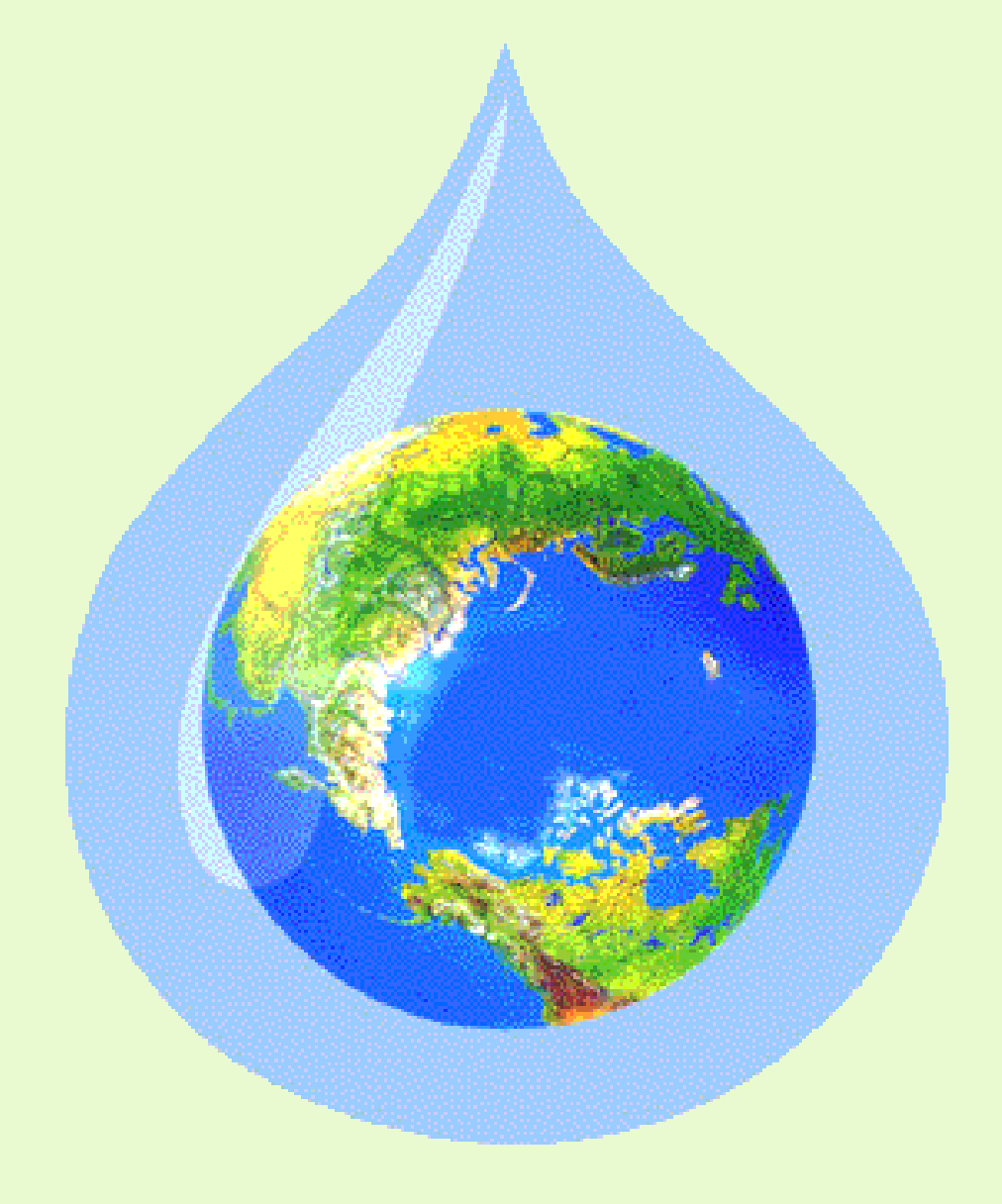
WATER - THE ELIXIR OF LIFE



THE BLUE PLANET

About 4.5 billion years ago, the earth was a ball of fire covered with volcanoes. Steam and other gases escaped into the atmosphere. Then the earth cooled and all the steam in the atmosphere condensed and fell as rain. The rainwater filled the hollows and the oceans and lakes were formed. If all the land were pushed together to form one mass, it would occupy only one third of the surface. The remaining two thirds would be covered with water. The water supports life as we know it, giving our earth the name "LIVING PLANET". Our earth is also called the BLUE PLANET because of the large quantities of water, which when seen from outer space, give the planet a blue hue.

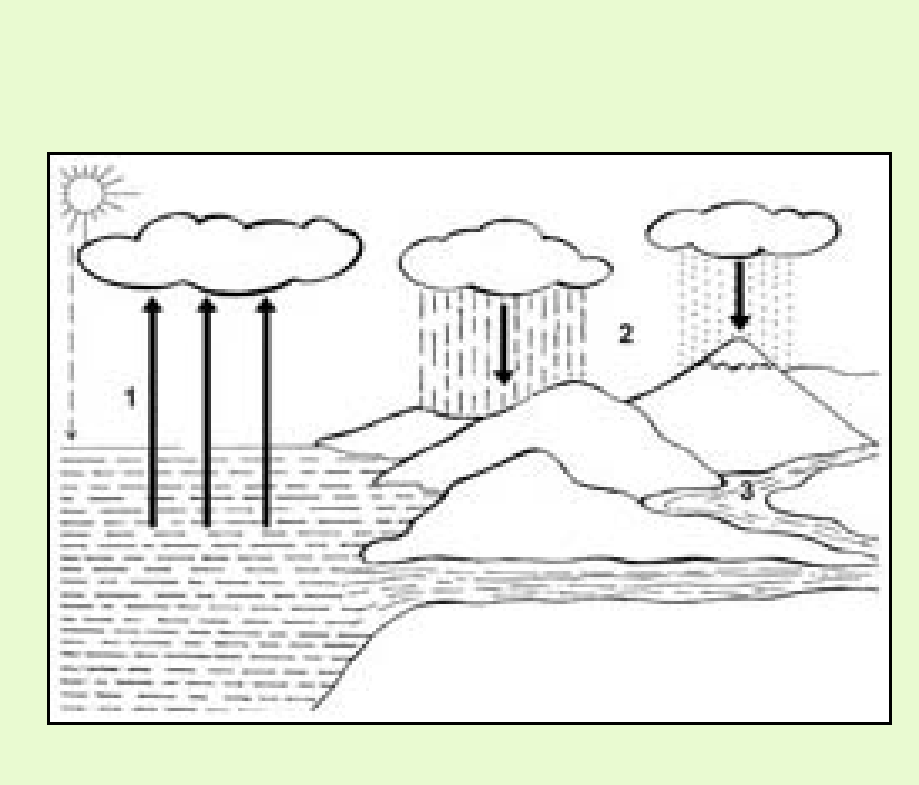
THE WATER OF LIFE

The first forms of life evolved in the sea. They gradually evolved features that helped them to swim up to the shore, crawl up the beach and over the land from where they climbed up into the trees and mountains, flew up into the sky and wandered all over the earth. Without water there is no life. We are 65 % water and even our blood has roughly the same salt content as seawater, linking us indisputably to the first life forms that evolved from the sea.

THE WATER CYCLE

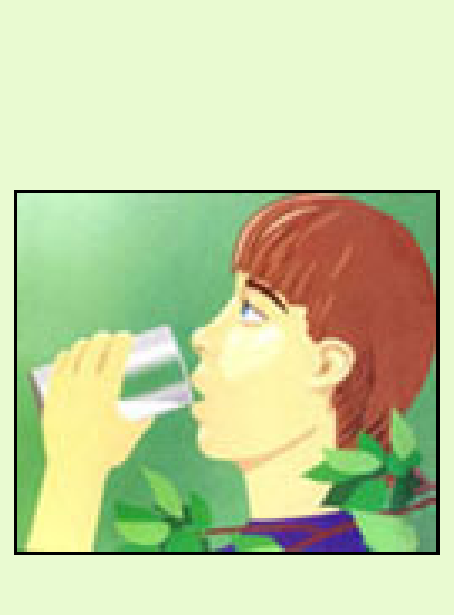
The water in inland sources has originated from the ocean, passing billions of times through the water cycle - nature's most efficient recycling mechanism. It is a constant reminder to us that water must be recycled over and over again as it cannot be produced. The amount of water on earth has been constant for millions of years.

A drop of water may spend 2 to 3 weeks in a river, 100 years in a lake or a 1000 years in a glacier. The water you drink today may have once flowed down the Amazon or the Nile; it may have washed the holy idol in a temple or watered the crops in China.



1. Warmed by the sun, water evaporates into the atmosphere.
2. Water vapours condense and fall as rain.
3. The rainwater flows down as rivers and joins the sea again.

WATER FOR LIFE



All forms of life - plants, animals and humans - need water.

- Plants take in water through their roots to make food by photosynthesis.
- Animals need water to drink and bathe.
- Fish and amphibians live and breed in water.
- Humans need water to drink, cook, bathe and clean their surroundings.

About 5000 years ago, the first civilizations developed on the banks of rivers.

- Egyptian civilization on the banks of the Nile.
- Mesopotamian civilization on the banks of the Tigris and the Euphrates.
- Harappan civilization on the banks of the Indus.
- Chinese civilization on the banks of the Yangtze.

People invented ways to raise, carry, move and store water. The wheel was first invented to turn clay into pottery which, when baked, made it possible for people to collect, store and transfer water in prehistoric times.

WATER - THE WONDER LIQUID

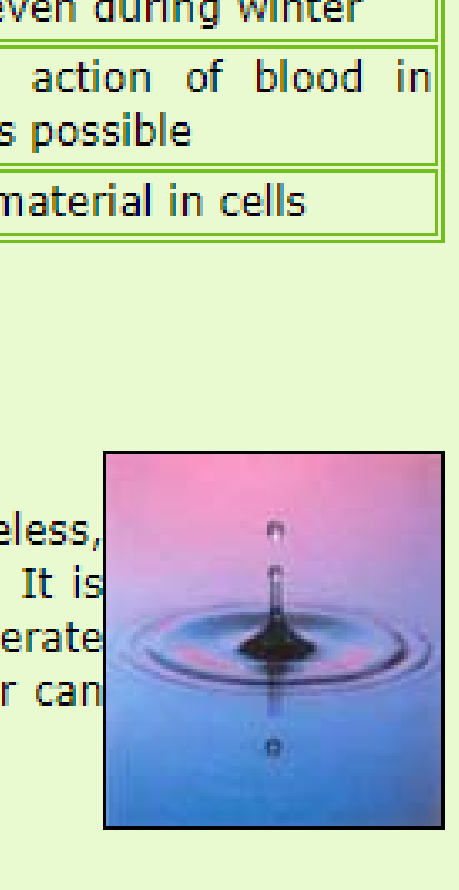
Of all the liquids available on earth, only water is indispensable for life. What makes it the wonder liquid that is so useful?

Some important physical properties of water

Property	Comparison with other Liquids	Environmental significance
State	Normally liquid, rather than gas	Provides a medium for life
Specific Heat Capacity Latent Heat of Vaporization	High (1 cal g-1) High (540 cal g-1)	Controls environmental temperature; good heat sink
Density (1gm/cc)	Maximum at 4°C (ice has low density)	Water freezes on the surface, so aquatic life can survive in the water below even during winter
Surface tension	High (73 dynes cm-1)	Can form drops; capillary action of blood in people and water in plants is possible
Heat conduction	High	An important heat transfer material in cells

Water is found in three useful states.

WATER - LIQUID FORM



This is the most useful form of water. In the pure form it is colourless, odourless, tasteless, harmless and neutral. Hence we can drink and use it for cooking, washing and bathing. It is used in irrigation and for cooling and washing in industries. Falling water is used to generate hydroelectric power and moving water can be used to transport goods and people. Water can also be moved easily in containers.

Water in the liquid form supports a great variety of plants, marine and animal life.

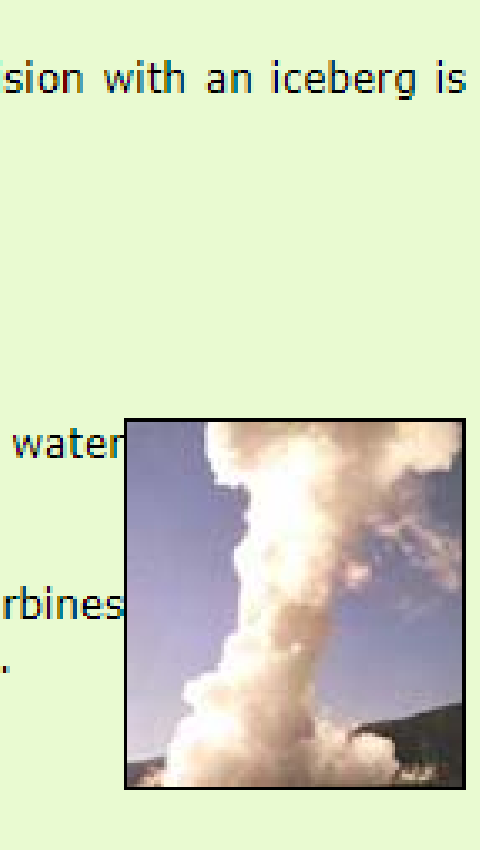
ICE - SOILD FORM

Without ice we cannot enjoy ice-cream or chilled drinks. It will not be possible to preserve fruits, vegetables and eatables or biological specimens. It is in the form of ice that the bulk of our freshwater is held.

Ice can float and hence, only the surface of water bodies freezes. The water beneath the ice is still able to support life. Ice is also a good insulator. The Eskimos live in houses made of ice - called igloos - to keep them warm.

Ice is one of the hardest substances. We can walk, skate, build and drive on ice. A collision with an iceberg is fatal for ships.

WATER VAPOUR - GASEOUS FORM



But for the property of water to evaporate and be held as vapour in the atmosphere, the water cycle would not be possible. Water vapour in the atmosphere condenses to fall as rain.

Steam is water vapour at the boiling temperature of water. It can be used to drive the turbines for generation of electricity. Steam engines are used to move people and goods by trains.

FROM SOURCE TO SEA - THE GREAT PROVIDER

The face of the earth is crisscrossed with the paths of rivers, streams and canals, some flowing gently while others rush forward in great haste to keep their tryst with the ocean. Even as we enjoy their abundance, we waste with impunity, pollute without hesitation and scheme to control.

Many of the major water sources of the world have become dreadfully polluted. The clear and sparkling waters that come tumbling down the mountains turn grey and murky by the time they mingle with the sea.

WATER IN OUR LIVES

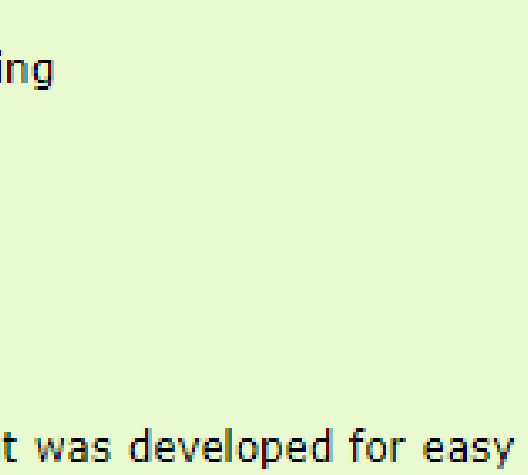
The divine cleanser of body and soul

Water, the life giver, cleanser and purifier, is the divine witness to all religious rites. Ganga, Yamuna, Brahmaputra, Godavari, Narmada, Kaveri or the mythical Saraswati, are all venerated as goddesses, whose swirling waters are bestowed with powerful healing powers that rejuvenate the body and cleanse the soul.

- Hindus bathe in the sacred rivers and after death the ashes are immersed in sacred rivers, lakes or the sea
- Muslims wash at the ablution fountain in the courtyard of a mosque before praying
- Christians are baptized with water

Trade and transport

In ancient times, the rivers were the arteries of economic development. The riverfront was developed for easy loading and unloading of grain, cattle and people.



Rivers around the world have been exploited for navigation by suitably engineering their course. Locks and weirs are put in to physically lift or bring down a vessel where the river drops vertically. Canals, ports and docks developed and ships and barges link inland cities to the ports on the coasts.

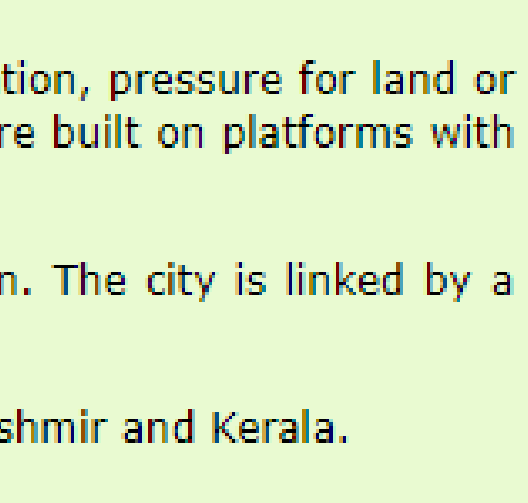
Living on water

There are many places around the world where people live on water due to their location, pressure for land or their profession. The first houses on water were built about 8000 years ago. They were built on platforms with stilts to protect them from high tides or floods.

Venice in Italy was built on wooden piles on muddy islands in the middle of a lagoon. The city is linked by a network of canals instead of roads.

Houseboats are found on rivers and in ports around the world. They can be seen in Kashmir and Kerala.

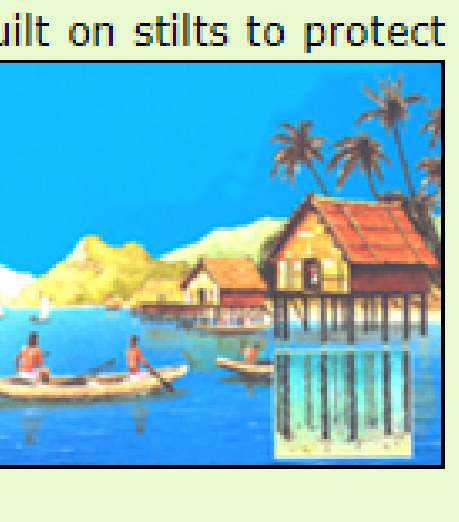
On the banks of the Mekong river and on the Tonle Sap lake in Cambodia, houses are built on stilts to protect them from the floodwaters.



In Thailand, tiny boats loaded with fruit, vegetables and cooked meals form a floating market for people who live in the canals and branches of rivers.

In the Philippines, whole fishing villages are built on stilts over lagoons and river estuaries.

Fun with water



Some of our most exciting sports are all water based - swimming, diving, surfing, sailing, skiing and skating.

Water has been a great inspiration for poets and painters. Fountains, artificial streams and water scenes have been created indoors to bring the comforting sight and sound of water into the home.

HOW MUCH WATER IS THERE?

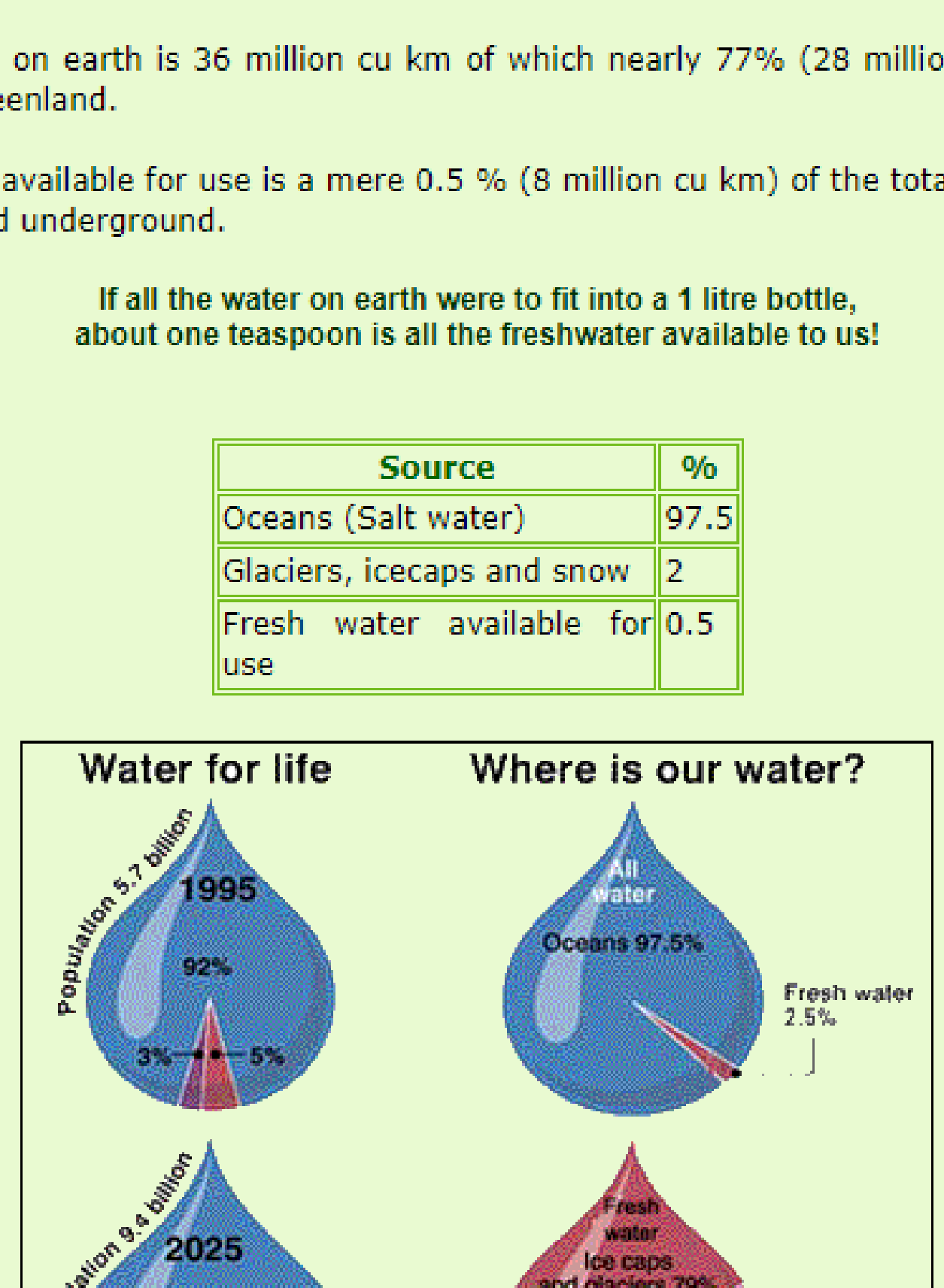
The volume of water available on the earth is 1.4 billion cu km of which more than 97 % is saline and present in the oceans.

The freshwater available on earth is 36 million cu km of which nearly 77% (28 million cu km) is frozen in the Antarctic ice cap and Greenland.

The fresh water actually available for use is a mere 0.5 % (8 million cu km) of the total quantity of water and is found in lakes, rivers and underground.

If all the water on earth were to fit into a 1 litre bottle,
about one teaspoon is all the freshwater available to us!

Source	%
Oceans (Salt water)	97.5
Glaciers, icecaps and snow	2
Fresh water available for use	0.5



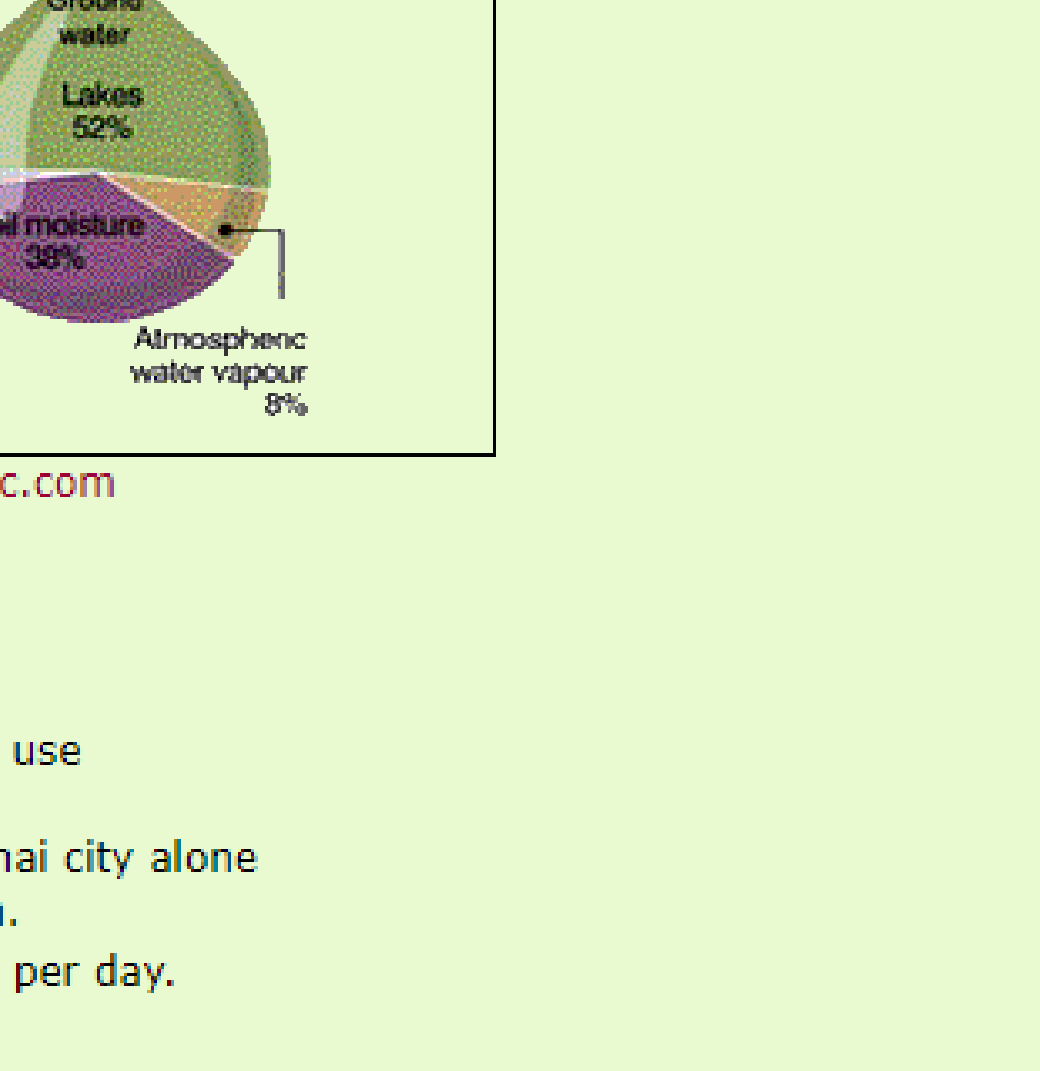
Source: www.bbc.com

HOW MUCH WATER DO WE USE?

- Less than 1% of the water on earth is available for our use
- 6 billion people are dependent on this water
- 300 million litres of fresh water are used daily in Chennai city alone
- In India, nearly 90 % of the water is used for irrigation.
- We require about 150 to 250 litres of water per person per day.

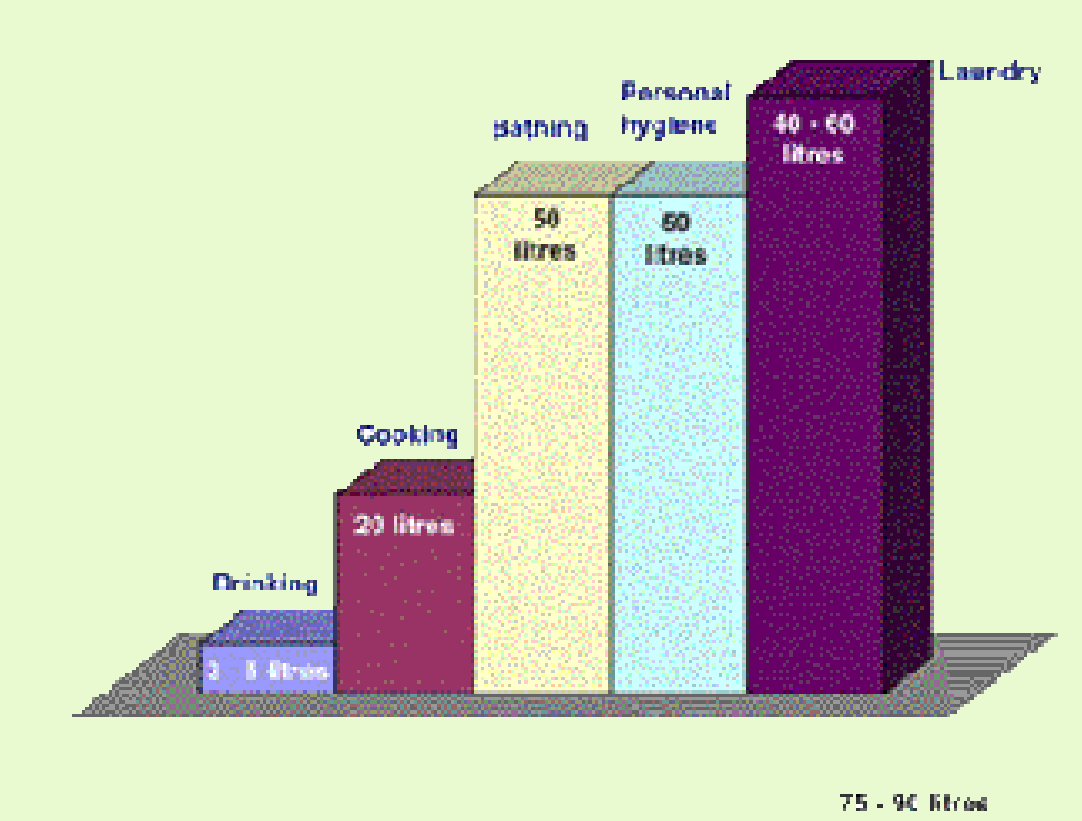
ROUGH ESTIMATION OF WATER REQUIREMENT PER

PERSON PER DAY



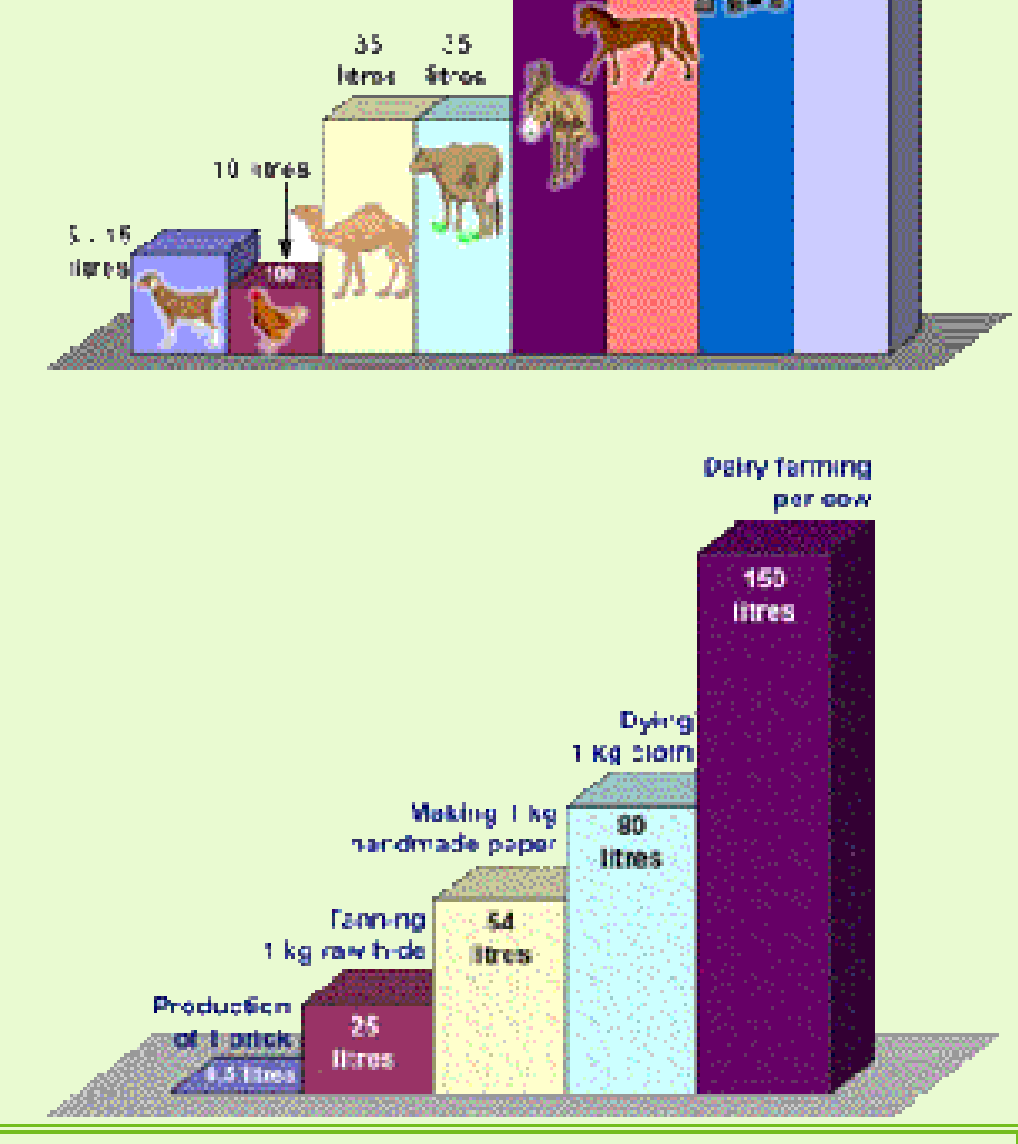
ROUGH ESTIMATION OF WATER REQUIREMENT PER

DAY PER ANIMALS



ROUGH ESTIMATION OF WATER REQUIREMENT PER

PERSON FOR DIFFERENT INDUSTRIES



Purpose	DEMAND (in km3)				
	1990	2000	2010	2025	2050
Irrigation	460	630	690	770	1008
Industrial use	15	30	60	120	180
Domestic use	25	33	42	52	67
Energy	19	27	48	71	95
Others	33	30	34	37	40

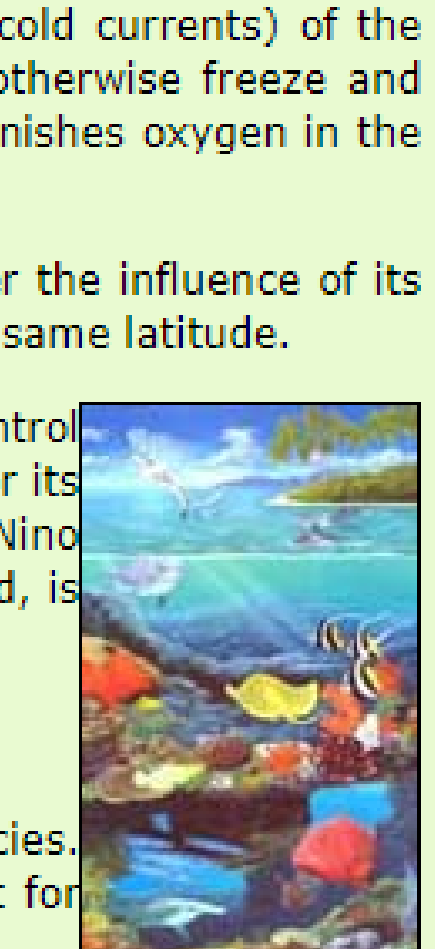
OCEANS IN OUR LIVES

The oceans have more impact on our lives than we are aware of. The oceans cover 66% of the earth's surface and play a pivotal role in climate control. The Pacific Ocean, which is the biggest ocean, contains more than half the earth's seawater. The oceans are rich in sea food, salt, minerals, chemicals, medicines and an incredible variety of marine life. More than 80% of ocean life remains unexplored as neither submersibles nor men can venture to depths where the pressure exceeds four atmospheres.

A gigantic weather machine

Ocean currents flow like rivers both at the surface (warm currents) and at the bottom (cold currents) of the ocean. They mix together the cold and warm seawater, warming the lands that would otherwise freeze and cooling places that would otherwise become scorching hot. The flow of currents also replenishes oxygen in the lower levels and brings valuable nutrients to the surface.

The warm Gulf Stream is one of the most important currents in the Atlantic Ocean. Under the influence of its warmth, farming is possible in England while polar bears roam over parts of Canada at the same latitude.



The surface temperature of the oceans ranges between 270C and -10C. Oceans also control the wind, rain, air pressure and humidity. The monsoons on which India is so dependent for its rainfall, are influenced by the high and low pressure areas in the Bay of Bengal. The El Nino effect, which periodically causes extremes of weather effects over many parts of the world, is caused by the temperature differential in the Pacific Ocean.

Life in the ocean

Life began at sea. The oceans support the largest and most diverse range of living species. The combination of vital salts, dissolved gases and minerals provides a rich environment for the survival and growth of innumerable species.

Coral reefs - forests in the ocean

The coral reefs are the equivalent of tropical rain forests. Spreading along the coastlines over an area of 6,00,000 sq. km., they are home to an incredible variety of marine life. The maximum number of coral species are found in the Indian and Pacific Oceans. Nearly 60% of the known coral species are found in the Indian Ocean, around the Andaman and Nicobar Islands, Lakshadweep, Gulf of Mannar and Palk Strait in Tamil Nadu and Gulf of Kutch off the Saurashtra coast.

Chemicals in the organisms found in the coral reef are a potential source of drugs to cure many diseases.

The reefs guard the coastline from the fury of storms and waves. When the reefs are destroyed, the coasts become vulnerable to erosion.

Food from the sea

More than 50% of the world's population depend on fish as food. It is an excellent source of protein. The world fish catch is about 80 million tonnes and India with a harvest of 1.5 million tonnes ranks 8th among the fish producing nations of the world. The major fishing areas in India lie about 15 km. off the southwest coast.

Mineral wealth

Scientists estimate that there are enough mineral deposits under the sea to last us for thousands of years. They are found as nodules on the bed of the ocean. Zircon, garnet, monazite, copper, tin, aluminum, iron, cobalt, nickel and phosphorous are all found under the sea. Deep sea mining is, however, expensive and difficult.

Dissolved minerals

What is life without salt? Seawater is the source of salt. There is enough salt in the oceans to cover the land to a height of 150 metre. Magnesium used in the aircraft industry, sodium sulphate used in the manufacture of paper, pharmaceuticals, soap, glass and potassium sulphate are extracted from sea water.

Oil and natural gas

1/5 of the world's total supply of oil and natural gas comes from under the seas. In India, oil has been found in the Gulf of Khambhat, Bombay High, Cauvery delta, Bay of Bengal and off the Andaman and Nicobar Islands.

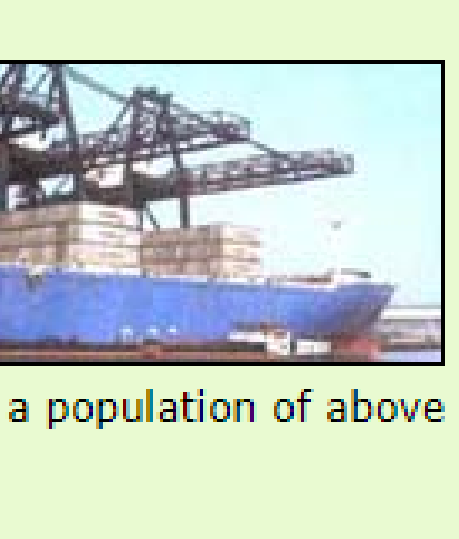
Medicines

Fish have been the source of various medicines. The venomous chemicals produced by some fish to protect themselves against predators are a possible source of drugs. Sea sponges have yielded materials with antibiotic and antifungal properties

Energy

The constant motion of tides and waves can be harnessed to generate energy. Tidal waves reach a height of 6m along the Saurashtra coast. The first big tidal power station was built at the mouth of the River Rance in Brittany, France.

Trade and transport



Ships were the major mode of transport until the development of road, rail and air transport. 80% of the volume of world trade is carried by sea. Different types of cargo ships transport crude petroleum, iron ore, coal, minerals, food grains and perishable foods. Many people still travel by sea, while luxury cruise ships are a tourist's paradise.

The length of the world coastline is over 1 million kilometers. Two thirds of the cities with a population of above 2.5 million live near estuaries.

DECREASING AVAILABILITY

Despite the seeming abundance of water on earth, as much as 40% (2.4 billion) of the world's population live in water-scarce areas. And this could increase to 48% (3.5 billion) by the year 2025.

The U.N. Population Fund predicts that the world will begin to run out of fresh water in 2050 when the world population will be 9.3 millions. There will be 3 billion people in 48 water-stressed countries out of which 4.2 billion people will not be able to get their daily 50 litres - the minimum requirement for drinking, washing and cooking, according to the U.N.

Groundwater provides for the needs of 20% of the world's people. About 20% of the water in rivers is withdrawn annually.

The spiralling global population and rapid increase in agriculture and industrial development has lead to a gigantic increase in the demand for water.

The growth of cities, industries and increasing use of chemical fertilizers and pesticides have polluted more than 70 % of the freshwater resources in India.

The three major areas of concern with regard to water are the rate of exploitation, the pollution of water sources and inequitable distribution.

WATER IS EVERYONE'S CONCERN

Water is everyone's concern. Conserving and protecting water sources is a local issue demanding the participation of every individual in a village, city, state or country. Each one of us must take stock of how much water we consume, for what purpose, the state of the water after consumption and where the used water ends up.

REDUCE YOUR USE OF WATER

- Repair leaking taps

  15 litres of water are wasted in one day when, from a leaky tap, leaks just one drop of water falls every second

  7 litres of water are wasted when you leave the tap open as you brush your teeth
- Put a filled plastic bottle in the toilet flush tank, so less water is consumed for flushing
- While washing dishes or brushing your teeth, keep the tap closed
- Have a bucket bath rather than a shower
- Use buckets instead of hose pipes for washing vehicles
- Note the time taken to fill the overhead tank and switch off the motor before the tank overflows
- Plant drought-resistant plants which require less water
- Reduce the use of washing machines, which consume more water
- Wash vegetables etc., in a bowl containing a pinch of potassium permanganate
- Save electricity as it saves water used in its generation
- Water plants early in the morning or late evening to avoid evaporation
- The less water you use, the less water goes you waste

REUSE USED WATER

- Use the water used for washing vegetables, rice, dhal, etc., for watering the plants
- Cook dhal or rice in water used for cooking vegetables. You will not only save water but will also get the benefit of added vitamins and minerals from the vegetables
- Divert the kitchen wastewater to the garden

RECYCLE

Many cities all over the world treat their waste water and recycle it. Does yours?

Recycle as many items as you can. Recycling saves resources and energy used for producing new items and at the same time saves water used in their production.

HARVEST AND CONSERVE

- All rainwater should be guided to recharge underground aquifers
- Collect rainwater in vessels and use it for washing clothes or vessels
- Waste water (from the kitchen and bath) should be used to water plants

DO NOT POLLUTE

- Avoid the use of chemical pesticies and fertilizers that pollute the ground water
- Do not throw paper, empty bottles, cans or plastic covers into water bodies

Where does your sewage go? If it is discharged into the sea or a fresh water source (like a river or lake), go to your local water-board office and tell them to change the practice.

Reduce your needs.

Reuse or Recycle as much water as you can.

Harvest and conserve water.

Do not pollute water.