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Climate change and human security: The water security

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Abstract
Global Environment is on one of the central themes in global politics alongside security and economic issues. The span of global environmental issues is indeed large. The main focus of contemporary global environmental politics is climate change because of its inextricable linkages with economic growth and development, and its serious threat to human security. The conceptualization of human security is wide but precludes our understanding of the emerging issues that are of crucial importance to human security. The most important such issue is that of water security. The climate change is negatively impacting the global supply of fresh water. Climate change coupled with increasing population and rise in per capita consumption will seriously impact the global availability of freshwater supplies. The shortfall in global supply in relation to global demand for freshwater has already begun to occur and in the foreseeable it is likely to lead to serious 'water crisis' that would threaten human existence. In order to mitigate the looming water crisis, it is important to adopt climate change mitigation and adaptation measures. In addition, policies and strategies aimed at efficient management of the current supply of global fresh water have to be adopted.

Keywords: global environment, climate change, human security, water security

Introduction

The contemporary phase of serious concern with global environment began with the holding of the United Nations Conference on Human Environment (UNCHE) in 1972 in Stockholm, Sweden. The issue remained dormant thereafter until the mid-1980s but gained momentum in the late 1980s and emerged with increased salience in the early 1990s with the holding of the of the United Nations Conference on Environment and Development (UNCED) held in Rio in 1992. It was the largest international conference ever held and was also called 'Earth Summit' as an expression of serious concern with the degradation of the global environment. The substantive outcomes of the conference were *Agenda 21*, international conventions on climate change, and the preservation of biodiversity. As a follow up to the Earth Summit, the World Summit on Sustainable Development (WSSD) was held in 2002 at Johannesburg. In the context of environment and development, the exclusive focus was on sustainable development. Eradication of poverty was clearly emphasized alongside access to provision of clean water, sanitation and improvement in agricultural practices. Another ten years later, Rio + 20 was held in Brazil. It set the sustainable development goals for the future.

The formal political process of defining the issue of climate change began with the establishment of an Intergovernmental Panel on Climate Change (IPCC) in 1988 by United Nations Environmental Program (UNEP) and World Meteorological Organisation (WMO) for coordinating research and establishing a factual basis for negotiations. The IPCC consensus reaffirmed the seriousness of the threat of climate change and paved the way for the Intergovernmental Negotiating Committee (INC) by the United Nations General Assembly (UNGA) in December 1990. The INC began the process of negotiations for a United Nations Framework Convention (UNFCC) in 1991. The final text was adopted at the Earth Summit in 1992 as the United Nations Framework Convention on Climate Change (UNFCCC). It came into force in 1994 after the requisite number of fifty countries ratified it. After arduous and protracted negotiations and bargaining, the Kyoto Protocol to the UNFCCC was adopted in Kyoto in December 1997. It clearly stated that the industrialized countries party to the Kyoto Protocol should reduce the overall emission of greenhouse gases by 5.2 percent below the emission level in 1990 during the period 2008-2012. However, developed countries were allowed differentiation in fixing national targets through negotiations and bargaining among themselves. After protracted negotiations through Conference of Parties (COP) held every year, the outcome of the COP 21 held in Paris in 2015 was the 'Paris Agreement' as a successor to the Kyoto Protocol. The Paris Agreement mandated that developed and developing countries were required to prepare and communicate every five years intended nationally determined contributions that they needed to achieve in the reduction of greenhouse gases [1].

The analytical construct will therefore address four interrelated dimensions of the issues involved. The first section addresses the questions of what is climate change and why it is considered the most serious issue confronting humanity. The second part deals with the conceptualization of human security. The third section analyses the concept of water security. The fourth part examines the impact of climate change on one of the most important aspect of human security: water security.

Climate Change and its Implications

The focal point of contemporary global environmental politics is *Climate Change*. There appears to be consensus among analysts that climate change is perhaps the most serious environmental problem that is confronting the

humanity as it is inextricably linked to the processes of economic growth and development. Therefore, any viable solution will have to revolve around the axis of 'environment *and* development' and also address the issue of 'sustainable development'.

A combination of several factors led to *belated* realization and acceptance that climate change is the biggest threat to humanity. First, advances in scientific knowledge eventually led to the recognition of the rise in global mean temperature. The IPCC Science Report of 2013 gave explicit recognition to the fact that scientific evidence of the late 1980s about the increasing trend in global mean temperature is correct, and this global warming trend continues even today [2]. Second, there were rapid advances in the late 1970s and 1980s in climate modelling which helped our understanding of the past climate patterns. Climate modelling also confirmed the predictions of global warming. Third, the emergence of environmental social movements in the developed countries (North) and then in the developing countries created awareness not only amongst the elites but also at the grassroots level. These environmental social movements operate at the grassroots, local, national, and global level. The South/Third World countries account for about eighty percent of the World's population and were latecomers to the process of industrialization. The environmental social movements created environmental awareness within the Third World [3]. Importantly, they also increased awareness of the negative impact of environmental degradation, particularly climate change, on development efforts. Creation of environmental agencies in several developing countries also led to increased environmental awareness. In 1972, only 11 developing countries had an environmental agency, and by 180 there were 102 developing countries which had these agencies [4]. The creation of these agencies was by itself a product of increasing environmental awareness, and these agencies in turn contributed to further environmental awareness within the Third World. Fourth, the epistemic community created environmental awareness by dissemination of scientific knowledge about climate change and its negative impact on development efforts, particularly alleviation of poverty. Fifth, media played an important role in creating awareness about environmental degradation in general, and in particular about climate change. In the new millennium, there has been an exponential increase in the media coverage of the issue of climate change and its impact on humanity.

Global climate change refers to the increasing temperature of the Earth primarily due to anthropogenic emissions or simply human activities. The anthropogenic emissions refer to green-house gases (CHGs) that are emitted into the atmosphere due to human activities and range from carbon dioxide, methane, nitrous oxide and water vapours. These green-house gases facilitate the retention of heat radiated by the Sun and consequently increase the surface temperature of the Earth. Amongst these green-house gases, carbon dioxide is the most important one as it constitutes the dominant component of these gases and is the direct result of human activities. Carbon dioxide is generated by fossil fuels (which contain carbon) including coal, oil, gas and wood. There is robust evidence that CHGs have been rising since the industrial revolution in the eighteenth century. In the last hundred years, more carbon dioxide has been emitted into the air than the previous thousands of years. The scientific evidence has clearly established that these recent changes in the concentrations of CHGs in the atmosphere have already led to rise in global temperature. The emission of methane has also risen because of increased agricultural production. The average global temperature has already increased by 1 degree Celsius since 1880 [5]. This global warming has caused a significant warming of the ocean, a rise in sea level by 20 centimetres, melting of the artic sea ice by 40 percent, and a range of extreme weather conditions [6].

The global mean temperature is expected to increase further between 2 and 4 degrees centigrade by 2100 [7]. The actual increase of the temperature would depend on the rate of increase of carbon dioxide emissions. If the rate of increase in carbon emissions is low, then the rise in global mean temperature can be limited to 2 degrees centigrade. However, if the increase in emissions is high, then the global mean temperature could increase by as much as 4 degrees centigrade.

The long-term increase in global mean temperature has led to long-term changes in humidity, clouds and rainfall. The frequency of incidence of heavy rainfall has increased in most land areas of the world in the past fifty years; and is expected to increase with the increase in global mean temperature. The global warming has the potential of a negative impact on agriculture and food production, both globally and regionally. The important question that comes up in this context is whether we would be able to feed the extra two million people on the Earth by 2050 in a scenario of rapidly changing climate [8]. Similarly, global warming also has the potential of creating water stress across the world. The increasing population and the rising per capita consumption of water will impact the availability of water.

Human Security

The broad context for change in the conceptualization of security to include human security was provided by the ending of the cold war and the intensification of the contemporary phase of globalization. The ending of the cold war provided space and time for global issues of serious concern to be brought onto the international agenda. Globalization, particularly rapid advances in communication technology, increased awareness of the global issues such as poverty, inequalities of income and wealth between the North and the South as well as in the domestic societies, environmental degradation and its dire consequences for humanity, civil wars and armed conflicts, and diseases and pandemics.

Traditionally, before and during the cold war era, conceptualization of security was state-centric and meant military security. Security was perceived as defence of national sovereignty and territorial integrity of states from external armed attack. Poverty, environmental degradation, food, energy stress, increasing volume of refugees, and human rights violation provoked analysts from the Third World to redefine and broaden the concept of security. The ideational origins of the concept of human security lie in Mehboob ul Haq and Amartya Sen's dissatisfaction with the traditional conceptualization of development as a derivative of economic growth. The concept of human security is people centric rather than state-centric. The focus is on how to make human life better, more secure, safe, and meaningful.

The first distinct articulation of human security appeared in the Human Development Report published by the United

Nations Development Programme (UNDP) in 1994. The report identified seven areas that enfolded human security. *First*, it refers to economic security. Every human being should have assured basic income from productive and remunerative work, and if not so, then there should be publicly financed safety net. *Second*, the focus is on food security. All the people should be ensured of basic food with physical and economic access at all times. *Third*, there should be a guarantee of a minimum protection of all the people from disease and unhealthy lifestyle. *Fourth*, environmental security has to ensured. There should be protection of people from the short- and long-term effects of nature, man made threats in nature, and deterioration of the natural environment. *Fifth*, personal security of all individuals should be ensured from physical violence. This includes violence from state, external states, violent individuals, domestic abuse, and predatory adults, *sixth*, community security is to be assured. People should be safeguarded from the loss of traditional relationships and values, and from sectarian and ethnic violence. *Seventh*, political security has to be ensured so that people live in a society that honours their basic human rights, and individuals and groups are free from government attempts to exercise control over ideas and information [9].

The crux of human security was encapsulated by the United Nations Human Security Commission in 2003 as 'objective of human security is to safeguard the vital core of all human values in ways that enhance human freedoms and human fulfilment' [10]. However, the policy makers have criticized the conceptualisation of human security as too wide, fluid and imprecise. It poses problems for policy formulation and implementation; particularly in relation to prioritization of one aspect over the other.

Although the conceptualization of human security is wide, it does not include issues that have increased in salience and are vital to human life. For example, the issue of water security.

Water Security

It is common knowledge that scientists across the world are working on renewable sources of energy, particularly in the context of climate change. Equally important, or perhaps more important, is the search for technological breakthroughs for restoring renewable components of fresh water because water is essential for human civilization.

A brief explanation of the hydrological cycle is important for understanding the supply and demand for fresh water. Nearly seventy percent of Earth's surface is sea. The solar heat energy reaches the Earth's surface and gets converted into latent heat/water vapours from the seawater, wet soil, rivers and lakes, through evaporation and from plant leaves by transpiration. Evaporation from the sea leaves behind salt. The water vapours reach the upper atmosphere where they get condensed and return to the Earth as precipitation. There is more evaporation than precipitation over the sea, and the reverse is true over the land as precipitation is more than evaporation. The difference between precipitation and evaporation on land is the additional water available to feed the lakes, streams, springs and the ground water. The balance is the run-off back to the sea. The water that falls into oceans does not constitute the water resource [11].

According to the UNESCO Water Report [12], the land surface of the Earth receives annually on an average 42,700 cu km^3 of water (precipitation – evaporation). This is the amount of water renewed annually and constitutes the basic source of fresh water. In the long run, the stock of water available in surface reservoir and groundwater should be treated as reserve water. The main function of the reserve water is to stabilize the water supply due to variability of run-off water over time. The global water demand is around 3750 km^3 /year and constitutes only 8.4% of the annual fresh water resources. This is suggestive of the availability of sufficient global freshwater supplies. However, the devil lies in the details. The interplay of excessive mal-distribution of world run-off water sources and the anthropogenic causes, mainly climate change, have intensified the water scarcity.

The Global stock of water on the Earth's surface is a very large volume of water: 1.386 million cubic kilometres. However, 97.5 % of this stock of water is saline water in the seas, and only 2.5 % is fresh water. Of this stock of freshwater, 68.7 % is in the form of ice and snow cover in the Antarctic, Artic, and the mountainous regions. Further, 29.6 % exists as fresh groundwater, and only **0.3 %** of the available freshwater is in lakes, reservoirs, and rivers and is accessible for human requirements.

The distribution of global freshwater across continents is highly skewed. Asia and South America receive 31.6 % and 28.1 5 % of freshwater annually. Europe and Australia with Oceania receive the smallest volume of the annual freshwater at 6.8 % and 5.6 %. North America and Africa receive 18.4 % and 9.5 % of the annual volume of freshwater water. The percentage of world population that these six continents inhabit is as follows: Asia – 59.76 %; South America 5.53; Africa – 16.76 %; North America – 4.75; Europe – 10.7 %; and Australia and Oceania – 0.54 %. The distribution of fresh water is skewed not only in relation to the continents but also between the Northern hemisphere (developed countries) and the Southern hemisphere (developing countries) divide. The South has about 82 % of the world population and approximately only 68 % of the world freshwater supply annually. The North has about 18 % of the world population and 32 % of the world freshwater supply annually.

There are three important reasons for the increase in the consumption of fresh water in the future, particularly in the South. First, the population of the world is increasing and is likely to increase by 2 million by 2050. In other words, the current population is 7.7 billion which would increase to 9.7 billion by 2050. And it would further increase to 11billion by 2100 [13]. The increasing population is leading to extra consumption of water. In addition, the per capita consumption of water is increasing. Second, the increase in population would require increased agricultural production of food, and this would require additional consumption of water in the agricultural sector. Third, increase in population would also lead to increase in energy consumption and production in the industrial sector and that would also require extra consumption of water.

It was estimated that the total global water withdrawal in 1995 was about 3750 cu km^3 /year. The actual consumption was about 2,270 cu km^3/year, and this annual consumption amounts to 61% of the annual water withdrawal. The scientific assessment projected that the water withdrawal would grow by 10-12% every ten years, and would reach approximately 5,100 cu km^3/year by 2025, representing a 1.38-fold increase in water withdrawal. In addition, water consumption would also increase by 1.26 times due to

increase in: per capita consumption, world population, agricultural production (mainly food), and industrial production (mainly energy).

Another scientific report of 2000 extrapolates that the global water requirements would grow from the current 4,500 cu km^3 in 2000 to 6,900 cu km^3 per year by 2030. In 2000, the global water availability was only 4,100 cu km^3 and the consumption was 4,500 cu km^3 [14]. The shortfall was made up perhaps by overdrawing groundwater. As a result, the groundwater level is falling across the continents.

Climate Change and Water Security

The IPCC Fourth Assessment Report 'Climate Change 2007', based on accumulated knowledge of scientific evidence in relation to climate change, confirmed the GHGs induced climate change. In general, climate change would lead to rise in air and ocean water temperature, melting of ice and snow, more extreme events (storms, cyclones, floods and draughts) and rise in average sea level. In relation to climate change and water resources, the report has underscored several important aspects. First, climate change would lead to increased run-off and earlier spring discharges in many glaciers and snow-fed rivers. Second, warming of lakes and rivers in many regions would affect the thermal structure and the quality of water. Third, the report projects that by mid-century annual average run-off and water release would increase by 10-40 % at high altitudes and some wet tropical areas. However, in water stressed areas such as dry regions at mid-latitude and dry regions, there would be a decrease by 10-30 %. Fourth, drought affected areas across the world would increase. Fifth, heavy daily precipitation rate would increase and lead to increase in frequency of floods. Sixth, global warming would lead to substantial decline in water scored in glaciers and snow covers and therefore global water supplies and availability will decline. Seventh, the rising sea level may intrude further into inlands and encroach upon fresh water aquifers, estuaries and surface reservoirs.

In sum, the global water supply would decline with global warming, and the demand would go up due to increase in population, increase in per capita consumption of water, increase in food production, and increased water requirement in the industrial sector for increased production of energy. The climate change impinges upon water security and poses a serious threat to humanity.

Conclusion

The conceptualization of human security is incomplete without the inclusion of access to fresh water to people; therefore 'water security' should be an integral part of 'human security'.

It is the complex interplay of direct and indirect approaches that could mitigate the impending shortage of global freshwater supply. The direct approach relates to developing efficient water management policies and strategies to deal with the existing sources of freshwater supplies. This would ensure minimal wastage in the movement of water, water storage and transfer of water. Also, strategies should be developed to tap multiple sources of water. Equally important is ensuring efficiency in the usage of water by the people. The indirect approach relies on measures to mitigate and adapt to climate change in order to minimize the negative effects of global warming on the global supply of water. These measures include making renewable sources of energy, such as wind and solar energy, economically viable. In addition, there should be an increase in the efficiency of the usage of energy in all the sectors. The two approaches need to be pursued simultaneously to have some impact on the imminent water crisis in the world.

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