

WATER RESOURCES

Water covers 70% -75% of earth's surface of which 97.2% is locked in sea or oceans (1332 million cu.km, considering total availability as 1400 million cu km), 3% is fresh water 2.15% in polar ice caps (29.20 cu.km), < 1% available as surface and sub surface water (rivers, streams, lakes) with which we have to manage ourselves. Water is renewable resource. It may change it's form but quantity of water on earth has remained same for millions of years. Out of 1400 million cu.km of water available on earth, only 14 million cu. km is fresh water. As per the National Commission on Agriculture, considering an average rainfall of 1200mm, the water wealth of India is about 400 million hectare meters.

Main sources of water for our use are:

Rainfall: India can be broadly divided into 15 ecological regions. The vast ecological diversity of this country is reflected in the diversity in available water resources. With an average annual rainfall of 1170 mm, India is one of the wettest countries in the world. However, there are large variations in the seasonal and geographical distribution of rainfall over the country. At one extreme are areas like Cherrapunji, in the northeast, which is drenched each year with 11,000 mm of rainfall, and at the other extreme are places like Jaisalmer, in the west, which receives barely 200 mm of annual rainfall. Though the average rainfall is adequate, nearly three quarters of the rain pours down in less than 120 days, from June to September.

Groundwater: India's groundwater resources are almost ten times its annual rainfall. According to the Central Groundwater Board of the Government of India, the country has an annual exploitable groundwater potential of 26.5 million hectare-meters. Nearly 85% of currently exploited groundwater is used only for irrigation. Groundwater accounts for as much as 70-80% of the value of farm produce attributable to irrigation. Besides, groundwater is now the source of four- fifths of the domestic water supply in rural areas, and around half that of urban and industrial areas. However, according to the International Irrigation Management Institute (IIMI), the water table almost everywhere in India is falling at between one to three meters every year. Furthermore, the IIMI estimates that India is using its underground water resources at least twice as fast they are being replenished. Already, excessive ground water mining has caused land subsidence in several regions of Central Uttar Pradesh.

Surface water: There are 14 major, 44 medium and 55 minor river basins in the country. The major river basins constitute about 83-84% of the total drainage area. This, along with

the medium river basins, accounts for 91% of the country's total drainage. India has the largest irrigation infrastructure in the world, but the irrigation efficiencies are low, at around 35%.

USES: Is essential for all forms of life. Many uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually, all of these human uses, require fresh water. No plant or animal species can survive without water. If water in our body drops by 1% we feel thirst, if it drops by 10% we face death.

Reasons for decline of ground water

Population continues to rise at an unprecedented and unsustainable rate; many more areas are expected to experience this imbalance in the near future.

(i) Population explosion: World population is > 6 billion and will continue to increase significantly during the next few decades - Enormous demands on the world's limited freshwater supply. The total annual freshwater withdrawals today are estimated at 3800 cubic kilometers, twice as much as just 50 years ago (World Commission on Dams, 2000).

(ii) Overutilization of Surface and Groundwater: occurs at various levels. Use of more water than really needed by human beings. Many agriculturists use more water than necessary to grow crops. Industries in order to maximize short-term economic gains does not bother its liquid waste and releases it into streams, rivers and the sea.

(iii) Deforestation: Once hill slopes are denuded of forest cover, the rainwater rushes down the rivers and is lost. Forest cover permits water to be held in the area permitting it to seep into the ground. This charges the underground stores of water in natural aquifers. This can be used in drought years if the stores have been filled during a good monsoon. This soil and water management and afforestation are long-term measures that reduce the impact of droughts. The destruction of forests influence the regulation of natural water cycle. The removal of dense and uniform cover over the hilly zones leads to occurrence of floods in drainage basins. Nations situated in tropical climates including India experience disastrous floods caused by the indiscriminate deforestation of the slopes above the valleys.

(iv) Hydropower generation: Large amount of water is used for generating power which other wise used for human needs.

(v) Dams: for Agriculture and Power Generation

(vi) Rain fall: The erratic and inadequate rainfall results in reduction in storage in subsurface reservoirs. The building construction activities are sealing the permeable zone, reducing the area for per collation of rainwater into subsurface and increase in surface runoff.

Sustainable Water Management

1. Building several small reservoirs instead of few mega projects
2. Developing small catchment dams and protecting wetlands
3. Soil management, micro-catchment development and afforestation permits recharging of underground aquifer, thus reducing the need for large dams
4. Treating and recycling municipal waste water for agricultural use.
5. Preventing leakages form dams and canals and loss in municipal pipes
6. Effective rainwater harvesting in urban environments
7. Water conservation measures in agriculture, such as using drip irrigation, control of growing water intensive cash crops ; control of water logging.
8. Pricing water at its real value makes people use it more responsibility and efficiently and reduces wastage
9. In deforested areas where land has been degraded, appropriate soil management practices, making bunds along the hill-slopes and making *nalla* plugs can help retain moisture and make it possible to revegetate degraded areas
10. Domestically use water by VED principle- use for Vital activities, control for Essential activities, cut down for Desirable activities.
11. Use waste water for activities that does not need fresh water – Recycling
12. Adopt mini water harvesting models for domestic usage.
13. Protect existing tanks
14. Develop systematic water management and adopt strict water auditing
15. “Save water Campaigns” for public awareness on water scarcity
16. Through rainwater harvesting, community based participatory initiatives and holistic watershed management.
17. Responsible water usage can only be achieved by empowering local communities and creating local accountability.
18. The government should develop policies that protect water resources, promote sustainable watershed management and invest in technologies that will increase efficiency in irrigation, industrial usage and improve water harvesting techniques.

FOOD RESOURCES

Our food comes almost entirely from agriculture, animal husbandry and fishing *i.e.*, - 76% from crop lands, 17% from range lands *i.e.*, meat from grazing livestock and 7% - marine and fresh water *i.e.*, fisheries.

World Food Problems and Environmental Concerns:

1. Population growth: Food production in 64 of the 105 developing countries is lagging behind their population growth levels.
2. Poor agricultural practices: Poor environmental agricultural practices such as slash and burn, shifting cultivation, or 'rab' (wood ash) cultivation degrade forests.
3. Degradation of agricultural lands: Globally 5 to 7 million hectares of farmland is degraded each year. Loss of nutrients and overuse of agricultural chemicals are major factors in land degradation. Water scarcity is an important aspect of poor agricultural outputs. Salinization and water logging has affected a large amount of agricultural land worldwide.
4. Our fertile soils are being exploited faster than they can recuperate.
5. Forests, grasslands and wetlands have been converted to agricultural use, which has led to serious ecological questions.
6. Use of genetically modified seed variety, without minding the conducive environment for such experimentation, will seriously affect the land ecosystem.
7. Our fish resources, both marine and inland, show evidence of exhaustion.
8. There are great disparities in the availability of nutritious food. Some communities such as tribal people still face serious food problems leading to malnutrition especially among women and children.
9. Loss of Genetic Diversity: Modern agricultural practices have resulted in a serious loss of genetic variability of crops. India's distinctive traditional varieties of rice alone are said to have numbered between 30 and 50 thousand. Most of these have been lost to the farmer during the last few decades as multinational seed companies push a few commercial types. This creates a risk to our food security, as farmers can lose all their produce due to a rapidly spreading disease.

Food security: It is the ability of all people at all times to access enough food for an active and healthy life. It is estimated that 18 million people worldwide, most of whom are children, die each year due to starvation or malnutrition, and many others suffer a variety of dietary deficiencies. The earth can only supply a limited amount of food. If the world's carrying

capacity to produce food cannot meet the needs of a growing population, anarchy and conflict will follow.

The following 3 conditions must be fulfilled to ensure food security

- Food must be available
- Each person must have access to it.
- The food utilized must fulfill nutritional requirements

Options To Achieve Food Security

Food security is closely linked with population control through the family welfare program. It is also linked to the availability of water for farming. Food security is only possible if food is equitably distributed to all. Many of us waste a large amount of food carelessly. This eventually places great stress on our environmental resources.

1. Institutional support for small farmers: A major concern is the support needed for small farmers so that they remain farmers rather than shifting to urban centers as unskilled industrial workers.
2. Trade related issues: International trade policies in regard to an improved flow of food across national borders from those who have surplus to those who have a deficit in the developing world is another issue that is a concern for planners who deal with International trade concerns. 'Dumping' of under priced foodstuffs produced in the developed world, onto markets in undeveloped countries undermines prices and forces farmers there to adopt unsustainable practices to compete.
3. Protecting genetic diversity: The most economical way to prevent loss of genetic diversity is by expanding the network and coverage of our Protected Areas. Collections in germplasm, seed banks and tissue culture facilities, are other possible ways to prevent extinction but are extremely expensive. The most effective method to introduce desirable traits into crops is by using characteristics found in the wild relatives of crop plants. As the wilderness shrinks, these varieties are rapidly disappearing. Once they are lost, their desirable characteristics cannot be introduced when found necessary in future.
4. Ensuring long-term food security may depend on conserving wild relatives of crop plants in National Parks and Wildlife Sanctuaries. If plant genetic losses worldwide are not slowed down, some estimates show that as many as 60,000 plant species, which accounts for 25% of the world's total, will be lost by the year 2025. Scientists now believe that the world will soon need a second green revolution to meet our future demands of food based on a new ethic of land and water management that must be based on values which include

environmental sensitivity, equity, biodiversity conservation of cultivars and in-situ preservation of wild relatives of crop plants.

5. Environmental friendly farming methods: Shift from chemical agriculture to organic farming, practicing integrated nutrient management (INM), integrated pest management (IPM).
6. Several crops can be grown in urban settings, including vegetables and fruit which can be grown on waste household water and fertilizers from vermi-composting pits.
7. Prevention of water and land degradation: Pollution of water sources, land degradation and desertification must be rapidly reversed. Adopting soil conservation measures, using appropriate farming techniques, especially on hill slopes, enhancing the soil with organic matter, rotating crops and managing watersheds at the micro level are a key to agricultural production to meet future needs.
8. Population control: Most importantly food supply is closely linked to the effectiveness of population control programs worldwide.
9. Education: Educating women about nutrition, who are more closely involved with feeding the family, is an important aspect of supporting the food needs/security of many developing countries.
10. Changing food habits : Today the world is seeing a changing trend in dietary habits. As living standards are improving, people are eating more non-vegetarian food. As people change from eating grain to meat, the world's demand for feed for livestock based on agriculture increases as well. This uses more land per unit of food produced and the result is that the world's poor do not get enough to eat.
11. Women play an extremely vital role in food production as well as cooking the meal and feeding children. In most rural communities they have the least exposure to technical training and to health workers trained in teaching/learning on issues related to nutritional aspects. Women and girls frequently receive less food than the men. These disparities need to be corrected.
12. Alternate Food Source: Food can be innovatively produced if we break out of the current agricultural patterns.