



We learnt about natural resources like water, soil, forests, flora, fauna etc. and how to conserve them, in previous classes. We also learnt about the pollution of natural resources as a result of human activities. Natural resources are present in abundance, but do we really manage them properly? We shall study about human interventions affecting them and efforts that are being made to sustain and save them.

Try to make an exhaustive list of natural resources in your locality. Try to find out about a particular resource especially one that is scarce in detail. Some questions below will help you to find out more about the resources.

- *Which resource in your locality is scarce? How does it affect you?*
- *Was the resource present in abundance earlier?*
- *How did it become scarce over the years?*
- *What can you do as a step towards saving a resource?*

Let us study about two villages of Andhra Pradesh to make a study of an important resource and see what happens when it becomes scarce.

### **Case I: Situation in two villages Vanaparthi and Vaddicherla of Warangal District**

A survey was conducted in two villages, Vanaparthi and Vaddicherla of Warangal District of Telangana region -the first with no-scarcity (good), and the second with scarce groundwater. Well census was carried out in the villages in order to get a complete picture of well irrigation and its status as well as availability of water. Basic information on well irrigation


was collected using a small questionnaire from all the well owners in the sample villages.

Detailed information regarding various socio-economic aspects was collected using a detailed questionnaire from a sample of 25 households owning wells. Families in both the villages were asked to narrate the changes in groundwater situation during the last five years.

There are no alternative sources of supply as against wells in Vaddicherla, whereas there is an existing tank that has been converted into a percolation tank, so that the water situation is much better in Vanaparthy.

**?** **Do you know**

Percolation tanks are normally earthen dams with masonry structures where water may overflow. Construction materials consist of a mixture of soil, silt, loam, clay, sand, gravel, suitably mixed and laid in layers at the base or bed and sides. It is properly compacted to achieve stability. Outlets for surface irrigation are made and a cut-off trench is made below the earthen bund or dam with depth limited to one fourth of the height between bed level and full storage level.



*Percolation tank*

Basic features of the villages Vanaparthy and Vaddicherla are almost similar in terms of occupational pattern, cropping pattern, infrastructure and social services. In both the villages small farmers are in majority. Vanaparthy has the higher average household income. The main livelihood activity in these villages is cultivation and the primary source of irrigation is well. Household income is dependent on the status of groundwater. Vanaparthy has a higher proportion of its area under irrigation. The cropping pattern which influences average household income in these villages differs substantially. Though rain has not been consistent for a few years, farmers in these villages prefer growing paddy.

**Table-1: Area under irrigation**

Village	Total Area (acres)	Percentage Area Irrigated	Number of Wells	Sample Size
Vanaparthy	3791	25	155	25
Vaddicherla	2970	15	175	25

- *What is the total irrigated area in acres, in Vanaparthy?*

- *If one needs to irrigate all the land in Vanaparthi, how many wells would be required?*
- *Though the number of wells is less in Vanaparthi, the area under irrigation is more as compared to Vaddicherla. How is this possible?*
- *Do you think the area under irrigation will change due to rise in population?*

The change in area under cultivation, percentage change in number of wells and cropping pattern in 5 years as narrated by the people has been presented in table-2.

The population in the villages have also gone up in a period of 5 years by nearly 10%.

**Table 2: Status after five years**

Village	Percentage change in area under irrigation	Percentage decline in number of wells	Percentage change in area under crops					
			Paddy		Cotton	Gingelly	All Crops	
			K	R			K	R
Vanaparthi	-14	-39	-17	-17	163	86	11	-17
Vaddicherla	-30	-68	-22	-50	27	138	-05	-50

K stands for Kharif while R stands for Rabi. Negative values indicate loss/ decline, while positive ones show gain/rise.

- *If the number of wells is 155 now, what was it 5 years back?*
- *What do you think 'decline in number of wells' represents?*
- *How would crops be affected due to decline in the number of wells?*
- *Compare table 1 and 2 and state what they tell us about the area under irrigation in both the villages?*
- *Which village do you think is more affected?*
- *What is the change in types of crops grown in the villages?*

Of late, most of the open dug wells were converted into bore wells that could reach greater depths of ground water zones and would also reduce loss of water by surface evaporation. Most of the open wells have dried up and water tables have gone down substantially during the last 5 years. During this time, 85 percent of the wells, mostly open, have dried-up in Vaddicherla while 45 percent of the wells dried-up in Vanaparthi.

- *If 45 percent of wells have dried up in Vanaparthi, and there is 39 percent decline in number of wells, what percentage of wells do you think have been converted to bore wells?*

- *By comparing the two villages, find out where greater number of wells dried up? What methods would have saved the wells in other village?*
- *Which type of farmers, those having small land holdings or those with large land holdings are most affected when wells dry up?*
- *If water resource becomes scarce, will it affect the nature of soil in an area?*
- *As wells dry up, how are people in the area dependent on the well affected?*
- *Why do you think water became scarce mainly in Vaddicherla?*

Water is usually pumped out of wells and bore wells using electricity. Farmers with small land holdings or small farmers tend to spend more money per well in terms of installation of pump sets and pipeline connections to farms (or capital expenditure) as well as running costs towards maintenance, electric charges etc. On per acre basis, both capital and running costs are the lowest in Vanaparthi (no-scarcity village) and highest in Vaddicherla (scarcity village).

**Table 3: Annual expenditure on well irrigation for small and large farmers(2002)**

Village	Type of Farmer	Depth of bore well (in feet)	Percentage area irrigated per well		Total cost of well irrigation per acre per year in rupees
			Kharif	Rabi	
Vanaparthi	Large	130 - 200	2.50	1.24	25000- 70000
	Small	110 - 180	2.00	1.13	25000- 65000
Vaddicherla	Large	90 - 300	1.53	0.87	22000- 50000
	Small	60 - 200	0.99	0.46	20000- 45000

- *Is the availability of water resource same for a small and a large farmer?*
- *Do you think the availability should be same for everyone in an area?*
- *A well irrigates more area in Kharif season as compared to Rabi, how is it possible?*
- *How should a farmer utilize such a condition?*
- *If a well can irrigate 2.5 percent of cultivable land, how many wells would irrigate whole of the land?*
- *Which factor has a greater effect on expenditure, number of wells or depth of a well?*
- *What is the total expenditure on a whole cultivable land owned by a small farmer in Vaddicherla? How do you think a small farmer meets this expenditure?*
- *What could help the small farmer reduce expenditure? (Hint: think of crops that require less water)*

- Do you think increasing the depth of bore well is a good solution for increasing total land area under irrigation? Why/Why not?



### Do you know?

Because of varying monsoon behaviour in recent years, there is a pressure on groundwater utilization. Indiscriminate tapping of groundwater in the State by too much drilling and construction of deep tube wells and bore wells, have resulted in over exploitation and depletion of groundwater resources in certain areas. Average fall of water level was around 3 meters in the State during the period of 1998- 2002.

**Table 4: Income on crops**

Village	Type of Farmer	Net income per acre in Rupees				Total income per acre year in rupees
		Paddy Kharif	Paddy Rabi	Cotton	Gingelly	
Vanaparthy	Large	8200	8700	4900	3300	25100
	Small	7046	8490	10889	3110	29535
Vaddicherla	Large	10698	5970	4000	3595	24263
	Small	9128	7380	3031	2650	22189

- Which crop is most profitable for a small farmer in Vaddicherla?
- What is the difference between a small farmer in Vanaparthy and Vaddicherla?
- Which crop could replace paddy and be profitable as well for a small farmer in Vanaparthy?
- Though we know that paddy consumes maximum water, why do you think farmers still like to grow paddy?
- What is the impact of a depleting resource upon the farmers?
- Do you think the income of a small farmer in Vaddicherla is sufficient enough to meet his expenditure?
- What are the major causes of pitiable condition of small farmers at Vaddicherla?
- Do you think farming as an occupation is profitable for the small farmer in Vaddicherla?
- Would the farmer have to look for other kind of occupations to meet his ends?
- How did the availability of water affect a small farmer at Vaddicherla?

A project of the Centre for world solidarity(Secundrabad, A.P) that addresses sustainability of ground water intervened to help in recharging wells that were drying up in the villages.

They encouraged more water sharing among farmers. They formed groups of farmers including large and small ones who would use the same water resource. Farmers were also motivated to use irrigation techniques like drip irrigation, sprinklers etc. (collectively called as micro irrigation techniques). Construction of soak pits to tap rainwater optimally was carried out as community efforts. Soakpits helped in recharging dried up bore wells. Dykes or barriers, nearly 30 cm thick of brick-cement or stone cement barrier, extending down to the compact bedrock, with mud or clay fillings were built in underground streams to tap ground water optimally.

- *How can wells be recharged?*
- *How would recharging dried up wells help farmers of Vaddicherla?*
- *What does the case tell us about a water resource and its effect on farmers?*

### **Water for all**

Out of all the water on Earth, salt water in oceans, seas and saline groundwater make up about 97% of it. Only 2.5–2.75% is fresh water, including 1.75–2% frozen in glaciers, ice and snow (nearly two thirds of the available freshwater), 0.7–0.8% as fresh groundwater and soil moisture, and less than 0.01% of it as surface water in lakes, swamps and rivers. Though it is a meagre portion of the whole, if used judiciously, shall last for a long time.

- *How do you think we can use water judiciously?*
- *Why were farmers at Vanaparthy at a better state than those at Vaddicherla?*
- *How did farmers of Vaddicherla and Vannaparthy recharge their ground water resources?*

### **Do you know?**

In ancient times, village boundaries were decided upon on a watershed (land between water sources usually of two rivers or streams) basis fixed at the common point of the drainage system in between two villages by the expert farmers in the village. Such boundaries were socially acceptable to all the members of the system.

### **Case II: A Study of Kothapally Village, an example of water management effort**

This tells us how people in the village through proper guidance could make optimum use of available water in the village.

A survey of Kothapally village indicated that initially: (i) dry land areas were more extensive than irrigated land; (ii) literacy was low; (iii) labour was scarce; (iv) more fertilizers/pesticides were used on small farms (v) crop yields were low, (vi) there was not even a single water harvesting structure in the village. Interventions to enhance productivity and income (Soil and water conservation measures)

International Crop Research Institute for Semi-Arid Tropics (ICRISAT) educated villagers by large and provided technical support for cost-efficient water storage and soil conservation structures. The measures were community as well as individual farmer-based. These helped to restore some resources and conserve others so that they may never be depleted. Thus sustainable management was carried out.

What is ICRISAT, where is it? What are its functions? Discuss with your teacher and prepare on it.

### Community-based interventions

Fourteen water storage structures (one earthen and 13 masonry dams) with water storage capacity of 300 to 2 000 m<sup>3</sup> were constructed. 60 mini-percolation pits and field bunding on 38 hectare were completed.



*fig-1: Communitybased masonry dam*



*fig-2: Contour field bunding*

### **?** Do you know?

Sri Rama Sagar Project also known as the Pochampadu Project is a project on the Godavari River. It is a “lifeline for a large part of Telangana”. It is mainly an irrigation project to serve needs in Karimnagar, Warangal, Adilabad, Nalgonda, and Khammam districts. But all is not well with the project as most of the water is retained before reaching Andhra Pradesh due to the dams built on river Godavari in another State. As of August 2013, the project has an estimated capacity of 80.66 TMC.



*Sri ram sagar project*

Twenty-eight dry open wells, near nalla or the Lakshmi canal (sourced from the Sri Rama Sagar project reservoir) were recharged by building dykes or barriers in the nalla and retaining the runoff rainwater in it. A users group was formed for each water storage structure, and the water collected in the storage structures was exclusively used for recharging the groundwater to the dried wells.

### Farmer-based interventions

Farmer-based soil and water conservation measures implemented in individual fields were broad bed furrow (BBF) landform and contour planting. These are all useful to conserve soil and water, fertilizer application and weeding operations, field bunding of 38 hectare, around boundaries in rectangular or in contours to conserve rain water. Planting *Gliricidia* (Madri, a leguminous plant adapted to grow in dry areas) on field bunds to strengthen them and make the soil nitrogen-rich. Farmers were encouraged to use water resource jointly and irrigate land using micro irrigation techniques.



*fig-3: Broad bed furrow*



*fig-4: Plantation of Gliricidia on bunds*

Farmers obtained 250 kg more pigeon pea and 50 kg more maize per hectare using broad bed furrows and micro irrigation techniques.

Drip irrigation (a type of micro irrigation) can reduce water consumption by 70% but unfortunately only 2% of cultivable land around the world is irrigated in this manner.

### Wasteland development and tree plantation

Saplings of useful species were planted along the roads, field bunds and nalas. Contour trenches at 10 m intervals with a 0.3 m height of bund were laid out. Custard apple plantation along with other useful species in trenches and *Gliricidia* saplings on bunds



*fig-5: Tree plantation on wasteland*



was undertaken by the farmers. 2500 fruit trees and teak plants were planted.

- *What other ways of restoration of a resource does the Kothapally case tell us about?*
- *What are some common means of restoration and conservation of water resource that we came across in the cases studied so far?*

According to a survey conducted in the year 2004

Total amount of water available in Andhra Pradesh - 3814 thousand million cubic feet (TMC)

Total amount utilised	-	2300 TMC of which
Irrigation	-	2268 TMC
Domestic use	-	21 TMC
Industries	-	10 TMC
Power generation	-	1 TMC

Amount required for utilisation by 2025 is 3989TMC of which 3,814TMC is for irrigation, 122TMC for domestic use, 51TMC for industries and 2TMC is for power generation.

- *What do you think will happen if we do not take care of the sources of water?*
- *How do you think we will meet our requirements in future?*
- *Do you think we would have to depend upon other states or perhaps other countries as well?*
- *Could the amount of water used for irrigation in Andhra be reduced? How?*
- *Does cropping pattern have any role to play in reduction of water utilisation? (Hint: Think of the case of Vaddicherla and Vanaparthy).*
- *Do you think one needs laws for distribution of water and its use? Why/Why not?*

### **Source of irrigation water in Andhra Pradesh**

- *How much per cent of area do you think is irrigated by other sources of water?*

We have seen that major consumption of water is in the farming sector. In spite of some major rivers like Godavari and Krishna, the major source of irrigation is groundwater.

- *Why is it important to recharge the ground water sources?*
- *Why do the rivers fail to benefit the state to an extent they should have?*