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Climate change and impact on water resources and water issues including pollution and management strategies in India

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Abstract

Climate change has become the focus of attention of scientists, environmentalists and planners in the recent years. Adequate evidence has been found to show that human activities have led to alarming increase in the levels of world temperature.

The atmosphere becomes warmer as various gases absorb the long-wave radiations of heat from the Earth, in a way similar to the heating of the air in a greenhouse. The “greenhouse effect” prevents warmth being dissipated into space and keeps the overall temperature of the Earth higher that it would be without these gases. Water must be managed and conserved to most current and evolving needs without compromising the ability of future generations to meet their own needs. Water must be wisely allocated and efficiently used and regulatory and administrative process for managing water must be streamlined, user-friendly and fair. The public must be involved in water management and decision making. Water rights which existed under the water resources act must be recognized.

The available water is generally used for agriculture, industrial production and domestic purposes. It can be seen that developing countries use comparatively less water for agriculture and more for industrial and domestic purpose.

It is therefore necessary to address these burning issues which are affecting the water availability, although India has water resources to meet the growing needs. So it is mandatory that we use water with utmost care. Again illegal encroachments deplete the natural water resources like lakes, ponds rivers and canals.

India is endowed with a rich and vast diversity of natural resources, water being one of them. Its development and management plays a vital role in agricultural production. Integrated water management is vital for poverty reduction, environmental substance and sustainable economic development. National water policy envisages that water resources of the country should be developed and managed in an integrated manner.

Introduction

Climate change, also called global warming, refers to the rise in average surface temperatures on Earth. An overwhelming scientific consensus maintains that climate change is due primarily to the human use of fossil fuels, which releases carbon dioxide and other greenhouse gases into the air. This includes warming, cooling and changes besides temperature. Climate change is the greatest environmental threat of our time, endangering our health, communities, economy and national security. Climate change is the single biggest environmental and humanitarian crisis of our time.

The biggest challenge that mankind is facing in this century is "Global Warming" and there is a "Global Warning" given by scientist to save our earth. The main destruction caused by man to nature is Global Warming. As the industrialization and globalization trend came, more harmful destruction is done. Now itself we have started to feel the impact of this global warming. It is not an issue with the scientists alone, every individual can join hands in this global mission on "How to save our mother earth from Global Warming"?

Present condition of water resource

Observational records and climate projections provides abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide ranging consequences for human societies and ecosystems. It offers the function and operation of existing water infrastructure as well as water management practices.

The adverse effects of climate change on freshwater systems also aggravate the impact of other stresses such as population growth, changing economic activity, changes in Land use and urbanization.

Globally, demand for water will grow in the coming decades, primarily due to population growth and increasing affluence on regional level, large changes in demand for irrigation water as a result of climate change are expected. Therefore, the provision of a water supply and sanitation, securing food for growing populations and maintaining ecosystems are all enormous challenges. Many countries, for example Bangladesh have enough or even too much water. But, poor water quality and the high cost of purification and efficient distribution mean that the people are faced with almost insurmountable problems. The problems are exacerbated by the increase in population and the associated increase in water and food requirements and by climate change.

According to the latest forecasts, as early as 2025, more than half of the world's population will have no reliable water supply.

India's challenge towards climate change and water management:

The superior growth in food production of India (from merely 50.80 million tones in 1950-51 to 235 tones in 2010-11) is mainly attributable to three major factors; namely, development of new superior genotypes in cereal, large expansion of irrigated area and fertilizer use. Among these irrigation may be considered as a backbone of modern intensive agriculture.

Agricultural sector is the largest consumer of water (82.8%) but with ever growing population and increased urbanization and industrialization in the country, the requirement of water from competing sectors like domestic and industrial needs are also increasing. In 2025, total demand for water would be 1093 billion cubic meter (BCM), the bulk of which 910 BCM will be consumed by irrigation and the country will face the stiff competition for water from different sectors.

There are projections that demand for food grains would increase to 345 million tones in 2030 and 494 million tones by 2050. But, reduction of average size of land holding deterioration of production environment, declining per capita water availability and climate change are the major concern to achieve these targets.

Water management principle

- Water must be managed sustainably
- Water is vital component at the environment
- Water plays an essential role in prosperous economy and balanced economic development.
- Water must be managed using an integrated approach with other natural resources.
- Water must be managed in consolation with the public.
- Water must be managed and conserved in affair and efficient manner.

Objectives

These are the following objectives of this study.

1. To study the availability of water resources in India.
2. To know about the voluntary water conservation programmes in Rural and Urban areas in India.
3. To recognize the importance of Living within the capacity of the Natural environment as a means of ensuring the sustainability of water and issues relating to Environmental Pollution of India.

Methodology

Technical paper is descriptive and analytical using secondary data. Secondary data is collected from various books, journals, websites etc.,

Global water availability

The 70 percent of the earth surface is covered with water. However, 97.5 percent of this water being sea water, it is salty. Out of this water, 68.7 percent is frozen in icecaps, 30 percent is stored underground and only 0.3 percent water is available on the surface water. Out of the surface water, 87 percent is stored in lakes, 11 percent is swamp and 2 percent in river. As all the sweet water is not extractable, only 1 percent of the total water can be used by human beings.

Table 1 Current Water Usage

Usage (%)	World	Europe	Africa	India
Agriculture	69	33	88	83
Industry	23	54	5	12
Domestic	8	13	7	5

Source: Govt. of India Report.

Table 1, Highlights the water usage in India vis-à-vis Africa, Europe and the world. It can be seen in the table that the developing countries use comparatively less water for agriculture and more for industrial and domestic purposes. Contrary to this, developing countries like India and Africa use 80-90 per cent of the water for agriculture and only 5-12 percent of the water for industrial use. This is reflecting on inefficient use of water in agriculture and poor investments in industrial development, with the urbanization and industrial development.

Future water usage

The usage of water is likely to increase in the coming years as presented in Table.2

Table : 2

Year	Agriculture	Industry	Domestic	Per Capita
India	**Billion Lit/ Day**			
2000	1658	115	93	88.9
2050	1745	441	227	167.0
China				
2000	1024	392	105	82.7
2050	1151	822	219	155.4
USA				
2000	542	605	166	585.7
2050	315	665	187	484.6

Source: Govt of India Report

It may also be noted that the per capita water use in India will increase from the current level of 99 liters per day to 167 liters per day in 2050. On the other hand, currently, per capita consumption in USA will reduce from 587 liters to 484 liters per day in 2050.

Per capita water availability in India

Table : 3

Year	Population	Per Capita Water Availability (M^3/Year)
1951	361	5177
1955	395	4732
1991	846	2209
2001	1027	1820
2025	1394	1341
2050	1640	1140

Source: Govt. of India report.

It can be seen in Table 3, the per capita water availability in 1951 was 5,177 m^3 per year, when the total population was only 361 million. In 2001, as the population increased to 1,027 million, the per capita water availability reduced drastically to 1,820 m^3 per year. By 2025, the per capita water availability will further drop down to 1,341 m^3 to 1,140 m^3 in 2050.

As the water available within the country varies widely as a result of rainfall, ground water reserve and proximity to river basins, most of the Indian States will have reached the water stress condition by 2020 and water scarcity condition by 2025. This would further hamper the food security, as the scarcity of water will directly suppress agricultural production.

Water issues including pollution and management strategies in India

Challenges in Water Sector

The water supply in India is going to be a serious challenge due to various reasons. The most serious concern is the growing population which is likely to increase to 1.66 billion by 2050, with increasing population. The annual food requirement in country will exceed 250 million tons. The total demand for grains will increase to 375 million tons including grain for feeding livestock.

With the growth in the National GDP at 6.8 percent per annum, during the period from 2000 to 2025 and 6.0 percent per annum, during the year 2025 to 2050, the percapita income is bound to increase by 5.5 percent per annum. This will increase the demand for food. This creates an additional demand for water. The requirement of water livestock will raise from 2.3 billion m^3 2000 to 2.8 billion m^3 in 2050.

It is therefore necessary to address these burning issues which are affecting the water availability. Although India has adequate water resources to meet the growing needs. With regard to the water use efficiency in agriculture, India is for below. This is due improper water conservation measures and crop varieties which demand more water.

However, farmers are not motivated to conserve water as there is no incentive for them to do so. Global warming is posing further challenge; as the water requirement for crops will increase due to higher evaporate transpiration.

Pollution – The major risk of water

Water pollution is an undesirable change in the state of water, contaminated with harmful substances. Pollution of the water bodies disturbs the ecosystem as a whole. Polluted water is not only unsafe for drinking. But it is also unsuitable for agricultural and industrial uses. The effect of water pollution are detrimental to human beings, plants, animals, fish and birds.

Domestic Sewage:

Domestic sewage is wastewater generated from household activities. It contains organic and inorganic materials such as phosphates and nitrates. Usually people dump household wastes in the nearly water source, which leads to water pollution.

Industrial Effluents:

Wastewater from the manufacturing and processing industries causes water pollution. The industrial effluences contain organic pollutants and other toxic chemicals. Wastewater from food and chemical processing industries contribute more to water pollution.

Agricultural Waste:

Agricultural waste includes manure, slurry and sewage runoffs. Although the quantity of agricultural waste is low. The effects are highly significant. It causes nutrient and organic pollution to both water and soil.

Fuel combustion

Vehicle Fuel:

As the world continues developing, there has been a rise in the use of vehicles as well. There are millions of vehicles running on our roads and releasing toxic fumes of sulphates and nitrates every day. When released into the air, they come in contact with the water vapour present in the air. They then return to the ground as acid rain.

Burning of Coal:

When coal is burned, it leads to the release of mercury into the atmosphere. This mercury reverts back to the earth's surface and enters the rivers, lakes and groundwater. As a result, all these water bodies get polluted and are unsuitable for safe use.

Farming practices and Animal Rearing:

Slash and burn farming practices are a component in shifting cultivation agricultural systems. Fertilizers are used for farming contain a large quantity of nitrogen and phosphorous. They enrich the soil near the lakes and rivers.

Cattle and Pig rearing results a significant amount of nutrient filled waste. A lot of waste is discarded into the water bodies. This makes it next to impossible for the aquatic animals there to survive

Radioactive waste

Nuclear Waste:

As the world is becoming more and more dependent on nuclear energy, there has been a tremendous increase in the amount of radioactive waste dumped into the aqueous regions. It has been proved that water containing radioactive substances (Uranium and Thorium) causes genetic disorders and lot of side effects on humans as well as aquatic life.

Oil Spills:

In recent times, with the increase in traffic in all the oceans of the world, oil spills have become common and are one of the major causes of water pollution. There have been numerous examples of large tanker ships spilling millions of gallons of oil into the seas. The spilled oil spreads to huge areas to form oil slicks, making it impossible for marine life and plants of the aqua to get proper sunlight and air.

Management strategies and changes proposed in water policy of India

Agriculture Sector:

a) Improvement in water usage efficiency
b) Adoption of rainwater harvesting and watershed management techniques.
c) Reduction of subsidies on power supply particularly for pumping water.
d) Prevention of ground water exploitation by differential pricing, rewards and punishments.

Industrial Sector:

a) Encourage recycling and treatment of industrial waste water through regulations and subsidies
b) Encourage introduction of new technologies which consume less water.

Domestic Sector:

a) Introduction of a policy for mandatory rainwater harvesting in cities.
b) Propagation of efficient water usage.
c) Creation of awareness about water conservation.

Conclusion

Climate change is mainly brought about by the release of toxic green house gases like carbon dioxide into the air. The best way to reduce this greenhouse gases is to grow more trees which use the gases for their food making process. Although 71 percent of earth's surface is covered with water bodies, we don't have enough water to drink. Therefore water needs to be conserved and prevent from pollution in order to make it safe for drinking and other consumption purpose. Water is the first sector to be affected by changes in climate. So water resources must be managed, and water used in a manner that reflects water variability, uncertainty, scarcity and abundance. There is the urgent need to create integrated water resource management to achieve the goal of sustainable water use.

Therefore, each and every individual should take some efforts to save the water resource from pollution and preserve its purity for the future generation.

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