

WATER RESOURCES MANAGEMENT

No life on earth can exist without water. Scientists estimate that there is over one billion cubic kilometres of water on this earth, which covers nearly three fourths of the earth's surface in the form of oceans, rivers, lakes, snow, glaciers and groundwater. Though this seems an inordinately huge amount, in actual fact, less than one percent is fresh and usable found in lakes, ponds, rivers and groundwater. Of the remaining, 97% is found in oceans and 2% is locked up in glaciers and ice-caps. Only 1% is available for use..

Water for Life

Water is the basic necessity of life, not only for human beings, but also for plants and animals. Life began in water and it is a basic component of every living cell. Water accounts for 65% of our body weight. If we lost even 12% of it, we would die. About 83% of our blood is water. It helps digest our food, take in oxygen, transport body wastes and control body temperature. We need water in almost every domestic activity, from cooking and washing to bathing and sanitation.

Water for Climate

Water, to a large extent, determines climate. Places near large water bodies are cooler because the water bodies act as large sinks for heat, thus moderating the climate of the area. Regions near water bodies generally have milder winters and cooler summers. Water has an even more basic role in climate control through the water cycle. The evaporation of water requires huge amounts of energy, which comes from the sun. When the water vapour falls back to earth as rain, this energy is released. Thus water acts as an energy transfer and storage medium for the climate system.

Water for Agriculture and Industry

Food cannot be produced without water. Vegetables are 80-90% water and milk about 87%. Agriculture is the major consumer of water in India, accounting for nearly 93% of the total water. Almost all industrial processes need water which is needed as a solvent, as a medium, as a coolant, as a cleansing agent, etc. Water plays a very important role in disposing of waste, be it domestic sewage or industrial effluents.

Water for Power Generation

Almost all types of power generation require water - from hydel power, where falling water turns turbines to produce power, to nuclear reactors which need huge amounts of water as a coolant. In thermal power generation, next to the fuel, water is the most important resource. For the production of 1 kilowatt of electricity, thermal plants use 140 litres and nuclear plants use 205 litres of water.

THE WATER CYCLE

From the beginning of time, water has been constantly and continuously in motion. Little has been added or lost over the years. The same molecules have been transferred time and time again from the oceans, rivers and lakes into the atmosphere by evaporation and through condensation, back to the earth as precipitation, which finds its way into seas, rivers and the ground. This is known as the water cycle and it is estimated that at any given time, 5 litres out of every 100,000 litres is in motion.

MAJOR USE IN INDIA

In India, water is used mainly for agriculture, livestock and industries. An estimate of the total water that will be consumed in India by 2000 A.D. is given below:

SOURCES OF FRESH WATER IN INDIA

Rivers

The amount of water available for use in India is estimated as 1900 billion cubic metres per year. About 86% of this is the surface run off found in streams, rivers, lakes and ponds. In fact, these are the major sources of water in our country.

Groundwater

India is estimated to have 3,700 mhm. of groundwater, almost 10 times the annual rainfall. Only 10% of the water is being made use of at present, but with lakhs of tubewells being sunk every year to meet the growing water shortage, the water table is declining rapidly.

Tanks

Tanks are small reservoirs built by constructing earthenware dams. They have been in existence in India since ancient times when tanks were built to store rainfall. But in both British and independent India, these tanks have been sadly neglected. As a result, where tanks irrigated half the cropped area a hundred years ago, today they irrigate hardly 10% of it. In Tamilnadu, man-made earthen reservoirs are known as yeris. There are over 40,000 yeris in Tamilnadu. Their place has been taken by big dams which span the major rivers. While the Indian farmer has benefited from these huge hydel projects, and while hydro electric power is a major source of energy in India, the dams themselves have many detrimental effects on the environment.

WATER SCARCITY

The apparent abundance of water is deceptive and we tend to take it for granted. We tend to abuse and overuse it. This has led to water scarcity, for which the reasons are:

- Increasing demand for water due to rapid increase in population.
- Bad management: India receives the second highest amount of rainfall in the world, next only to Brazil, almost 1150 mm. annually, draining a total volume of 400 million hectare metres. Of this, only 100 million hectare metres is retained in the soil. The rest is carried as run off into the oceans and seas.
- Poor ground water resources due to deforestation and overgrazing which result in soil erosion and inability of the soil to permit water infiltration.
- Poor storage facilities.
- Over-exploitation of groundwater in water-scarce areas often resulting in the intrusion of saline sea water in coastal areas.
- Dumping of various types of pollutants into our water bodies, reducing the usability of the available water.
- Cultivation of hybrid varieties of paddy, wheat, cotton, sugarcane and tobacco which consume more water.
- Evaporational loss of water stored in large reservoirs and loss by seepage in long canal systems.
- Siltation of bodies of water due to denudation of the vegetational cover in the hills and catchment areas.

In many parts of our country, water is scarce. In villages, women have to walk several kilometres everyday to catch a few pots of water, sometimes making several trips a day. Even in cities and towns, people face great hardships to collect a few buckets of water. With our ever-multiplying population, water scarcity is going to increase, not diminish. It is time we used our resources wisely.

WATER CONSERVATION

- Water should not be wasted. Leaky taps must be repaired and taps closed when not in use.
- Rain water can be collected and stored for domestic purposes.
- Delivery lines must be maintained properly and faulty and leaking pipes replaced. Plumbing should be done correctly, seeking advice from experts.
- Hand pumps should be well maintained to perform effectively.
- High HP motors to draw water from the well (open or bore) must not be used when low HP pumps can perform the same function.
- Overhead storage tanks should be maintained in good condition. PVC tanks which are cheaper and lighter in weight and which will not corrode or rust are preferable to metal tanks.

MANAGEMENT OF WATER RESOURCES

Desiltation

- Canals, tanks, yeris, etc. must be desilted regularly during the summer months.
- People should be encouraged to revive the ancient practice of protecting trees around tanks. Major rivers were sanctified and groves were established around villages and on the river banks.

Afforestation

Afforestation of barren, hilly slopes on a warfooting should be carried out. Trees withstand drought better than crops. They check dust, replenish streams, provide shade to cattle and man and give fodder for cattle. Their provision innumerable uses for man. Denuding the land of trees without compensatory afforestation is a suicidal and short-sighted approach to solving immediate needs.

Ponds and Tanks

- Creation of small reservoirs and percolation tanks to hold run-off water must be implemented and maintained well.
- Agronomic practices like off-season tillage (prior to pre-monsoon showers) conserve soil moisture. Moisture penetration to a depth of 90 cm. is achieved if the land is ploughed to a depth of 30 cm. Other practices like early sowing of seeds, moderate use of fertilisers, weeding, pest and disease control and timely harvesting increase the yield inspite of limited moisture in the soil.
- Terrace cultivation of hilly slopes prevents water run-off.
- Contour ploughing and planting of grasses and trees check run-off water and increase the soil's capacity to retain moisture.
- Green manuring (incorporation of fresh green leaves into the soil) and crop-rotation (cultivating different crops in rotation depending upon the soil and climate, e.g. cereals followed by legumes) conserve soil moisture.
- Mulching the soil with organic residue conserves soil moisture.
- The use of sprinkler irrigation for closely-spaced crops like millet, pulses, groundnuts, etc., conserves 30 to 40% of the surface water.
- Drip irrigation is most suited for closely-spaced row crops like vegetables, cotton, sugarcane. The efficiency of this system is around 25 to 30% in conserving soil moisture. The cheapest and easiest form of drip irrigation is to drill one to three holes in a mud pot and bury it partially in the soil next to the plant. The water in the pot drips slowly, ensuring that the soil is continuously moist and the plant gets a constant supply of water.
- Harvesting rain water and storing it in small ponds ensures water supply during summer.
- Deep trenches can be dug adjacent to bunds to collect run off water and soil.
- All these practices are useful only if utilised properly.

WATER POLLUTION

Like clean air, fresh water is also becoming a scarcity. The limited availability of fresh water and its unequal distribution make water pollution a matter of great concern. Water pollution is generally localised and confined, making it more severe. The pollutants undergo many reactions and can become hazardous. 70% of India's fresh water is polluted, including several high altitude lakes. While water pollution is easier to study and manage, its control is highly complex and very costly.

Sources of water pollution

In underdeveloped countries, sewage is a major source of water pollution. Human excreta contains 400 different species of bacteria and viruses. Even well-treated sewage contains pathogenic bacteria and virus, unless properly chlorinated before being discharged into any water course. Sewage is a major contributor to water-borne diseases and affects the health of people and other organisms in the environment in many ways.

Industrial effluents from sugar factories, distilleries, tanneries and paper industries are accompanied by very high organic loads. By-products of paper and pulp industry cause depletion of fish upto as far as 40 km downstream. The wastes from oil refineries and steel industries contain phenol which imparts a strong odour, apart from poisoning the water body. Fertiliser industry wastes contain ammonia, urea, phosphate and sulphate which, in water, cause algal bloom and are toxic to aquatic fauna and flora. Alkaline industry wastes contain mercury which can kill human beings who consume mercurised fishes. Lead generated from battery, printing, petrol and paste-processing industries, trace and toxic elements such as zinc, copper etc., and effluents from mining industries are injurious to aquatic organisms.

Water in which maximum permissible concentration of any single or more constituents is in excess is unfit for drinking and human health. There are definite tolerance levels for water used for different activities such as drinking, bathing, irrigation and industrial purposes. Depending on its use, there are different physio-chemical and bacteriological standards for water.

Major water pollutants and their effect on human health

There are some ways in which bodies of water get polluted:

- Discharge of untreated domestic sewage into waterways.
- Discharge of industrial effluents.
- Discharge of agricultural wastes into waterways.
- Use of pesticides, herbicides, fungicides and weedicides which seep into the ground water.
- Discharge of fertilizer residues as run-off from farm lands into waterways.
- Accidental spillage of oil in the seas by tankers.

Control of Water Pollution

- Legislation should be enforced to control water pollution.
- Effluents from industries should be treated and then discharged into water bodies.
- Treated effluents can be recycled for other uses like agriculture, and the sludge after drying can be used as manure.
- Many more sewage treatment plants must be installed. At present, raw sewage is fed directly into water bodies.

Water Purification - At Home

- The vessels which store water should be clean.
- Rusted, greasy vessels should not be used for storing water.
- Water must be filtered through a clean, white cloth before storing.
- The traditional 3-pot filters can be used for purifying water.
- Water must always be boiled before drinking.
- Modern water filtering equipment capable of removing bacteria can also be used.

Water Purification - by the Community

- The surroundings of water bodies should be kept clean.
- Care should be taken to prevent the disposal of sewage and industrial waste into bodies of water.
- Proliferation of Eichornea (water hyacinth), Pistia and algal bloom on water must be avoided.
- Fish should be introduced into bodies of water to purify the water.
- Wells should be kept open to allow fresh air and sunlight to act as a natural sterilizing agent on the surface of the water.
- Wells and tanks must be desilted regularly.
- Washing of clothes and vessels, cattle and automobiles should be prohibited at public tanks, yeris, etc.

Water Purification - by Industries

Effluents must be recycled and effluent treatment plants must be installed. Each large industry should have its own water treatment plant and small industries should contribute to a co-operative plant. Water pollution by industrial effluents must be treated at the site before the effluents are released into the water body. The Government should punish industries heavily if they pollute fresh water, and should supervise and inspect industrial effluent treatment plants to ensure proper de-toxification and recycling measures. LEGISLATION Right to life, which is a fundamental right under Article 21 of the Indian Constitution, has been interpreted by the courts to also include a right to pure air and water.

Time and again many citizens avail of this provision to fight against polluted water.

Section 277 of the Indian Penal Code deals with water pollution, which reads as follows:

Whoever voluntarily corrupts or fouls the water of any public spring or reservoir, so as to render it less for the purpose for which it is ordinarily used, shall be punished with imprisonment which may extend to three months, or with the fine of one thousand rupees, or with both.

The more recent legislation on water pollution is the Water (Prevention and Control of Pollution) Act, 1974. This Act is meant to curb the various kinds of pollution ranging from domestic to industrial pollution. Violations under this Act are more severe.

Parts X-B and XI-A of the Merchant Shipping Act, inserted by the Amending Act of 1983 deals with every aspect of marine pollution.

Note: Any citizen, who finds any water source polluted by a government or private agency may give a complaint to the State Pollution Control Board (PCB) and wait for 60 days for the PCB's action. Only in cases where the PCB does not respond can the citizen go to the court. However it is to be noted that this applies only to suits under the Water Act of 1974.

Another important right available to the citizens of this country is that where there is no water available for them to sustain their life and if that is caused due to the neglect of the State, that individual or individuals can file a writ petition either under Article 32 or Article 226 of the Constitution for the violation of their fundamental right, i.e. right to life which is enshrined under the Article 21 of the Constitution. This could also be applied to cases where the drinking water source is polluted by a government or private agency.