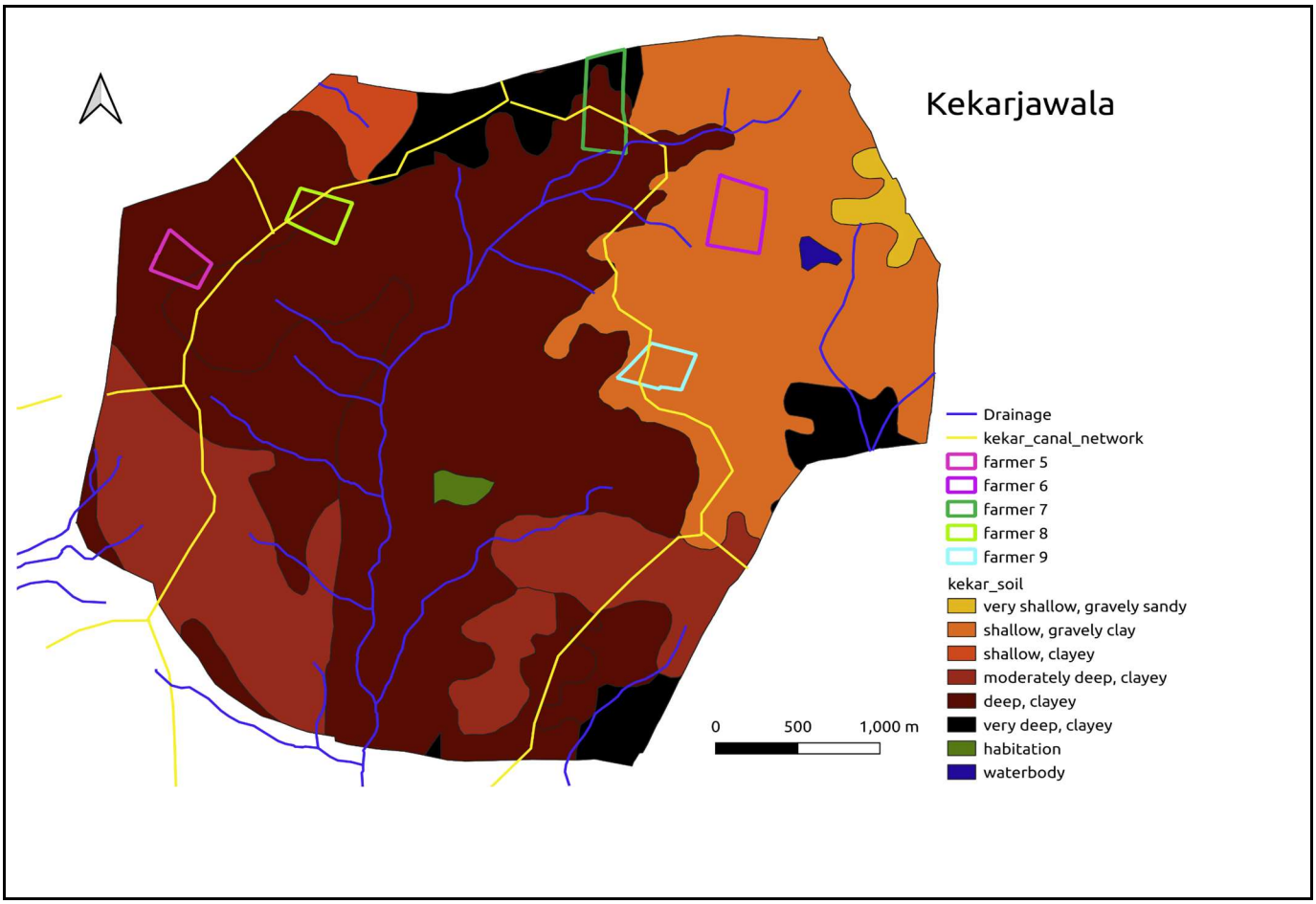
Farmer 4: **Story of Daji**

Daji's farm is large but the soil quality is poor. Daji can afford labourers, hence he handles the management in farming. The remaining work is done by the labourers. Despite having water and huge land he does not take any crop in rabi or summer season. This is because his farm is near a forest area and deer come and destroy the crops- mainly edible crops. They do not destroy cotton

as it is not edible. Daji gets a good yield of cotton. And hence it is fine even if he does not take any other crop in rabi and summer seasons. Other than agriculture he has a small business too.

Village 2: Kekar Jawala

The village Kekar Jawala comes in district Parbhani of Maharashtra. Unlike Mangrul, this village has water supply through canal water. As canal water is present throughout the year, farmers here can take cash crops that require a lot of water e.g. sugarcane which is the most common crop. Here are some farmers in the village telling their stories. (the stories were adapted from the farmer narratives collected during the field visit in February 2021)



Farmer 5: **Story of Eknath**

Eknath's medium sized farm is connected to the canal network. The soil is of medium quality but it does not affect the sugarcane crop. Eknath says that canal water supply is not reliable as it is not regulated properly. As the canal water frequency is not maintained, having a well is beneficial. Sugarcane is like a grass, it grows on its own and is not affected by pests or weeds. Hence one needs to provide less attention to the crop as compared to other crops. But the main importance of sugarcane is that it is a cash crop and has a fixed market i.e. sugar- producing factories. Sugarcane is an 18 month duration crop. Eknath hires labour for cutting. As he does not need to pay attention to the sugarcane crop, he can run his roadside tea-shop.

Farmer 6: **Story of Farooq and Fatima**

Farooq and Fatima have a medium- sized farm. They do not receive canal water but their well gets recharged by canal water. He would like to shift to sugarcane but there isn't enough water. He sows soybean in monsoon and wheat in winter. Fatima, Farooq's wife, adds that despite the canals and wells, the region does not get drinking water in summer. They are forced to transport water jars on bullock carts during the summer, to fulfil their household water requirements. Farooq's elder brother is in government service. This provides financial security and extra capital for farming.

Farmer 7: **Story of Gangaram**

Gangaram is a progressive, experimental farmer. He has a good amount of land with good soil and canal water available. His younger brother is in government service and hence he has extra capital available for experimentation in farming. He has switched to horticulture, and also grows capsicum, flowers, onion, and wheat.

Farmer 8: **Story of Harish**

Harish is a young progressive, experimental farmer, He has a medium- sized farm with good soil and a borewell. He received training as a part of his job with a company. He follows a sort of contract farming, and uses organic farming techniques. He is planning to install sensors in the farm etc.

Farmer 9: **Story of Indar**

Indar has a medium- sized farm with canal water available but poor soil. He is able to grow soybean, and fruit like pomegranate.

Water Classrooms WC-3-2(2)-Activity-III

Aim: To understand how collective action can lead to better water management and ensure economic profit for the farmers

Competition for water

In a village all the farmers require more and more water for agriculture. All the economically beneficial crops are the water-intensive crops. But the water resources are limited. Then how do we tackle the issue of not getting enough water?

Collective efforts: towards better water management

What do you do if your friend forgets his/her tiffin? We share, right? In sports also the team with best coordination and planning wins. Similarly for the issues that concern all of us we collectively can arrive at solutions. Let's see a case study of one village named Hiware Bazar from a drought prone area of Maharashtra.

Instructions:

1. Facilitator/educator will show the students the following documentary:

THE MIRACLE WATER VILLAGE

https://www.youtube.com/watch?v=9hmkgnonBgk

2. Facilitator/educator will ask students to discuss in their group and write down 3 important factors that led to the success of the Hiwade Bazaar community initiative- especially in terms of competition for water (especially groundwater)?

3. Facilitator/educator will assign a village from WC-3-2(2)-Activity-II to each group. Students discuss what they have learned and write down 10 bullet points for an action plan for the village assigned to them on a chart paper, outlining how the village community can manage their water sustainably and successfully. They need to show at least 3 specific bullet points to improve access to productive farming resources of village women.

4. Facilitator/educator will discuss the importance of cooperative framework for groundwater/ surface water sharing and the minuses of competition.