

IMPACT OF CLIMATE CHANGE ON INDIAN WATER RESOURCES

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Abstract: *Paper attempts to discuss critical issues affecting human living in India, especially regarding availability of (contaminants-free) pure water, affecting vitality of life in urban and rural areas. Environmental changes following warming are responsible for depletion of water bodies. Its implication for safe water use by humans requires deeper probing. It is modern India's bane that most of its inhabitants in urban and rural areas do not have access to safe water. Present generation is rather sandwiched between health and development paradox. Subject matter of human induced changes to environment and ecological balance is discussed intensely at various forums among intellectual and scientific community as also by others. Taking into consideration large volume of evidence gathered through research, scientists and researchers accept increase in atmospheric temperature, attributing it to indiscriminate use of fossil-fuels. Impact of warming is felt by people in different parts of the world. Paper attempts to debate conundrum for developing country like India that strives to accelerate its development programme.*

Keywords: Global Warming, Climate Change, CO₂ Emission, Water Resources

Introduction

Population in India has expanded rapidly during last century putting tremendous pressure on scarce natural resources. Environmental deterioration and ecological imbalance is also rapid. Paper attempts to discuss issue of climate change on our depleting water resources. Indians are known to display a sort of ambivalent attitude towards water and water bodies. While we show reverence to water, as observed during religious ceremonies and folk customs on various family and community ceremonies, the attitude of people towards water and water bodies leaves much to be desired. Availability of safe drinking water is a priority as people's health, hygiene, survival and above all wellbeing is directly linked to it. Konkani proverb *suie vinnem konnachean xinvom nozo, udka vinnem konnachean tanddum nozo* (as stitching requires needle, for survival humans need water) signifies critical importance of water for humans. Availability of clean water is a human need and should be a right too. Scientists, intellectuals and academicians are increasingly discussing about climate change and environmental issues from global perspective as also analyzing policy changes put into force by various governments to positively address the issue. Public awareness about climatic change and its impact on day to day living is also increasing as it has serious implication on livelihood and survival of humanity. Following court directives environmental education is integrated into curricula at all levels in India so as to create genuine awareness about environmental concerns. As disaster scoffs at humanity, scientists and academicians in general and Intergovernmental Panel on Climate Change (IPCC) in particular are making a fervent plea for concerted action to hold, halt and positively reverse global warming and consequential climate change. In spite of efforts of capitalistic countries and big business, the Copenhagen Accord, in 2010, accepted need to contain global warming to below 2°C. Agreement was reached following protected negotiations and by accepting argument of developing world for fair play and sustainable development.

According to Richard L. Ottinger, (2010), Copenhagen Climate Convention acceptance to contain global warming to less than 2°C is very significant objective by any standard though there are doubts whether it can be realistically achieved in near future when nations are competing with each other to promote faster economic growth. It was indeed noteworthy that for first time most world leaders came to terms with reality of climate change. Most leaders, in fact even quoted from IPCC scientific reports on climate change and global warming, with a fervent plea for arresting alarming trend in order to save earth from havoc resulting from environmental disasters. M. Montini, (2011) states that from advent of twenty first century general mood at least overtly is to pursue ways and means to save humanity and ensure uninterrupted food production, safe water supply and pollution free environment. Surely, trends point that health and living is increasingly becoming focus of scientific community, academicians, research scholars and commoners as well.

Dilemma Faced by India and other Developing Countries

Developing countries are caught between the devil and deep sea. On one hand economic development is a prime requirement in order to lift maximum population above poverty line and on the other hand these countries are at receiving end of facing brunt of environmental disasters which are often not of their own making. Faced with such piquant situation, future of energy and environmental policies are debated intensely among policy makers and academics in these countries. Scientists and academics are of opinion that appropriate policy would be to have a balance between developmental goals and protection of climate, so as to concurrently advance both critical issues. This is easier said than done as trends indicate. According to B. Sudhakara Reddy and Gaudenz B. Assenza, (2009), since the industrial revolution from 1750s, developing economies with 80 percent of world population have contributed just a fifth to collective GHG emission. Having suffered pangs of colonial brunt for centuries most developing economies have started industrializing their economies only in post World War II period. Unlike developed world, these countries are releasing pollutants into atmosphere (though at an increasingly rapid rate) only from post-colonial period i.e. from 1950s. On other hand emission of pollute developing countries like China, Brazil and India have per capita emission far less than world average. However, presently developing countries (mainly China and India) are witnessing substantial swell in emission, while that from developed countries is relatively at slower pace.

The scenario is fast evolving. BRICS countries itself have currently about half the world population. With their economies advancing at a higher rate consumption of goods and services is increasing in these countries with increasing pressure on scarce resources. International Energy Agency (IEA) estimates that over two-thirds of total energy consumption in the world will be by developing economies by 2030. This is really alarming. Current scenario is that GHG emission of China is more than that of US. India is also likely to outpace Russia in GHG emission to take third position. Presently over 50 percent of total emission in the world is coming from less developed countries, largely due to use of outdated technology. By end of this century it is presumed that current developed world will contribute only one-fourth of total emissions. Even if we presume that GHG emission in developed countries is reduced to zero and emission in developing economies continues at current rate than it would mean a scenario of world facing prospect of global warming of 3°C by end of 21st century. Experts working with models that forecast future climate changes through computer simulations indicate that rise in temperature of 3°C would mean a cataclysmic level for global environment and people in poor countries even when they are least responsible for the change. (Corina Haita, 2012, B. Sudhakara Reddy and Gaudenz B. Assenza, 2009)

Developing economies contribute substantially to global warming and will continue to do so is discussed openly as a matter of fact at all important global meets. However, what is of

greater concern is the developing world's vulnerability to climate change impact. As disasters mock the world frequently it is feared that millions from developing and poor countries stare at the prospect of food and (clean) water shortage. As carbon dioxide emission increases climate change is going to put people health and life in these countries to greater risk. Geographically too developing countries are in a not so advantageous position to face climate change shock. Recent quake in Nepal (2015) is best example of what natural disasters can and may do in developing economies. Besides the death toll the destruction of property and heritage is of immeasurable value. For land-locked Himalayan nation, humanitarian aid and restorative help from India is critical to meet situation following natural disaster. Likewise most developing countries being situated in tropical and sub-tropical region are likely to face maximum brunt of climate change impact. Indian sub-continent as a whole is largely vulnerable to climate change impact for we have a vast population living below poverty line surviving with meager resources. This vast majority even when they are least responsible for climate change face prospect of suffering misery from climate change impact as and when catastrophe strikes.

If world economies continue to grow at current pace in an unregulated manner with outdated technologies, it is feared that GHG emissions would heat the planet by 3°C in the twenty first century. Even if temperature rise is less, say between 1-2.5°C there will be serious effects on developing countries situated in tropical and sub-tropical regions. Unseasonal rains, sporadic floods in some regions and droughts in other areas are leading to reduction in production of food crops. This results in hunger for people dependent on agriculture for survival. People in these regions are also susceptible to spread of climate sensitive diseases such as malaria and other tropical diseases. As water table goes down, people in India are increasingly using bore wells to draw water. Arsenic and fluoride related health issues and deformities for these people are not uncommon. India has a vast coastline and coastal communities face prospects of inundation of low lying coastal areas and destruction resulting from tropical cyclones. Numerous small islands in Indian Ocean and worldwide face prospects of going under water as sea level rises steadily. The rate of extinction of large number of plant and animal species is also unprecedented with serious ramification for survival of life on earth itself. More than war, the world is facing a serious threat from climate change impact. It is a fact that in India, high inflation in 2009-10, besides global economic factors not unrelated to global climate change, was also largely due to drought like situation and quantum jump in prices of grains and pulses hit common man very hard indeed. Availability of safe and adequate water is another major problem affecting quality of life for both rural and urban population across India.

Aim of this paper is to study impact of climate change on water resources in India and to make some policy suggestions to address problem. Water is a basic human need and health and hygiene is dependent on consumption of safe water free from biological waste, chemical and toxic contaminants, oil, sediments, heavy metals, etc, which are harmful. As compared to developed countries in the West, per capita water utilized by people in developing world is meager. While a large section of residents in developing world do not have continuous safe water supply to their homes, it is women who walk for miles to get water, putting at risk their safety and of their daughters left alone at home. In fact access to safe drinking water at home (even in slum areas) is desired by people for more than anything the safety of our daughters. For as mothers travel long distances to fetch water, their daughters left alone at home are often at great risk of being molested or raped. Quality time which otherwise would have been utilized for productive economic activity is lost in fetching gallons of water from far off distance. It is estimated that approximately a third of the world population may be forced to dwell in water scarce regions in near future. It is predicted that as world continues to use alternate sources of energy, war and disputes over 'black gold' that is oil are likely to be fewer. However, war and disputes and struggles between peoples for control over

water bodies are likely to increase. In Indian subcontinent southern states are often at loggerheads in summer and disputes are not infrequent over matters related to water. It would not be an overestimation to state that at least a billion people round the world lack access to safe water, besides, millions die year after year due to water borne diseases.

Looming impact of Climate Change

Our planet is covered largely by water bodies to the extent of 70 percent of its surface area, of which 97 percent is salty and unsafe for drinking. 2 percent is in the form of snow and ice. This would mean that humans have less than 1 percent to cultivate crops, for industrial and domestic purpose. Two-thirds of our fresh water resources are used to grow food. As world population continues to grow the demand for fresh and safe water increases by the day. Leaving aside water locked in form of glaciers rest of fresh water is in aquifers which humans everywhere are draining much more quickly than natural recharge rate. Humans seem to stare at disaster as climate alters at a fast pace. Twentieth century has witnessed too many weather related calamities. Humans seem to believe in myth of earth's unbounded generosity with regard to natural resources. Activities like digging canals, building dams, pumping water from aquifers, diverting rivers, uncontrolled mining, etc have all gone unabated unmindful of its impact on scarce fresh water sources. In regions which are densely populated water tables have plummeted. Ecologist Garrett Hardin well researched and thoughtful paper in 1968 titled 'Tragedy of Commons' which required reading by biology students ever since. It addresses problem that can be solved only by a 'change in human values or ideas of morality' in situations where rational pursuit of individual self-interest leads to collective ruin. Cowherds who share commons for pasture eventually increase cattle gradually until it leads to destruction of pastures through overgrazing. Similar tragedy is now happening with water as well because of its indiscriminate and unregulated use and waste. What is the way out? Communities should agree to self-imposed limits arrived at through consensus. This though it seems, unthinkable and improbable, seems to be only right thing to do. Community living on lines of clanship which was norm for thousands of years could be replicated by way of making housing societies in urban areas and hamlets in rural areas share resources on mutually beneficial principles.

Himalayas are intricately with life and civilizations in India. However, today Himalayan glaciers which have sustained civilization in Indo-Gangetic plains for thousands of years are dwindling at a very rapid rate. In the last half century there has been over 40 percent decline in volume of Himalayan ice. Consequently most north Indian rivers have a decrease in summer discharge. These observations lead us to infer that these changes are a consequence of global warming. It is suggested by some experts that is it only a part of low frequency climate variability inherent to climatic systems. However repeated disasters indicate that changes effectuated by mankind have begun to haunt. Possible brunt of climate change on water resources include: vanishing of water bodies due to enhanced rate of evaporation, intensive precipitation causing geographical changes (as seen during Uttarakhand flashfloods in 2013 when skies opened up causing massive landslides), frequency and severity of droughts and floods, etc. Projections made through use of computer simulation models indicate either increase in rainfall in some parts of India and drought like situation in other areas as a result of green house gases emission. Year after year as farmers commit suicides either because their standing crops are destroyed by flash floods or wither due to drought like situation is to agree with Barbara Kingsolver, who writing in *National Geographic* deepest dread of humans in modern times is peril of having too little or too much water. Yet politics of and politicking over farmer deaths due to crop failure continues shamelessly year after year.

Therefore, climatic change has significantly altered soil moisture, groundwater recharge and incidence of flood or drought experience and groundwater level in different

areas, leading to forced migration in many areas. In India groundwater has been largely used for domestic and irrigation purposes with agricultural production even in 21st century significantly being dependent on it. Groundwater use in India is substantial and it contributes to 9 percent of the nation's Gross Domestic Product (GDP). Electricity used and power consumed to draw water from deep groundwater sources is quite substantial for country as a whole. If better and cost effective methods are developed and put to use then we would be in a position to contribute in no small measure to save burning of fossil fuel. Without doubt water is critical resource for farmer and agricultural sector is largest consumer of water resources in developing countries. It is imperative that guaranteed water supply is essential for sustainable agriculture. In most parts of India farmers make imprudent use of water and level of utilization of water in farms and agricultural fields is poor. Studies indicate that application and use-efficiencies of water by farmers in general in different parts of India have been quite low. According to Samanpreet Kaur, Satvinder Singh and Harjit Singh Gulati, (2009), most irrigation projects run at very low down efficiency of just 30-40 percent and loss of water either during conveyance and use is very high. Cropping pattern in India which is rice/wheat-based is such that crops require application of water in large quantities. Farmers are also largely unaware of profligate use of water for agricultural purposes and are either reluctant or unable to use suitable paraphernalia for regulated use of water in most parts of India causing low water use efficiency at field level. Consequently amount of waste of water at field level is in range of approximately 60-70 percent which is unacceptable by any standards in times of precarious water shortage staring at us. Need of hour is to initiate urgent measures for efficient and astute use of precious water. Otherwise it is hard to carry on agricultural productivity at sustainable levels. Colleges and students having a course in environmental education should be geared to give practical demonstration to farmers on efficient use of water. For this perhaps colleges and universities could devise procedures to ask student undergoing course in environmental education to map the extent to which there is inefficient use of water for domestic as well as agricultural purpose.

Scientific community is aware that climatic change is exerting heavy stress on water resources in Indian subcontinent. Every year about 45 percent of average rainfall (including snowfall) gets wasted with rivers emptying large volume of water in Arabian Sea on one side and Bay of Bengal on other. Government is promoting rain-water harvesting schemes to arrest the run-off and to augment groundwater table. However need of the hour is for intellectual community in colleges, universities and science research institute to collaborate with students (our young human resources) in order to map effect of possible climate change on rainfall patterns, evaporation and temperature in different areas and on water bodies as rivers, springs, lakes, ponds, etc. If every college, university and science research institute could also promote rain-water harvesting on their campus along with support of community and industrialist then its spill-over on generating interests among general public will be of use and benefit immensely. A massive exercise replicating *Swachh Bharat Abhiyan* (Clean India Mission) to carry out large-scale afforestation on sustained basis for a decade or two will yield better result for country as a whole. Undoubtedly there is uncertainty with respect to prediction of climate change at global level. Reservations in this regard may vary at national, regional and local levels. It is indeed a challenge for researchers of climatic change to deal with uncertainties and provide more accurate predictions to policy makers, planners, and disaster management experts so that we are not caught napping whenever calamity comes calling. In absence of such predictions it is difficult to prepare for extreme weather events. Variations in temperatures and monsoons bring about variation in rainfall patterns. And if these variations cannot be predicted in advance it can lead to heavy losses especially to small farmers who are highly vulnerable. As experienced in 2009, neither government nor farming communities were prepared in India to face severe drought which affected more than 200 districts across country. Situation has hardly improved since. Slowly droughts or floods are become common feature

in India, leading to decrease in water-supplies even when water demand is increasing. This leads to deterioration in quality of freshwater bodies, and strains already (very) fragile equilibrium between supply and demand. Even in areas where there is increase in rainfall it often occurs not at times when most required by farming community or when it is not required leading to flood laying waste standing crops.

Conclusion

There is a felt need to protect and preserve our common resources like fresh water bodies as rivers, springs, lakes, ponds and wells for beneficial use of posterity. Realizing that water bodies were commons Konkani community used to say: '*boddi katrun kuddke korum-iet, udok katrun korum iet gi?* (You can cut stick into bits, but can water be cut likewise?). When human population was a fraction of what it is today watercourses seemed abundant and idea of protecting water was unthinkable. Hundred years back talking of bottling and marketing water for commercial gain would have perhaps invited scorn from others. Today situation is different. Other countries are putting into force laws for protection of commons. In India situation is not very encouraging. If the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act which was passed in 2006, is enforced in letter and spirit than it would perhaps help country to avoid depletion and help preserve our resources including water bodies for future generations. It is important that we move positively towards conservation of our water resources. A century earlier Svante August Arrhenius had discussed problem of warming due to atmospheric CO₂. Today, we are concerned about increase in CO₂ and other green house gases warming the planet with grievous cost. Development paradigm promoting GDP growth needs questioning and we need to pursue GNH (Gross National Happiness) instead. Growth by caring for our commons would undoubtedly give better returns in long run. Society seems to be living in self-denial being overtly unconcerned with global warming. However, TRPs (Television Rating Points) that news channels get while covering catastrophic climatic events in different parts of the country and world over seems to indicate that deep inside humans have a lurking fear about impending apocalypse. Despite encouraging signs, ignorance, disinterest, apathy and opposition still rules the roost in large parts of the country. It is here that HEIs (Higher Educational Institutions) have a larger role to play to address the issue. It was in this light that Environmental Studies are mandated to be compulsory taught in educational institutions. Academic Audit is required to assess if teaching Environmental Studies have led to any meaningful change in the way we deal with our environment and delineate corrective steps.

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