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The clean water: The basic need of human and agriculture

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Abstract
Water is vital for human, animals and plant life. It is a part of all organisms, some of which contain more than 92 percent. It is estimated that in 2010 total water withdrawal was 761 km^3 of which 91 percent, or 688 km^3, are for irrigation. About 56 km^3 are for municipal and 17 km^3 for industrial use (FAO-2016). The increasing demands on water resources by India's burgeoning population and diminishing quality of existing water resources. India is facing a freshwater crisis. India has just 4% of the world's fresh water-but 18% of the global population. The main source of freshwater pollution can be attributed to the discharge of untreated waste, dumping of industrial effluent, and run-off from agricultural fields. In India, 163 Million Indians lack access to safe drinking water, 210 Million Indians lack access to improved sanitation, 21% of communicable diseases are linked to unsafe water, 500 children under the age of five die from diarrhea each day in India. In world scenario is more or less same, More than one out of six people lack access to safe drinking water; 3900 children die every day from water-borne diseases. Poor quality water can be responsible for slow growth, the poor aesthetic quality of the crop and, in some cases, can result in the gradual death of the plants. There is a serious mismatch between the cropping pattern of these crops and water resource availability in the states growing them. There is urgent need to change cropping pattern, adopt methods of WUE and all other possible means to cope with emerging water crisis for all sectors.

Keywords: Water crisis, population, crop, industry, resources, WUE etc.

Introduction
Pollution is not just the addition of substances that damage or kill organisms; it is any man-made impact that increases the risk of damage to a natural system. The shape of the water molecule is a sphere, dipole (+ve and –Ve charge), it posses Cohesion (water-water) and adhesion (water-soil). Water occurs on earth in three forms viz solid, liquid and gaseous. Water is vital for human, animals and plant life. It is a part of all organisms, some of which contain more than 92 percent. Water is an essential part of protoplasm. It is an important ingredient in photosynthesis.

In India, 163 Million Indians lack access to safe drinking water, 21% of communicable diseases are linked to unsafe water, 500 children under the age of five die from diarrhea each day in India (Hawthorne, 2018)[14]. The right to water has several dimensions. The quantity of water must be, at a minimum, sufficient to meet basic needs, in terms of drinking, bathing, cleaning, cooking, and sanitation. The quality of the water must be safe and free from contamination. Though the quality of water can vary with its use, water should never contain anything that could pose a health threat. In world scenario is more or less same, more than one out of six people lack access to safe drinking water; 3900 children die every day from water-borne diseases. An adequate supply of fresh and clean drinking water is a basic need for all human beings on the earth, yet it has been observed that millions of people worldwide are deprived of this. Freshwater resources all over the world are threatened not only by overexploitation and poor management but also by ecological degradation. The daily drinking water requirement per person is 2-4 liters, but it takes 2000 to 5000 liters of water to produce one person's daily food (Anonymous. 2015) [2].

Agriculture has comprehensively changed the face of the Earth. Good seeds and fertilizers fail to achieve their full potential if plants are not in the situation of optimum availability of soil water. Adequate availability of water is important for animal husbandry as well. Fisheries are, of course, directly dependent on water resources.

About 400 to 500 liters of water is necessary for the production of one kilogram of plant dry matter. Water is also required for translocation of nutrient and dissipation of heat.

1. Water distribution in the world and India

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) estimates, the total volume of water on earth is about 1.4 billion km^3, which is enough to cover the earth with a layer of 3 km depth. Our earth is a combination of the lithosphere (solid crust) and Hydrosphere (Oceans, lakes, rivers and other water bodies). The hydrosphere composition is Oceans (96%), a small portion (2%) as snow and ice and rest (2%) in the water bodies of the continents. Continuous circulation of water between hydrosphere, atmosphere, and lithosphere is known as the hydrological cycle. This has neither a beginning nor an end. The physical and biological processes in the environment are sustained by the Hydrological cycle. Oceans account for 85% of worldwide evaporation. Evaporation is the chief source of water vapour in the atmosphere. Water vapour in the atmosphere constitutes only 0.001 percent (if converted in term of water it will be 2.5 cm of rainfall) of the total global water. Of the precipitation that falls over continents, about 65% is returned to Atmosphere through evapotranspiration and the rest goes as surface runoff into the rivers and finally into the oceans.

About 97 percent of worlds in the oceans and this are not useful for irrigation. Of The total quantity of water, only 2.6 percent is fresh water, which is in the form of ice caps, icebergs and glaciers and the only small fraction of water are present in the ground, rivers, and atmosphere that can be harvested for irrigation of crops.

Some of the crucial issues faced by the water sector in India include (a) erratic distribution of rainfall, often leading to floods and droughts in various areas; (b) water use inefficiency; (c) unregulated groundwater extraction; (d) water pollution; and (e) decreasing water quality due to poor waste management laws, inter-state river disputes, growing financial crunch for development of resources and scarce safe drinking water (Anonymous, 2013) [5].

Water resources of India

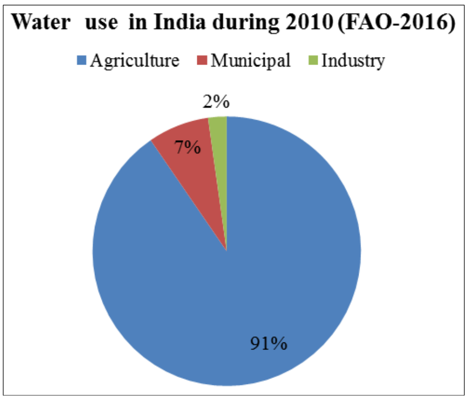
The average rainfall of India is 1194 mm. When considered over the geographical area of 328 million hectares, this rainfall amounts to 392 million hectare meters (m. ha. m). This may round off to 400 (m. ha. m) by including the contribution of snowfall which is not yet fully determined. Out of 400 (m. ha. m) of rainfall, 75% is received during the South-West Monsoon period (June to September) and rest in remaining months as shown below. A Major portion of water (215 m. ha. m) soaks into the soil, while 70 (m. ha. m) is lost as evapotranspiration (Anonymous, 2018a) [7].

Table 1: The trend of rainfall received (India) during recent time.

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total Rainfall (mm)	1234	1086	1215	1161	1181	1117	954	1213	1116	1024	1243
Total Volume of Rainfall (BCM)	4057	3570	3996	3819	3882	3674	3136	3989	3669	3467	4085
Source*:* Indian Meteorological Department *(IMD)*, M/o Science & Technology											

2. The requirement of water by different sectors

It is estimated that in 2010 total water withdrawal was 761 km^3 of which 91 percent, or 688 km^3, are for irrigation. About 56 km^3 are for municipal and 17 km^3 for industrial use (FAO-2016) [13]. Agriculture is the largest water user worldwide, accounting for 70 percent of total freshwater withdrawals on average (FAO-2011) [12] but these amounts can reach as much as 95 percent in some developing countries.



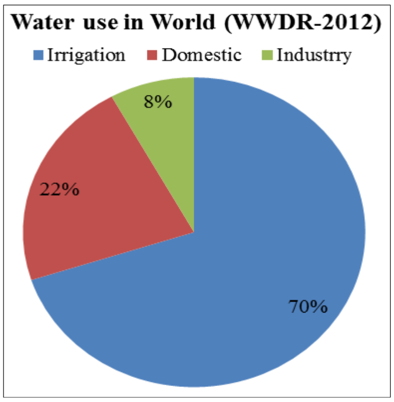


Fig 2: Use of water by different sectors in India and World.

Table 2: The water require of different crops grown in India.

Crop	Water Requirement (mm)	Crop	Water Requirement (mm)
Rice	900-2500	Chillies	500
Wheat	450-650	Sunflower	350-500
Sorghum	450-650	Castor	500
Maize	500-800	Bean	300-500
Sugarcane	1500-2500	Cabbage	380-500
Groundnut	500-700	Pea	350-500
Cotton	700-1300	Banana	1200-2200
Soybean	450-700	Citrus	900-1200
Tobacco	400-600	Pineapple	700-1000
Tomato	600-800	Gingelly	350-400
Potato	500-700	Ragi	400-450
Onion	350-550	Grape	500-1200

3. Shortage of fresh water

"Composite Water Management Index", underscores the looming threat of India's water crisis (Anonymous, 2018b) [3]. Its current proportions are severe-about 200,000 people die every year due to inadequate access to water (WHO, 2018) [19]. The present-day availability is 695 BCM. The total availability of water possible in the country is still lower than this projected demand, at 1,137 BCM.

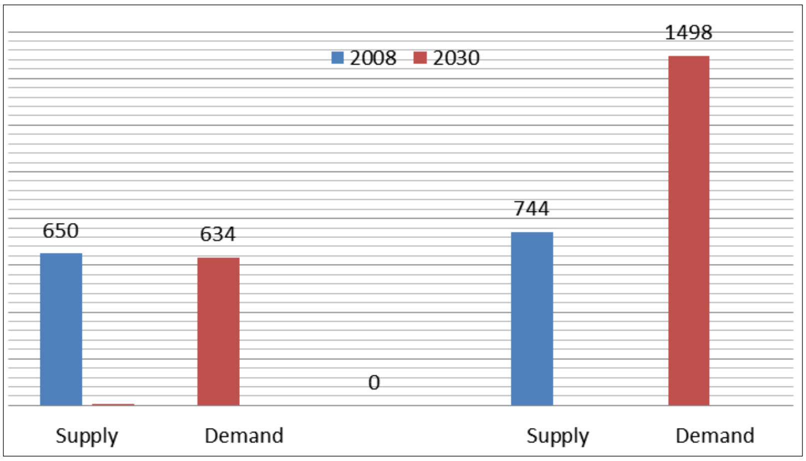


Fig 3: Demand and supply of India (BCM)

The increasing demands on water resources by India's burgeoning population and diminishing quality of existing water resources because of pollution and the additional requirements of serving India's spiraling industrial and agricultural growth have led to a situation where the consumption of water is rapidly increasing while the supply of fresh water remains more or less constant (Dhawan, 2017) [10].

India is facing a freshwater crisis. India has just 4% of the world's fresh water — but 18% of the global population. In 2013-14, only about 47.7% of total agricultural land in India was reliably irrigated. About 2/3rd cultivated land in India is dependent on monsoons. The ultimate irrigation potential of the country has been estimated to be 139.5 mha. India has acquired an irrigation potential of about 84.9 mha against the ultimate irrigation potential. The share of water use other than for agriculture was only 13 percent in 1985, which is likely to become 27 percent by 2025. Such a fast growth of water need in the face of emerging supply constraints is likely to result in a wide supply gap for irrigation water in the near future (Dehadrai, 2003) [9].

4. Causes of Water pollution and its consequences on human

India's rivers receive millions of litres of sewage, industrial and agricultural waste on a daily basis. The most polluting source for rivers is city sewage and industrial waste discharge. Presently, only about 10 percent of the wastewater generated is treated; the rest is discharged as is into our water bodies. Due to this, pollutants enter rivers, lakes and the groundwater. Such water, which ultimately ends up in our households, is often highly contaminated and carries disease-causing microbes. Agricultural runoff, or the water from the fields that drains into rivers, is another major water pollutant as it contains fertilizers and pesticides (Anonymous, 2012) [4]. It is reported that 75 to 80% of water pollution is caused by domestic sewage. Waste from the industries like, sugar, textile, electroplating, pesticides, pulp, and paper are polluting the water. Polluted rivers have an intolerable smell and contain less flora and fauna. 80% of the world's population is facing threats to water security (Kamble, 2014) [15]. The major sources of water pollution are domestic sewage, Industrialization, Population growth, indiscreet use of Pesticides and fertilizers in agriculture, excessive use Plastics and polythene bags, Urbanization without proper planning. 10% of the population depends on food and vegetables that are grown in contaminated water (Corcoran *et al.* 2010) [8].

Heavy rainfall and floods are related to extreme weather provide a congenial environment for different water born diseases (Ahmad *et. al.*, 2014) [1]. Bacterial diseases; Typhoid (Salmonella typhi), Cholera (Vibrio cholera), Bacterial Diarrhea (Shigella spp), Leptospirosis (Leptospira), Viral diseases; Infective Hepatitis (Hepatitis virus), Protozoan diseases; Amoebic dysentery (Entamoeba histolytica), Diarrhoea {Giardia (Lambliaintestinalis)}, Bilharzia (Schistosoma spp), Guinea worm (Dracunculusmedinensis). Preventive Measures; The city water supply should be properly checked and necessary steps are taken to disinfect it. Water pipes should be regularly checked for leaks and cracks. At home, the water should be boiled, filtered, or other methods and necessary steps taken to ensure that it is free from infection (Pandey and Sharma, 2018) [18].

It is not easy to separate the effects of agriculture from those of urbanization. Nitrogen and phosphorus leached from fields or animal dung have exactly the same effects as those produced by street drainage. Links between irrigated agriculture and increased malaria incidence in the tropics are well established (Kebede *et al*. 2005) [16].

5. Effect of quality water on agriculture production and quality of produce

Poor quality water can be responsible for slow growth, the poor aesthetic quality of the crop and, in some cases, can result in the gradual death of the plants (Anonymous, UMAAS). High soluble salts can directly injure roots, interfering with water and nutrient uptake. Salts can accumulate in plant leaf margins, causing burning of the edges. Water with high alkalinity can adversely affect the pH of the growing medium, interfering with nutrient uptake and causing nutrient deficiencies which reduce plant health.

Only 60% fertilizers are used in the soil other chemicals leached into soils polluting the water, cyanobacteria are rich in polluted water and excess phosphate runoff leads to eutrophication. Residues of chemicals mix with river water due to flooding, heavy rainfall, excess irrigation and enter the food chain. These chemicals are lethal for living organisms and many vegetables and fruits are contaminated with these chemicals (Ebenstein, 2008 and Kamble, 2014) [11, 15]. Soluble inorganic nitrogen compounds come from mineralization of organic nitrogen in agricultural and undeveloped soils, from wastewater treatment works, from the oxidation of nitrogen oxides in the atmosphere as well as from fertilizer run-off. Nitrogenous chemicals are responsible for cancer and blue baby syndrome (Krishnan and Indu, 2006) [17]. Poor drainage and irrigation practices have led to waterlogging and salinization of approximately 10 percent of the world's irrigated lands. In the extreme cases of waterlogging and salinity, the seeds may not germinate and the plants may wilt permanently. Waterlogging and salinity of agricultural lands are due to a natural process or man-made activities. In irrigated areas, chemical degradation of land is a subsequent development on account of long duration waterlogging. Besides the erratic rainfall distribution, inundation of coastal areas by back-water flow from the sea and absence of proper soil and water conservation measures in the catchments are also important factors leading to drainage congestion and related problems in the agricultural lands. There is a lack of up-to-date and methodically monitored information on the type, severity, and extent of drainage problems in the country. Estimates of waterlogged areas in India range from 2.5 to 16 mha, and those for salinized areas from 3.3 to 10.9 mha.

6. Water quality for crop production

(a) Irrigation water tests should always include pH and alkalinity. (b) Reclaimed water, runoff water, or recycled water may require reconditioning before use for irrigation since disease organisms, soluble salts and traces of organic chemicals may be present. (c) Water quality should be tested to ensure it is acceptable for plant growth and to minimize the risk of discharging pollutants to surface or groundwater. (d) Use filtration to remove suspended solids from water to prevent clogging of piping, valves, nozzles, and emitters in an irrigation system. Suspended solids include sand, soil, leaves, organic matter, algae, and weeds. (e) Water pH may need to be adjusted before being used for mixing some pesticides, floral preservatives, and growth regulators (Anonymous, UMAAS).

7. Using agriculture to tackle the water crisis

Water use efficiency

Different approaches have been put forward for using water efficiently, some are listed below: 1. The method of irrigation followed in the country is flood irrigation, which results in a lot of water loss. Greater efficiency in irrigation was achieved through 2: Proper designing of irrigation system for reducing water conveyance loss. 3: Adoptions of water-saving technologies such as sprinkler and drip irrigation systems have proven extremely effective in not just water conservation but also leading to higher yields. 4: New agronomic practices like raised bed planting, the ridge-furrow method of sowing, subsurface irrigation, and precision farming which offer vast scope for economizing water use. 5. Selection of crops, their varieties and salt tolerance at various stages of their growth are also important. 6. Adaptation of guidelines for using saline irrigation water.

The shift in the Cropping System

Consider the production of water-thirsty crops like paddy and sugar cane in the Punjab-Haryana belt and Maharashtra, respectively. There is a serious mismatch between the cropping pattern of these crops and water resource availability in the states growing them. The National Bank for Agriculture and Rural Development (NABARD)- Indian Council for Research on International Economic Relations' (ICRIER'S) report also makes an argument for moving such high water-reliant crops to other, relatively water-abundant areas. For instance, in regions with high irrigation water productivity better suited to water-intensive crops and poor power supply and other such problems make cultivation of water-intensive crops non-remunerative. There is room for the government to correct such misalignment.

Investment on new technologies

Investing in readjusting irrigation patterns is equally important for fulfilling the "more crop per drop" objective. To deal with such water-management challenges it is alarming time to boost alternative irritation techniques such as drip irrigation is a necessity. There has been some progress here; the Maharashtra government has made drip irrigation mandatory for sugar-cane cultivation, for instance. But more must be done.

> *"The earth, the land, and the water are not an inheritance from our forefathers but on loan from our children. So, we have to hand over to them at least as it was handed over to us."* **-** Mahatma Gandhi

Table 3: The major river basins in India and their Catchment Area, Average Water Resources Potential and Utilisable Surface Water

River Basins(BCM)				
	River Basin	**Catchment Area (Sq. Km.)**	**Average Water Resources Potential**	**Utilizable Surface Water Resources**
1	Indus (up to Border)	321289	73.31	46.0
2	Ganga- Brahmaputra-Meghna			
	a) Ganga	861452	525.02	250.0
	b) Brahmaputra	194413	537.24	24.0
	c) Barak & Others	41723	48.36	
3	Godavari	312812	110.54	76.3
4	Krishna	258948	78.12	58
5	Cauvery	81155	21.36	19
6	Subernarekha*	29196	12.37	6.8
7	Brahamani&Baitarni	51822	28.48	18.3
8	Mahanadi	141589	66.88	50
9	Pennar	55213	6.32	6.9
10	Mahi	34842	11.02	3.1
11	Sabarmati	21674	3.81	1.9
12	Narmada	98796	45.64	34.5
13	Tapi	65145	14.88	14.5
14	West Flowing Rivers From Tapi to Tadri	55940	87.41	11.9

15	West Flowing Rivers From Tadri to Kanyakumari	56177	113.53	24.3
16	East Flowing Rivers Between Mahanadi &Pennar	86643	22.52	13.1
17	East Flowing Rivers Between Pennar and Kanyakumari	100139	16.46	16.5
18	West Flowing Rivers Of Kutch and Saurashtra including Luni	321851	15.1	15
19	Area of Inland drainage in Rajasthan	-	Negl.	-
20	Minor River Draining into Myanmar(Burma) &Bangladesh	36302	31	-
	Total	1869.37	690.1	
Source: B.P. Directorate, CWC.				

Table 4: State-wise total length of rivers and canals

River Length (km)	Name of States/UT
<500	Andaman & Nicobar Is, Chandigarh, Dadra & Nagar Haveli, Daman & Diu, Delhi, Goa, Lakshadweep, Puducherry
500-999	Sikkim
1000-1999	Mizoram, Nagaland, Tripura
2000-4999	Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Manipur, Orissa, Uttarakhand, West Bengal
5000-9999	Haryana, Karnataka, Meghalaya, Rajasthan, Tamil Nadu,
10000-14999	Andhra Pradesh
15000-19999	Madhya Pradesh, Maharashtra, Punjab
25000 & above	Jammu & Kashmir, Uttar Pradesh
Source: Department of Animal Husbandry, Dairying & Fisheries, M/o Agriculture	

Conclusion

Large scale adaptation of rainwater harvesting apart from construction of new water storage structure along with enhancing the water use efficiency, taking appropriate step to prevent the contamination of water resources (surface and groundwater). Agriculture is a major stakeholder in freshwater consumption, So, primary responsibility of Agricultural researcher to develop new technologies and made necessary update in existing methodologies of irrigation for enhancing water use efficiency and disseminated these technologies to farmers.

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