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WATER CONSERVATION AT DIFFERENT LEVELS

You have already learnt how important water is for survival of all living beings. You have also learnt that usable water is becoming scarce. In this lesson you will learn some important methods of conserving water and the role of individuals, community and government in conservation of water.

OBJECTIVES

After completing this lesson, you will be able to:

- *discuss the various methods to overcome water scarcity (concept of water use efficiency may be included);*
- *explain water shed management;*
- *cite examples of individual actions towards preventing water scarcity (case study);*
- *discuss community action required for protecting fresh water resources;*
- *enlist and explain government action (existing and required) for conservation of fresh water;*
- *describe the role of an individuals for conservation of water.*

31.1 DIFFERENT METHODS OF WATER CONSERVATION

31.1.1 Conservation and management

India is a developing country with a vast territory, complex topography, varied climate and a large population. The precipitation and runoff in the country is not only unevenly distributed, but also uneven with regard to time of distribution of water during the year. Frequent

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floods, drought and unstable agricultural production have always been a serious problem. According to Indian Meteorological Department (IMD), there are only 40 rainy days in India, and hence a long dry period. India, being an agricultural country, its economic development is linked with agriculture. The major limiting factor for agriculture is water. A growing population and consequent need for increase in food production requiring increasing area of agricultural fields and irrigation are resulting in over use of water. Due to overexploitation of water resources, it has become scarce in many parts of our country. Needless to say, water conservation is of great importance to the economic,social and cultural development in India.

31.1.2 Conservation techniques

Primary source of water in India is south-west and north-east monsoons. Monsoon, however, is erratic and as you have already studied the duration and the amount of rain fall is highly variable in different parts of our country. Hence, surface runoff needs be conserved. The techniques for conservation of surface water are:

(a) **Conservation by surface water storage**

Storage of water by construction of various water reservoirs have been one of the oldest measures of water conservation. The scope of storage varies from region to region depending on water availability and topographic condition. The environmental impact of such storage also needs to be examined for developing environment friendly strategies.

(b) **Conservation of rain water**

Rain water has been conserved and used for agriculture in several parts of our country since ancient times. The infrequent rain if harvested over a large area can yield considerable amount of water. Contour farming is an example of such harvesting technique involving water and moisture control at a very simple level. It often consists of rows of rocks placed along the contour of steps. Runoff captured by these barriers also allows for retention of soil, thereby serving as erosion control measure on gentle slopes. This technique is especially suitable for areas having rainfall of considerable intensity, spread over large part i.e. in Himalayan area, north east states and Andaman and Nicobar islands.

In areas where rainfall is scanty and for a short duration, it is worth attempting these techniques, which will induce surface runoff, which can then be stored.

(c) **Ground water conservation**

Attributes of groundwater

- There is more groundwater than surface water.
- Groundwater is less expensive and economic resource and available almost everywhere.

- Groundwater is sustainable and reliable source of water supply.
- Groundwater is relatively less vulnerable to pollution.
- Groundwater is a free of pathogenic organisms.
- Groundwater needs little treatment before use.
- There is no **conveyance losses** in underground based water supplies.
- Groundwater has low vulnerability to drought.
- Groundwater is the key to life in arid and semi arid regions.
- Groundwater is source of dry weather flow in some rivers and streams.

As highlighted earlier, out of total 4000 BCM (billion cubic meters) precipitation that occurs in India, about 45 mhan (million hectares meters) percolates as ground water flow. It may not be possible to tap the entire ground water resources. The ground water potential is only 490 BCM. As we have limited ground water available, it is very important that we use it economically and judiciously and conserve it to the maximum. Some of the techniques of ground water management and conservation are described below.

(i) Artificial recharge

In water scarce areas, there is an increased dependence on ground water. The water table declines quickly due to low and erratic rainfall. The only alternative is to replenish the ground water by artificial means. As you have studied in the previous lesson, there are various techniques to develop and manage ground water artificially. In one of the methods, water is spread over ground to increase area and length of time for water to remain in contact with soil. So as to allow maximum possible opportunity for water to enter into the ground. Try to recollect the other methods of recharging ground water.

(ii) Percolation tank method

Percolation tanks are constructed across the water course for artificial recharge. The studies conducted in a Maharastra indicates that on an average, area of influence of percolation of 1.2 km^2, the average ground water rise was of the order of 2.5 m and the annual artificial recharge to ground water from each tanks was 1.5 hec m.

(d) **Catchment area protection (CAP)**

Catchment protection plans are usually called **watershed protection** or management plans. These form are an important measure to conserve and protect the quality of water in a watershed. It helps in withholding runoff water albeit temporarily by a **check bund** constructed across the streams in hilly terrains to delay the run off so that greater time is available for water to seep underground. Such methods are in use in north-east states, in hilly areas of tribal belts. This technique also helps in soil conservation. Afforestation in the catchment area is also adopted for water and soil conservation.

(e) **Inter-basin transfer of water**

A broad analysis of water and land resources and population statistics of various river basins in our country reveals that areas in western and peninsular regions have comparatively low water resources/cultivable land ratio. Northern and eastern region which are drained by Ganga and Brahmaputra have substantial water resources. Hence, the scheme of diverting water from region with surplus water to water defecit region can be adopted Ganga-Cauveri link would enable to transfer of vast quantities of Ganga basin flood water running out to sea, to west and south west India. The transfer of the surplus Ganga water would make up for the periodical shortage in Sone, Narmada, Godaveri, Krishna and Cauveri. The National Grid Commission envisages diversion of part of the surplus discharge in the Ganga near Patna during the high flood period.

(f) **Adoption of drip sprinkler irrigation**

Surface irrigation methods, which are traditionally used in our country, are unsuitable for water scarce areas, as large amount of water is lost through evaporation and percolation. Drip irrigation is an efficient method of irrigation in which a limited area near the plant is irrigated by dripping water. It is suitable method for any area and specially for water scarce areas. This method is particularly useful in row crop. Similarly sprinkler method is also suitable for such water scarce areas. About 80% water consumption can be reduced by this method, whereas the drip irrigation can reduce water consumption by 50 to 70 %.

Fig. 31.1: *Sprinklers irrigation fields*

(g) **Management of growing pattern of crops**

In water scarce areas, the crop selection should be based on efficiency of the crop to utilize the water. Some of the plants suitable for water scarce areas are (i) plants with

shorter growth period; (ii) high yielding plants that require no increase in water supply; (iii) plants with deep and well trenched roots and (iv) plants which cannot tolerate surface irrigation.

(i) **Selection of crop varieties**

Crop performance and yield are the results of genotype expression as modulated by continuous interactions with the environment. Generally, the new varieties of crop do not require more water than the older ones. However, they require timely supply of water because their productivity is high. Frequent light irrigation is more conductive than heavy irrigation at large intervals for obtaining high yields.

(ii) **Nutritional management**

Potassium plays a major role under stress conditions. It improves the tissue water potential by osmoregulation, ultimately increasing the water use efficiency. Experiments conducted at the Water Technology Centre, Coimbatore, indicated that foliar application of 0.5% potassium chloride can reduce the moisture stress in soyabean, sorghum and groundnut.

(iii) **Role of antitranspirants**

Application of antitranspirants reduces transpiration maintaining thereby the tissue water potential. Plants then take up less water from soil. Antitranspirants can prolong the irrigation intervals by slowing down soil water depletion. Application of Kaolin (3%) and lime wash (2%) was found to maintain the water balance of plant and resulted in normal yield of sorghum under moisture stress conditions. Certain growth regulators reduce the plants susceptibility to water stress. Application of cycoel, a growth retardant increases the ability to withstand drought. Cycoel application also reduces production of gibberellic acid which leads to closing of stomata. Transpiration loss of water gets reduced.

(h) **Reducing evapotranspiration**

Evapotranspiration losses can be reduced by reducing the evaporation from soil surface and transpiration from the plants, in arid zones, considerable amount of water is lost in evaporation from soil surface. This can be prevented by placing water tight moisture barriers or water tight mulches on the soil surface. Non-porous materials like papers, asphalt, plastic foils or metal foils can also be used for preventing evaporation losses. Transpiration losses can be reduced by reducing air movement over a crop by putting wind breaks and evolving such types of crops which possess xerophytic adaptations.

(i) **Reducing evaporation from various water bodies**

The quantity of water lost through evaporation is very high in many areas in our country. It is estimated that 10000 hectares of land loses about 160mm^3 of water each year. The water losses through evaporation from storage tanks, reservoirs, irrigation tanks, rivers

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and canals reduce the water available for various uses. The methods that reduce evaporation from water bodies are- installing wind breaks, reducing energy available for evaporation, constructing artificial aquifers, minimizing exposed surface through reservoir regulation, reducing ratio of area/volume of water bodies, locating reservoirs at higher altitudes and applying monomolecular firms.

(j) **Recycling of water**

The wastewater from industrial or domestic sources can be used after proper treatment, for irrigation, recharging ground water, and even for industrial or municipal use. If agricultural lands are available close to cities, municipal waste water can be easily used for irrigation.

31.1.3 Conservation of water in domestic use

There is a large scope of conserving water at house hold level. A general awareness among the people about the importance of water and its availability, and need for conservation can help in minimizing wastage to a large extent. Losses during water supply also need to be prevented by reducing the leakages.

Some of the ways for improving the efficiency of water use at household level are:

- Reduce wastage-leaking pipes mean that lot of water never reaches to the people. In Delhi estimated losses are 35-40 %.
- Closing of taps while not in use.
- Better irrigation techniques – irrigation systems waste up to 70% water used. In drip irrigation water loss is significantly less.
- Use low flush toilets-reducing the amount of water used each time the lavatory is flushed.
- Build latrines and compact toilets which can turn human waste into clean, useful manure-this is much cheaper than connecting toilet to a piped sewage line.
- Use bowls to wash vegetables, dishes instead of running tap.
- Greater use of recycled water 'grey water' in the home. Instead of using potable or treated water use bath and shower water for watering the plants.
- Use washing machine or dish washer when it is fully loaded.

31.1.4 Reduce the loss of water

There are numerous methods to reduce losses due to evaporation and to improve soil moisture. Some of them are listed below:

- Mulching i.e. the application of organic or inorganic materials such as plant debris, compost, etc., slows down the surface run-off, improves soil moisture, reduces evaporation losses and improves soil fertility.

- Soil covered by crops, slow down run-off and minimize evaporation losses, hence, fields should not be left bare for long periods of time.
- Ploughing helps to move the soil around. As a consequence it retains more water thereby reducing evaporation.
- Shelter belt of trees and bushes along the edge of agricultural fields slow down the wind speed and reduce evaporation and erosion.
- Planting of trees, grass, and bushes breaks the force of rain and helps rainwater penetrate the soil.
- Fog and dew contain substantial amounts of water that can be used directly by adapted plant species. Artificial surfaces such as netting-surface traps or polythene sheets can be exposed to fog and dew; the resulting water can be used for crops.
- Contour farming is adopted in hilly areas and in lowland areas for paddy fields. Farmers recognize the efficiently of contour based systems for conserving soil and water.
- Salt-resistant varieties of crops have been also developed recently. Because these grow in saline areas, overall agricultural productivity is increased without making additional demands on fresh water sources. Thus, this is a good water conservation strategy.
- Desalination technologies such as distillation, electro-dialysis and reverse osmosis are available;

31.1.5 Reuse of wastewater

Wastewater contains lots of nutrients. Its use for irrigation saves these nutrients. It improves the productivity of crops and soil fertility. General utilization of wastewater through reuse and recycling improves water use efficiency. In fact, wastewater is a resource rather than a waste since it contains appreciable amount of nitrogen, phosphorus and potash. Stabilization ponds can be used for fish aquaculture. The effluent can also be used for cultivation of short-term and long term, ornamental, commercial and fodder crops.

Benefits of reuse

Practical experience has shown that wastewater reuse not only reduces the demand for fresh water but also can improve environmental quality; reuse of treated wastewater has the following benefits:

- Make up for the shortage of water supply (reduces demand on good quality water)
- Reduces the wastewater discharge thus reducing water pollution.
- Results in cost reduction.

The potential applications of reusing of treated wastewater are in the following fields or areas:

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- Agricultural use through irrigation of crops as well as for improving river amenity;
- Industrial cooling especially in large industrial enterprises;
- Reuse in municipal public areas such as watering lawns, parks, play grounds and trees;
- Flushing toilets in hotels and residential districts;
- Reuse of the treated wastewater for urban landscape purposes.
- Treated waste water can also be used for groundwater recharging.

Untreated water: Water or grey water can also be reused for various purposes.

Grey water is defined as untreated household wastewater, which has not come into contact with toilet waste. It can originate from the shower, bath, bathroom, washing basin, clothes washing machine and laundry trough.

In our country nearly half of the wastewater is used for irrigation. Many municipalities sell their wastewater to the farmers. Many industries are buying the wastewater and using it.

INTEXT QUESTIONS 31.1

1. List at least three reasons why water conservation is important.

   _____

2. List two irrigation practices which reduce water requirement.

   _____

3. List two benefits of reuse of water.

   _____

4. How can transpirational loss be reduced?

   _____

5. What are the benefits of contours farming?

   _____

31.2 WATERSHED MANAGEMENT

Watershed is an area that contribute water to a stream or a water body through run-off or underground path. That is the region from which surface water draws into a river, a lake, wet land or other body of water is called its watershed or drainage basin. Watershed management is a technique for conservation of water and soil in a watershed. The presence

of water in soil is essential for the growth of plants and vegetation. Forests and their associated soils and litter layers are excellent filters as well as sponges, and water that passes through this system is relatively pure. Various kinds of forest disturbances can speed up the movement of water from the system and in effect, reduce the filtering action.

In mountainous terrain the forests play a prominent role in prevention of soil erosion. Erosion threat can be tackled by the maintenance of continual cover. Ideally, this is achieved by single stem harvesting; only one tree is felled at any one point, and the small gap so created is soon sealed by the outward growth of its neighbours.

Despite the uncertain balance of water gain and loss, forests offer the most desirable cover for water management strategies. In constrast to the rapid flows of short duration characteristics of sparsely vegetated land water yields are gradual, reliable and uniform in forests. Deforested land sheds water swiftly, causing sudden rises in the rivers below. Over a large river system, such as that of the Ganga and the Yamuna, forests are a definite advantage since they lesson the risk of floods. They also provide conditions more favourable to fishing and navigation than does un-forested land. All natural streams contain varying amounts of dissolved and suspended matter, although streams contain varying amounts of dissolved and suspended matter, although streams issuing from undisturbed watershed are ordinarily of high quality. Waters from forested areas are not only low in foreign substances, but they also are relatively high in oxygen and low in unwanted chemicals.

The belief that forests increase rainfall has not been substantiated by scientific inquiry. Local effects can, however, prove substantial, particularly in semiarid regions where every millimeter of rain counts. The air above a forest, as contrasted with grassland, remains relatively cool and humid on hot days, so that showers are more frequent. Many areas in India used to get significant rainfall when they were forested are now facing severe draught due to denudation (example Rajasthan desert).

INTEXT QUESTIONS 31.2

1. What is watershed?

   _____

2. How do forests reduce the risk of flood?

   _____

3. List any two ways in which forests help in maintaining the quality of water.

   _____

4. What is achieved by single stem harvesting?

   _____

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31.3 ROLE OF INDIVIDUAL AND COMMUNITY IN OVERCOMING WATER SCARCITY

31.3.1 Examples of individual and community efforts to overcome water scarcity

There are many examples of individual and community efforts on water conservation in our country. Some important examples are given below:

Year after year, every summer, both the rural and urban areas of Saurastra and Kutch reel under water shortages. In the coastal areas the problem is further compounded by salinity ingress into ground water aquifers. The government machinery responds to the situation by providing water trucks and trains. While a large number of people continue to depend on the rain Gods or the government water tankers, in some areas people have begun to take the matter in their own hands.

Case Studies

(i) In Gandhigram, a coastal village in Kutch distrirct, the villagers had been facing a drinking water crisis for the past 10 to 12 years. The groundwater table had fallen below the sea level due to over extraction and the seawater had seeped into the ground water aquifers. The villagers formed a village development group, Gram Vikas Mandal. The Mandal took a loan from the bank and the villagers contributed voluntary labor (Shramdan). A check dam was built on a nearby seasonal river, which flowed past the village. Apart from the dam, the villagers also undertook a micro-watershed project, due to these water retention structures, the villagers now have sufficient drinking water, and 400 ha of land, which earlier lay barren, has come under irrigation.Similar examples of people's initiative in organizing rainwater harvesting can also be seen in the two villages of Khopala and Jhunka in Bhavnagar district of Saurastra.

(ii) A noteworthy example of students's participation in such an endeavor took place in 1955-98 at Bhavnagar University under the guidance of the, then Vice Chancellor of the university Prof. Vidyut Joshi. The coastal city of Bhavnagar was facing a severe drinking water shortage. Prof. Joshi initiated the digging of a percolation tank in the university premises. About 650 students, 245 teachers and other employees of the university worked as voluntary labour. During the following monsoon, all the bore wells in university as well as those in the adjoining areas were recharged.

The success stories have proved that management of water resources by the end users themselves can lead to sustainable benefits. Such community based systems of resource management are not new to society. They have been practiced by many traditional communities all over the world, but are gradually being replaced by 'modern' centralized systems of resource management.

31.3.2 Artificial recharge to groundwater

Artificial recharge to ground water is a process by which the ground water reservoir is augmented at a rate exceeding normal rate of seepage and replenishment. Any man-made scheme or facility that enhances seepage water to an aquifer may be called to be an artificial recharge system.

Ground water exploitation is inevitable is urban areas. But the groundwater potential is getting reduced due to certain adverse effects of urbanization. These are:

- increase in water demand.
- more dependence on ground water use.
- over exploitation of groundwater.
- increase in run-off, decline in well yields and fall in water levels.
- reduction in open soil surface area.
- reduction in infiltration and deterioration in water quality.

Hence, a strategy to implement the ground water recharge, in a major way needs to be launched with concerted efforts by various governmental and non-governmental agencies and public at large to build up the water table and make the ground water resource, a reliable and sustainable source for supplementing water supply needs of the urban dwellers.

Recharge of groundwater through storm run off and rooftop water collection, diversion and collection of runoff into dry tanks, play grounds, parks and other vacant places are to be implemented by town panchayats/municipaliites/ municipal corporations and other government establishments.

The town panchayats/ municipalities/ municipal corporations offer help to the citizens and builders for adopting suitable recharge method in one's own house or building through demonstration and offering subsidies for materials and incentives.

Methods of artificial recharge in urban areas:

- Water spreading.
- Recharge through pits, trenches, wells, shafts.
- Rooftop collection of rainwater.
- Roadtop collection of rainwater.
- Induced recharge from surface water bodies.

Computation of artificial recharge from rooftop rainwater collection:

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Factors taken computation

- Roof top are 100 sq.m. for individual house and 500 sq.m. for multistoried building.
- Average annual monsoon rainfall = 780 mm.
- Effective annual rainfall contributing to recharge 70% = 550 mm.

	Individual houses	**Multistoried building**
Roof top area (sqm)	100sq.m.	500 sq.m.
Total quantity available for recharge per annum (Cum)	55 cu. m.	275 cu. m
Available water (in day) for 5 member family	100 days	500 days

Benefits of artificial recharge in urban areas

- Improvement in filtration and reduction in run-off.
- Improvement in groundwater levels and yields.
- Reduces strain on town panchayats/municipal/ municipal corporation water supply.
- Improvement in groundwater quality.
- Estimated quantity of additional recharge from 100 sq. m. roof top area is 55.000 litres.

31.3.3 Government's efforts on water conservation

On water conservation following main efforts can be noted.

- National Water Policy 2002 strongly emphasize conservation of water.
- Efforts to retain rain water on land through various schemes.
- Construction of large number of dams on various river systems.
- Interlinking of rivers (proposed).
- Promotion of bunds at village level.
- Promotion of rain water harvesting.
- Promotion of reuse and recycling of wastewater.
- Steps to protect water quality.
- Drought-proofing the future.

Temporary cutbacks or permanent operating adjustments can help conserve water. Permanent conservation measures may include:

- Subsidizing use of water-efficient faucets, toilets and showerheads
- Public education and voluntary use reduction.
- Billing practices that impose higher rates for higher amounts of water use
- Building codes that require water-efficient fixtures or appliances
- Leak detection surveys and meter testing, repair and replacement
- Reduction in use and increase in recycling of industrial water

Temporary cutbacks may include:

- Reduction of system-wide operating pressure
- Water use bans, restrictions, and rationing

Strengthening of local or municipal bodies could help addressing the issue of water shortage and its management in cities. India's national water policy give overriding priority to drinking water. Urban development projects are required to make provisions for drinking water. India is developing both ground and surface water resources. Current policies prioritize the utilization of static reserves to prevent ground water mining but development of ground water mining is very intensive in many parts of our country.

Success stories like the revival of the Aravari river basin by the waterman of Rajasthan-Rajender Singh –are already well known. The drought prone rain fed areas in Karnataka are being drought proofed. Farm ponds and re-adoption of tree agriculture ensures water consuming tree produce in the drought years.

There was also a discussion on the role that central and state ground water boards can play in improving prospects of success of water harvesting initiatives across the country. These bodies should act as libraries and resource centres for those planning to work on ground water. The government needs to support initiatives for water conservation across the country and to assess earlier large projects before any new ones are announced. On the whole, smaller local efforts found much more support than grandiose schemes; revival of a large number of ponds and tanks in the country would provide for water storage for dry months and also prevent floods by storing excess river water in depressions. Small structures, be it tanks or check-dams or lakes, have higher ecological efficiency in ground water recharge.

It is also recognized that rural and urban water crises are very closely related. Urban areas enjoy political and economic clout to divert rural resources to urban centres. Hence techniques like rooftop rainwater harvesting should be promoted in urban centres to avert

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water crises in cities without impacting rural areas. The use of commercial media and regular airtime on national channels to discuss issues of water management is an effective way to promote water conservation. Publicity and government support to success stories will motivate the public to think about water conservation. There is a strong need to create awareness about water conservation among the urban youth.

The urban water economy is seen as wasteful and highly polluting. The importance of applying a polluter pays principle to domestic users in urban areas must be recognized.

In many parts of our country the water is polluted by discharges of domestic or industrial effluents. There is an urgent need to implement the anti-pollution law. Quality of groundwater is a very important concern as it supports more than 50% of agriculture even today.

31.3.4 Traditional solutions revisited

Indian communities have long been aware of the dependence of their lives on the natural resources around them, when unscrupulous traders were felling trees, local people, under the leadership of environmentalist Sunderlal Bahuguna, spearheaded the Chipko movement which involved local people physically embracing trees to prevent loggers from cutting them.

India has a rich legacy of water harvesting technologies and these methods, combined with modern science, could lead to permanent solution to this problem. Rainwater harvesting, simply put, is putting water back into soil where it is stored in underground rivers and reservoirs so that it can be drawn when needed. In cities, rain water harvesting is merely collecting rainwater in large tanks constructed on roof tops to be used when required.

Revival of traditional rain harvesting systems, have transformed some of the areas from places of economic backwardness to areas of abundance. They are also highly sustainable.

Economic growth and urbanization will go hand-in-hand with environmental crises. We must rejuvenate our traditional knowledge and tap the traditional systems of resource management to suit our present day needs. The basic simple wisdom is underlined by the continued success of traditional methods of managing earth's resources in India as well as in other parts of the world. Modern communities the world over should, therefore, be encouraged to look at time tested traditional methods of resource management.

There are many ways to conserve water that result in significant reduction wastage of water. For example, residential water consumption can be reduced by using water efficient fixtures (faucets, toilets and showerheads) and appliances and through better managed lawn watering.

30.3.5 Some simple water saving methods are as follows:

(i) What can an individual do to conserve water?

The most important step in the direction of finding solutions to issues of water and environmental conservation is to change people's attitudes and habits this includes each one of us. Conserve water because it is right thing to do. we can follow some of the simple things listed below for water conservation:

- Use only the amount you actually need.
- See that there are no leaks in the toilet tank. You can check this by adding colour to the tank. If there is a leak, colour will appear in the toilet bowl within 30 minutes. (Flush as soon as the test is done, since food colouring may stain the tank).
- Do not leave the tap running while you are brushing your teeth or soaping you is your face.
- Avoid flushing the toilet unnecessarily.
- Put a brick or any other device that occupies space to cut down on the amount of water needed for each flush.
- When washing the car, use water from a bucket and not a hosepipe.
- Do not throw away water that has been used for washing vegetables, rice or dals use it to water plants or to clean the floors, etc.
- Make sure that your home is leak –free. Many homes have leaking pipes that go unnoticed.
- Encourage your family to keep looking for new ways to conserve water in and around your home.
- Try to do one thing each day that will result in saving water. Don't worry if the savings are minimal every drop counts'! You can make a difference.
- Form a group of water conscious people and encourage your friends and neighbours to be part of this group. Promote water conservation in community newsletters and on bulletin boards. Encourage yours friends, neighbours and co-workers to also contribute.
- You can store water in a variety of ways. a simple method is to place a drum on a raised platform directly under the rainwater collection source.

Keep a water bottle filled with water in a cistern tank for reducing the amount of flushing water by one litre. Only 1.5 litres of water 7 litres flushing required for water is solid waste, however, the existing cistern tank size is 12 litres. Simple strainer in the wash basin tap will reduce the outflow of water by 50% just as practiced by air crafts. Using a mug instead of running water for shaving saves 17.5 litres per shave.

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Activity	Method adopted	Qty. used Ltr.	Methods to be adopted	Qty. required Ltr.	Qty. saved Ltr.
Brushing teeth	Running tap for 5 minutes	45	Tumbler or glass	0.5	44.5
Washing hands	Running tap for 2 minutes	18	Half filled wash basin	2.0	16.0
Shaving	Running tap for 2 minutes	18	Shaving mug	0.25	17.75
Shower	Letting shower run while soaping staying under shower too long	90	Wet down, tap off, soap up, rinse off	20.00	70.00
Flushing toilet	Using old fashioned large capacity cistern	13.5 or more	Dual system short flush liquid waste full flush solid waste	4.5 9.0	4.5 or more
Watering plants	Running hose for 5 minutes	120	Water can	5.0	115.00
Washing floor	Running hose for 5 minutes	200	Mop and bucket	18.0	182.00
Washing car	Running hose for 10 minutes	400	Buckets (two)	18.0	382.00

Case study

Tarun Bharat Sangh

The work of **Tarun Bharat Sangh** (TBS), and its founder Shri Rajendra Singh in then districts of Rajasthan can easily be over-simplified as water-shed management whereas, it is in fact a revolution in regenerating life and society in denuded and deserted lands.

It is seemingly simple two-step programme. First, revive vegetation on barren hill slopes and second, build small water catchments in the valleys and the plains.

The efforts resulted in:

- dead rivers begin to flow.
- agriculture becomes possible round the year.
- impoverished villagers, labouring in cities return, and families are re-united.
- wearying labour like fetching water, gives way to positive developmental work.
- with enough water and fodder, income from animal husbandry begins to flow.
- nutrition levels rise and public health improves.
- wooded hills welcome back wildlife, that round off forests whole-ness.

- people rid of insecurities, come together to address other issues of life, like education and local governance.
- awareness and confidence enable micro-credit schemes that lower the cost of households and starts small enterprises.
- people with leisure, turn to crafts, reviving folk practices like herbal medicine and community welfare.
- when small communities like these succeed, the government itself wakes up and development becomes what it should be: ground-up, instead of top-down.

How did it happen?

Well, it has happened in the space of 15 years in Rajasthan. Beginning from the small village of Bhikampura in Alwar district, the people-centred development model is spreading all over Rajasthan. Today you can see the river Aravari, dead for 40 years flow again. So too the rivers Ruparel, Jahjajwali and numerous other rivulets. You can drive through Alwar district and observe without effort, stark barren hills contrasting with those beginning to turn green. You begin to believe more hill slopes will be green too. You see a land where peace reigns. The contentment in the air is palpable.

Johad rediscovered

It all began with a young man called Rajendra Singh in 1985. A self-effacing man with nerves of steel. As he himself would want it, let us talk of his Tarun Bharat Sangh's (TBS) work first and then look at his personal story.

Tarun Bharat Sangh's (TBS), discovered that only people's fullest cooperation can achieve these ends. No amount of money, government action or legislation can deliver results. Therefore the design, location and construction of each water harvesting structure is discussed endlessly by Gram sabha's until a true consensus is reached. True consensus is measured as attained, when every member of the community agrees to contribute either money or labour towards the construction of a johad, a check dam or a weir. In one village the consensus took 5 years to arrive at. To the modern mind, that may seem too long for a piece of civil works that then took 6 months to build. But once such consensus-work are built, they become everyone's are guarded and maintained. Issues of use and sharing have been settled before construction began rather than later. Such works are forever and the 5 years of deliberation recedes into significance.

Regeneration of vegetation on hills ensures dependable water supply to streams. Hills can be revived when left alone by preventing humans cutting off mature trees, and nibbling of sprouting stumps by cattle. TBS discuss these issues with villagers in the chosen hill areas through hundreds of hours of meetings over several months until they all agree to suspend browsing by cows for 3 years, goats for 5 years and camels for 7 years.

Notes

This agreements leads to what TBS calls 'social fencing' which, in contrast with physical fences, is virtual; only in mind. With great fanfare, elders lead villagers on a walk through the entire line of the agreed 'social fence', sanctify it by sprinkling a mixture of scared waters and milk. Once thus notified, TBS has found that villagers respect it and police it! Can government funds and fiats ever achieve this?

TBS's 'people centred' approach to development is:

- endless discussions on every conceivable issue.
- arrival at a consensus, however long it takes.
- involvement of villagers with, service, money or material.
- keeping the government at bay, with defiance if needs be.
- and finally, low down the list, balance fund raising and actual execution of the works.

This was not a received wisdom that Rajendra Singh has handed down. he put the rules together as he worked over the years, close to the people. In 1985, as a newly married 28 years old he was well settled, with a government job in Jaipur. But the ghosts of Mahatma Gandhi and Jaiprakash Narayan haunted him goading him into doing something. Not unlike the Buddha he walked out on his wife and home and was inaccessible for two years. Along with four of his friends, he arrived at the village of Kishori and said to the bewildered villagers that he wanted to do something. They were puzzled, intrigued or wary.

Accident had chosen the place well for him. In the thirties, the district of Alwar in the green valleys of the Aravalli hills was a prosperous land. But a greedy prince, with an eye cocked on a free India that would take away his primacy, sold off the rights to the timber on the hills. In ten swift years, contractors laid the land low. Rains brought down loads of earth from naked hills that filled catchment works. Water sped off without stopping to feed the wells and fields. Often they hurtled into deep marble mines and lay uselessly there. Land owners joined landless labourers on a trek to Delhi and Agra to toil for small sums to send home. Families broke up.

For forty years, a whole new generation did not know that there had been hope and fertility once around them.

A water conservation model

A few like Mangu Ram remembered the old days. He led Rajendra Singh and his friends to a place where they begin to dig. It was the first johad in forty years. A johad is a dug out pond, created at a place chosen with native wisdom, informed by remembered patterns of water flow during the rains. After the rains, water stays in for months and recharges the wells nearby. The success of the first johad switched on the collective memory of the people. And enthusiastic construction began all around, guided by elders. When the 650th

johad was dug out, close to the forgotten river bed of the Aravari, the river woke up at the next rains and began to run! and providing water and life to the people of the area. At Hamirpur, it is broad river supporting year round agriculture on it's bank. Today all over Rajasthan the TBS model pioneered by Rajendra Singh, is spreading. There are 3500 people-made water conservation structures. Villagers contribute one third the cost of all construction. TBS organizes the rest. Government at last, has stopped being a hindrance and begun to be a facilitator. President Narayanan, flew down to Hamirpur to pay tribute to the villagers.

It is nothing but humbling to see the transformation brought about by unlettered man who rallied around an unsophisticated young man, who preaches that mountains are nature's breasts and rivers water, the milk.

INTEXT QUESTIONS 31.3

1. How can you save water at your personal level? List at least 6 ways.

   _____

2. There are many examples in Gujarat of individual and community action on rain water harvesting. List two such activities.

   _____

3. Government is promoting conservation of water. List any two reasons of such promotions.

   _____

4. List the achievement of Tarun Bharat Sangh in context of water conservation.

   _____

WHAT YOU HAVE LEARNT

- Water is a scarce resource. It needs to be conserved.
- Conservation can be accomplished through many methods.
- Efficient use of water at domestic and agricultural level may save water significantly.
- Better irrigation techniques are very important in water conservation.
- Recycling of waste water is very important in water conservation.It has many benefits.
- Watershed is an area through which a water body gets its water.
- Protection of forests and vegetation helps conservation of water in a watershed.
- Forests-soil-litter is a good filter media for water.

- It removes most of the impurities of water.
- The water passing through a forested watershed is generally clean.
- There are many examples of individual, community and government on conservation of water.
- The efforts of Tarun Bharat Sangh led by Sh. Rajendra Singh to revive Aravari river in Rajasthan is a world famous example of water conservation.
- Efforts at individual and community level in Gujarat on water conservation are also quite famous.
- A large number of dams and reservoirs created in the country are good example of government's efforts of water conservation.
- There are number of policy and regulatory initiatives taken by the government to promote rainwater harvesting and water conservation.

TERMINAL EXERCISE

1. Why water conservation is important in India
2. Name few important methods of water conservation.
3. What an individual can do for water conservation at house hold level.
4. How watershed management helps promoting water conservation?
5. What is rainwater harvesting? How it helps conserving water?
6. Explain in brief the example from Gujarat on rainwater harvesting
7. What are the benefits of rain water harvesting?
8. What are the main attributes of ground water?
9. Name few initiatives of the Government on water conservation.
10. How Tarun Bharat Sangh has changed the face to few villages in Rajasthan?

ANSWER TO INTEXT QUESTIONS

31.1

1. Refer to text
2. Sprinklers, drip irrigation
3. Saves water and minerals
4. Antitranspirants, K^+ use

5. Two benefits: 1. Conserve water by holding it for longer time in the field 2. Since it prevents run off water too fast, prevents soil erosion.

31.2

1. An area through which a water body gets water either run off or underground path.
2. Forests prevent rains and excellent filler and excess water absorbs through the roots of the forest trees.
3. Water moves through soil and little layers are excellent filters and relatively pure.
4. Only one tree is felled at any one point and the small gap so created is soon sealed by the outward growth of its neighbour.

31.3

1. Refer to section 31.3
2. Refer to section 31.3
3. Refer to section 31.3
4. Refer to section 31.3