CLIMATE CHANGE THREAT IN THE CONTEXT OF FOOD SECURITY CHALLENGES IN INDIA

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Abstract

Climate change acts as a threat multiplier, making the challenges of sustainable food security more difficult. For millions of people in the developing countries the major issue is how to face the threat to their food security and livelihood as climate change unfolds. Hence the developing countries have to face the dual challenges of climate change and food security. One very important reason why these nations are more vulnerable to climate change is because their infrastructure is not strong enough and extensive to withstand the deleterious impacts. Thus climate change is a major challenge to food and agriculture because it negatively affects the basic elements of food production. More broadly it affects all the dimensions of food security, 1. Availability (physical access). 2. Accessibility (economic access) 3.Absorption (nutritional outcomes). . The Global Hunger Index 2010 estimates that the number of hungry people increased to 1.02 billion in 2009 from 854 million people in 2006.Undernourishment captures an access-adjusted perspective of food insecurity. India has 40%of world's malnourished children under the age of five years of age. The devastating cycle of malnutrition has continued to alarming levels in India as identified by the 2008 India State Hunger Index (ISHI) released by IFPRI. This paper is an attempt to discuss the present food security and climate change scenario in India to highlight the various challenges facing food security attainment.

Key Words: food security, climate change, malnutrition, poverty.

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I. Introduction:

Climate change acts as a threat multiplier, making the challenges of sustainable food security more difficult. For millions of people in the developing countries the major issue is how to face the threat to their food security and livelihood as climate change unfolds. The concern relates to increasing food security, reducing freshwater scarcity, protecting the livelihood of forest dwellers, dryland farmers and coastal settlements and reducing health risks. The recent Intergovernmental panel on climate change (IPCC) Fourth Assessment report indicates that climate change will have significant impact on crop production and water management systems in the coming decades. The strong trends in climate change are already evident and the increasing magnitude of potential climate impacts globally gives additional urgency to address agricultural adaptation more coherently. (IPCC AR4, WG11, ch 5).The most likely changes are an increase in the number of hot days and nights (with some minor regional exceptions), or in days exceeding various threshold temperatures, and decreases in the number of cold days, particularly including frosts. These are virtually certain to affect human comfort and health, natural ecosystems and crops. Extended warmer periods are also very likely to increase water demand and evaporative losses, increasing the intensity and duration of droughts, assuming no increases in precipitation. Extended warm periods and increased drought will increase water stress in forests and grasslands and increase the frequency and intensity of wildfires. The combination of rising sea level and more intense coastal storms, especially tropical cyclones, would cause more frequent and intense storm surges, with damages exacerbated by more intense inland rainfall and stronger winds. (IPCC AR4, WG ch19. Some of the anticipated costs of climate change have been highlighted in a report by International Food and Policy Research Institute (IFPRI) and they are as follows (CGIAR).

1. 25 million more children will be malnourished in 2050 due to climate change without serious mitigation efforts or adaptative expenditure.
2. Irrigated wheat yields in 2050 will be reduced by around 30% and irrigated rice yields by 15% in developing countries.
3. Climate change will increase prices in 2050 by 90% for wheat, 12% for rice and 35% for maize on top of already high prices.
4. At least US $ 7 billion a year are necessary to improve agricultural production and productivity to prevent adverse effects on children.

Hence the developing countries have to face the dual challenges of climate change and food security. One very important reason why these nations are more vulnerable to climate change is because their infrastructure is not strong enough and extensive to withstand the deleterious impacts. We have already started to experience variability in climatic conditions. Severe floods in Pakistan, drought and extreme heat in Russia, tsunami in Indonesia, cloud burst as it happened in Mumbai in 2005 and is expected to recur more often now. The Chinese government recently released " Second National Assessment Report on climate change" and warns of long term threat to its prosperity, health and food output by cutting crops shrinking rivers and unleashing more droughts and floods. The extreme events of heavy snowfall in USA and excessive flooding in Australia in 2011 leading to loss of crops and source of livelihoods are becoming more recurrent in many parts of the world. The annual flood cycles, sea level rise (Ganges, Brahmaputra) will no doubt stress some of the prime productive land and will reduce agricultural (including Fisheries) output and biodiversity in India. Off all the climatic factors the daily and inter annual variation in precipitation are most crucial for rainfed and runoff for irrigated production. The day to day variability of rainfall associated with weather is the major risk factor for most forms of agriculture. Soil moisture deficits damages crops and many crop diseases are all driven by rainfall and associated humidity. The cost of growing food will also increase with rising temperature. No doubt farmers will try to adapt to changing climatic conditions but then the cost of adaptation will increase. It is the developing nations whose poor population are more dependent on natural resources and have less ability to adapt that are hardest hit. Besides this climate change also offsets some of the benefits of income growth due to increased prices of food stuffs.

II. Constraints to achieving food security:

The constraints to achieving food security are often region specific and the variation in achievement is caused by the variability in environment. India being a vast country with diverse natural and geographic features the challenge is more acute. Many parts are disaster prone facing frequent floods, droughts and cyclones etc. Various studies have indicated that the key sectors impacted by climate change are agriculture, forests and fisheries and natural resources (water, biodiversity, mangroves, coastal zones, grasslands) and since a very large part of the Indian population depends on these climatic sensitive sectors for their subsistence and livelihood, therefore climate change has enormous implications for India. The Indian Network for Climate

Change Assessment (INCCA) released a report in November 2010 on assessment of the impact of climate change on key sectors and regions of India in the 2030s. The report warns of impacts such as sea-level rise, increase in cyclonic intensity, reduced crop yield in rainfed crops, stress on livestock, reduction in milk productivity increased flooding and spread in malaria.(Economic Survey 2010-11). A brief history of most intense cyclones from 1970-2010 reveals that whereas in the 70's and 80's it was an annual occurrence but in 2010 itself there have been 5 cyclones damaging life and property and means of livelihood of the coastal areas population.(Agriculture at a Glance 2011). These natural disasters impact the poor most who suffer from hunger and malnutrition as they fail to procure food due to crop loss, damage and high prices of food items. In the recent past, India has suffered an average economic loss of Rs 14,000crore per annum. Floods account for about a half of economic loss due to natural disasters as the table 1 here gives. The next in importance is loss caused by cyclones and storms.(India Development Report 2011).

Table- 1

Total Economic Damages: India (All Natural Disasters, 1950-2008) (in 2007 Rs crores)

Type of Disaster	1950-79		1980-2008		Increase over period col (4)/ col (2)
	Rs crore	Share (%)	Rs.crore	Share (%)	
1	2	3	4	5	6
Flood	107,836	48.45	207,499	49.72	1.99
Droughts	31,854	14.31	22,371	5.36	0.73
Earthquakes/Tsunami	1,625	0.73	59,990	14.37	38.20
Cyclones/Storms	81,278	36.51	106,655	25.56	1.36
Forest Fires	NA		20,824	4.99	
Others	NA		NA		
Total	222,593	100.00	417,338	100.00	1.94

Source: India Development Report 2011.

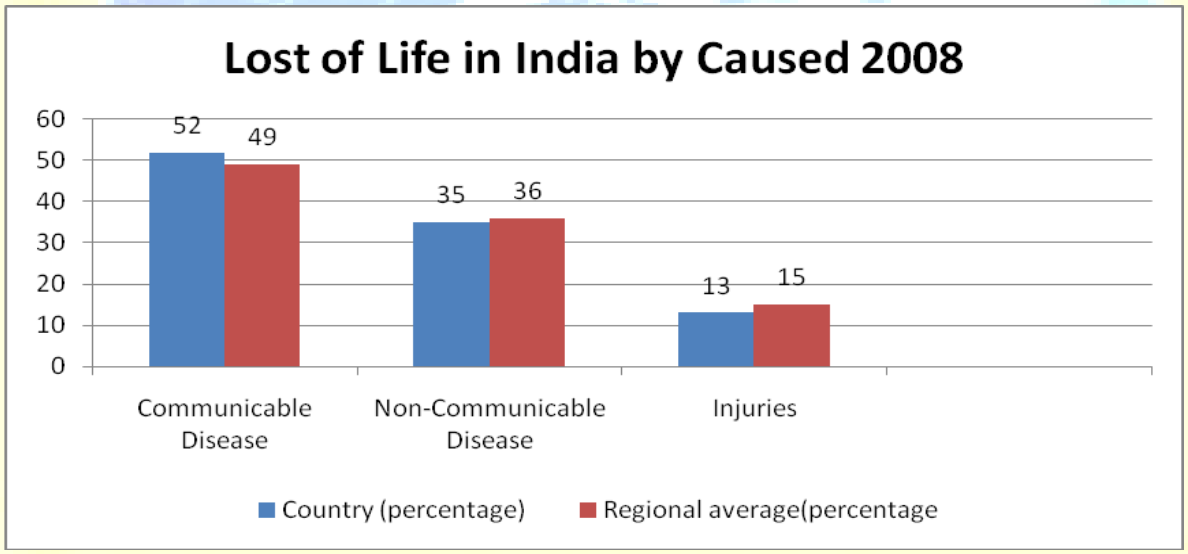
The drought of 2002 highlighted the vulnerability of irrigated areas to drought. An overwhelming majority of cropped area in India—68 % --- falls within the medium and low

rainfall ranges. Since crop productivity is very sensitive to variability in rainfall and temperature large areas are affected and huge reductions in crop yields are reported from various parts of the country when monsoons plays truant. The table 2 here gives the percentage departure in the distribution of overall rainfall in India consisting of Monsoon season (June to September), post monsoon (October-December), winter season (January –February) and premonsoon season (March to May).

According to WHO lost of life in India due to climate variability is at risk as compared to regional average. The Indian economy faces some different types of disease such as communicable disease, non-communicable disease, and injuries. Communicable disease is more in India than as compared to regional average see the fig below.

Fig-1

Lost of life in India by Caused, in 2008.



Source: Public Health and Environment, WHO, Geneva 2009.

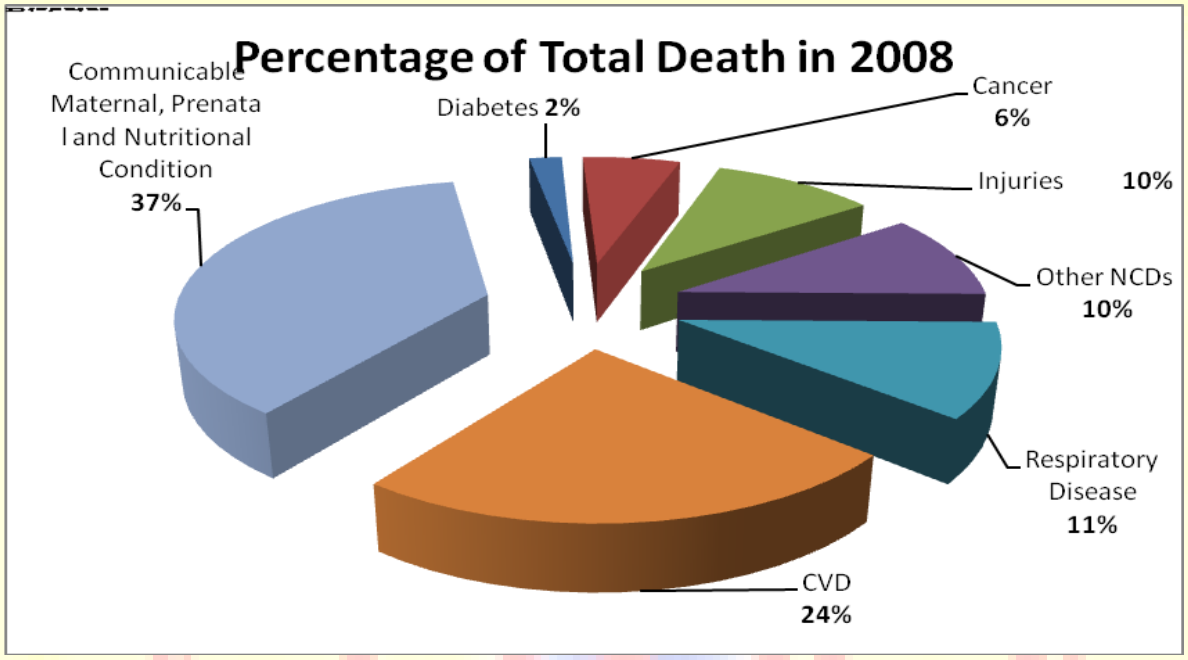
The fig clearly indicates the climate sensitive disease in India is very high. Total deaths in India is recorded alone 52 percent caused by communicable disease. Whereas 35 percent is caused by non- communicable disease and 13 percent due to injuries.

Environmental degradation adversely affects the human health and caused millions of people suffer and die every year. Some of the adverse health effect and deaths caused by

environmental hazards is communicable maternal, prenatal and nutritional condition, diabetes, respiratory disease, Cardiovascular Disease (CVD), injuries and cancer. Percentage of total death in India in 2008 caused by environmental hazards can be explained with the help of another fig.3.3.

Fig-2

Percentage of Total Deaths in India in 2008 Caused by Environmental Hazards



Source: Public Health and Environment, WHO, Geneva 2009.

NCD= Non-communicable Disease. CVD= Cardiovascular Disease.

The impact of climate change on water availability is likely to be one of the most significant for the health of populations. Higher temperatures are hastening rates of evaporation of surface water thereby reducing the availability of fresh water (Ahmad jamil, 2012). Lack of fresh water compromises hygiene and hence increasing incidence of diarrhea disease. On the other hand, too much water, in the form of floods, causes contamination of freshwater supplies. Extreme events like sea level rise coupled with stronger storm surges and coastal flooding can be followed by outbreak of diseases such as Cholera. (Dream 2047, Vigyan Prasar).

Inadequate drainage resulting in stagnant water is also a cause of mosquito-borne diseases such as malaria in urban areas. Flooding also may lead to the contamination of waters with chemicals, heavy metals or other hazardous substances, either from storage or from chemicals already in the environment (for example, pesticides).

A New Delhi based National Policy Laboratory study focus on malaria, a vector borne disease, because of its prevalence in India. With the increase in temperature predicted to increase the malaria in the country. For most vectors of malaria the temperature ranges from 20^0c to 30^0c for development and transmission. In India, the maximum accidents occurs in the month of May, June, July, and August in which the temperature recodes during this period is high and the humidity recorded at greater than 60 percent and less than 80 percent.

Table -2

All India Rainfall Distribution from 1992-93 to 2010-11and Growth Rate of production of foodgrains.

Year	Overall Rainfall (June to May) % Departure from normall	Growth rate of Production of Food Grain.
1994-95	9.0	4.37
1995-96	-2.9	-6.81
1996-97	0.4	10.43
1997-98	7.8	-2.89
1998-99	6.4	6.44
1999-00	-1.1	1.95
2000-01	-12.7	-7.16
2001-02	-6.3	9.41
2002-03	-18.6	-14.86
2003-04	6.8	22.57
2004-05	-9.3	-7.06
2005-06	-1.0	5.75
2006-07	-5.2	4.13

2007-08	-1.2	6.21
2008-09	-10.1	1.60
2009-10	-18.6	-6.98
2010-11	1.7	10.76

Source: Agriculture at a Glance 2011. Directorate of Economics and Statistics, department of Agriculture and Cooperation.

The great fluctuations in rainfall as given in the table are the result of climatic changes and they impact the agricultural production and productivity and the growth rate of production of food grains has also fluctuated, often declining in the years when rainfall has been less than normal. Besides this, variability of temperature also has the capacity to affect food security. Rise in temperature is likely to increase the water requirement of crops due to high evaporative demand and crop duration due to forced maturity. It also further exacerbates land degradation, leading to desertification.

In the past several years we have experienced weather extremes and the year 2010 was warmest year since 1901. The increase in temperature was +0.93 C. (IMD-2010).The years 2002, 2003, 2006, 2007 and 2009 had all experienced high temperature with increase in temperature by 0.71, 0.56, 0.60, 0.55 and 0.92.

Thus climate change is a major challenge to food and agriculture because it negatively affects the basic elements of food production. More broadly it affects all the dimensions of food security, 1. Availability (physical access). 2. Accessibility (economic access) 3.Absorption (nutritional outcomes).

III. Availability (Physical Access):

India achieved self-sufficiency in food grains production and robust growth has helped ensure macro-level food security to a considerable extent but large sections of the population continue to live in poverty and hunger. The Global Hunger Index 2011 ranks India at 67 place out of 81 countries. Hunger stalks 300 million citizens and makes it one of the world's most hunger ridden nations. Hence achieving food security at the household level is a huge challenge for India with

21% population undernourished, 44% of under five year children underweight and 7% die before they reach the age of five years.

Food and nutritional security of India currently depends to a great extent on the production of wheat and rice. These two crops together constitute 78% of the total food grains production in 2009-10 whereas coarse cereals constitute only 15%. What is most worrying is that the growth pattern has been highly volatile since 1950's. During the 1980's the growth in area in rice was marginal at 0.41 per cent but growth in production and yield was above 3 per cent. From 2000-01 to 2009-10 the situation changed with growth in area turning negative and in production and yield standing at 1.59 per cent and 1.61 per cent respectively. In wheat too during 1980's the growth in area was marginal at 0.46 per cent but production and yield was above 3 per cent. During 2000-01 to 2009-10 the growth in area in wheat was 1.21 per cent and in production and yield was 1.89 per cent and 0.68 per cent respectively. This suggests that yield levels of these two crops have plateaued. (Economic survey 2010-11). Cereals are a major source of energy intake for Indian population and they dominate the discussion on food security. Average per capita cereal consumption has declined in both rural and urban areas. Consumption of non-cereals has not picked up for this decline. The per capita availability of cereals has declined from 422.7 gms / day in 2000 to 407 gms / day in 2010.

IV .Accessibility (Economic access):

Another pillar of food security is accessibility. While increased use of inputs and technology breakthrough can improve availability these may not translate into increased accessibility. Large sections of population live below poverty line and three quarter of poor live in rural areas and depend on agriculture. Poverty is connected with vulnerability and shocks compounded by general uncertainty with respect to livelihood and life. On the basis of NSS 61st round (2004-05) consumer expenditure data, the poverty ratio is estimated at 28.3% in rural areas, 25.7% in urban areas and 27.5% for the country as a whole in2004-05 using uniform recall period (URP). (Economic Survey 2010-11). This situation is worse in terms of PPP, ($1.25 a day). The poverty ratio then is 41.6% and poverty index of 0.296.

The expert group set up by planning commission submitted report in 2009 and used new methodology. According to that the all India rural poverty headcount ratio for 2004-05 was estimated at 41.8%, urban at 25.7% and all India at 37.2%. Whatever estimate is taken it shows

that tackling poverty is still a challenge and its decline has not been very significant. Hence economic access to food is an issue for poor and vulnerable groups more so when food accounts for 50% of monthly per capita expenditure in rural areas.

Table-3

Trends in percentage composition of consumer expenditure since 1987-88

Item group	Rural Share in total expenditure					Urban Share in total expenditure.				
	1987-88	1993-94	1999-00	2004-05	2009-10	1987-88	1993-94	1999-00	2004-05	2009-10
Cereal	26.3	24.2	22.2	18.0	15.6	15.0	14.0	12.4	10.1	9.1
Milk & products	8.6	9.5	8.8	8.5	8.6	9.5	9.8	8.7	7.9	7.8
Egg fish &meat	3.3	3.3	3.3	3.3	3.5	3.6	3.4	3.1	2.7	2.7
Food total	64.0	63.2	59.4	55.0	53.6	56.4	54.7	48.1	42.5	40.7

Source: extracted from, NSSO, M/O Statistics & Programme Implementation, Key indicators of Household Expenditure in India 2009-10.

Between 1987-88 to 2004-05 and 2009-10, food share declined from 64% to 55% and finally to 54% in rural India and from 56.4% to 42.5% and 40.7% in urban India. Reasons for decline are stagnant incomes and declining budget shares for food. In rural India though the shares of other food items like milk and milk products, fish ,eggs and meat has increased the increase has not been sufficient to make up for the loss in calories due to decline in cereal consumption. In urban India the share in expenditure of other food items like milk and milk products, egg fish and meat has declined.

V. Absorption (nutritional outcomes):

Poverty is not the only challenge in India but along with this the people are also undernourished and malnutrition. Hence nutritional security is also important. There is need for integrated nutrition and health programme for vulnerable groups. India ranks low in context of prevalence

of underweight children. Agricultural performance and nutritional outcomes are related to each other. Gulati and Shreedhar (2010) observed negative correlation between Gross Value of agricultural output per hectare (GVOAL/ha) and malnutrition status across Indian states. The higher the level of agricultural output on a per hectare basis, the lowest the malnutrition index in country. Kerala and Punjab have the two of the highest GVOAL/ha in country and their malnutrition rates are lowest. Madhya Pradesh with lowest GVOAL/ha and highest malnutrition. The average per capita calorie intake per diem decreased from 2,221 kcals (1983) to 2,153 kcals (1993-4), 2149 kcals (1999-2000) and 2,047 (2004-05) in rural India, that is by 8% between 1983 and 2004-05, the corresponding estimates for urban India are 2,089, 2,071, 2,156 and 2,020 involving a reduction of 3.3% in calorie intake. Average calorie intake in rural India as well as Urban India has fallen increasingly short of the corresponding calorie norms for official poverty lines 2,400 kcals for rural and 2,100 kcals for urban sector. (India Development Report 2011).

VI. Conclusion:

Increasing agricultural productivity is a necessary condition not only for ensuring food and nutritional security but also for sustaining the high levels of growth envisaged in plans. Although the availability of food grains has improved it has not resulted in eradication of hunger or reduction of undernourishment. Besides this there has been very little growth in area and marginal growth in yields of many crops during the last decade, Hence the major challenge is to further improve foodgrains production to meet the needs of growing population and also to increase the production of coarse cereals that are rich in nutrients; this will help in meeting the energy requirements of poor at a lower cost. Efforts are also to be made to improve pulses availability so that their consumption should increase. But climate change is emerging as a major threat to food security and hence it is essential that we integrate climate change concerns into food security and development issues. There has been lack of growth in agriculture after 1990's and hence decline in employment income and fall in aggregate demand especially by the rural poor. With rising GDP, the total demand for cereals will also rise but given the declining trend in production of cereals it is likely that it may fall short of demand in the near future. This situation gets more grave and serious due to negative impact of climate change on agriculture production and other natural resources.

Climate change will increase the vagaries of nature and this is bound to affect the food security of farmer household. It is exacerbated more due to integration with global market and price volatility resulting in substantial income reductions. Growth alone may not ensure food security and in view of the ongoing overuse of natural resources, land degradation and the effects of climate change, the introduction of locally adapted agricultural approaches that are resilient to climate change is vital. Integrated farming systems that would lead to dietary diversification essential for nutritional security is also needed. India has been pursuing some aggressive strategies to deal with the situation and has announced a National Action Plan on Climate Change (NAPCC) in June 2008. Its expenditure on adaptation- orientation scheme has increased impressively from 1.45% of the GDP in 2000-01 to 2.83% during 2009-10. There are several agriculture-based mitigation options for climate change that could generate significant benefits for both food security and climate change adaptation. Increasing soil carbon sequestration through forestry and agro-forestry initiatives and tillage practices, improving efficiency of nutrient management and restoring degraded lands are examples of actions that have large mitigation potential and high co-benefits. Adaptation of the agricultural sector to climate change will be costly but vital for food security, poverty reduction and maintaining the ecosystem. The current impetus for investing in improved agricultural policies, institutions and technologies to meet both food security and energy goals, provides a unique opportunity to mainstream climate change related actions into agriculture.

Climate change.

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