

Climate Change and the Rising Food Insecurity

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ABSTRACT

“A threat to the food security is a threat to the very existence of mankind.” This paper explores how climate change by altering the temperature and weather patterns, precipitation patterns and increased occurrences of extreme events like hurricanes and floods, is negatively affecting the food security of countries, especially the tropical and low income countries. Climate change affects food security both directly as well as indirectly. It has a direct impact on food production by impacting the yield and indirectly through water availability, pollination services, pests, diseases, nutritional quality etc. It puts pressure on all the four pillars of food security, that is, availability, access, utilization and stability, which are studied in detail in the paper. Because of climate change and increasing population when the demand for food is not met with the corresponding supply, prices will rise. Volatile food prices will have a severe impact on import dependent countries and will lead to an increase in food inequalities around the world. With an increasing population the situation will only worsen. Agriculture is a very important activity as it not only provides the food that we eat but is also a major source of livelihood for people especially for those living in Asia and Africa. The paper examines how climate change is having an impact on the food security and livelihood of the people.

Key Words : Climate change, Food security, Agriculture, Asia, Africa

INTRODUCTION

“Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to nuclear war. The earth’s atmosphere is being changed at an unprecedented rate by pollutants resulting from human activities, inefficient and wasteful fossil use and the effects of rapid population growth in many regions. These changes are already having harmful consequences over many parts of the globe” (Abrahamson, 2013, p. 3). The Intergovernmental Panel on Climate Change Report 2007 has warned that if the present rise in temperatures continues unabated then there will be more adverse manifestations of climate change in this century than the last. Global temperatures are on the rise since 1950 and if they continue unbated, then it will have serious repercussions for the present and future generations. Extreme weather events will become more frequent and

intense, with adverse effects on natural and human systems. Climate change is a reality and is happening now, with increased evidences of rising temperatures, changing precipitation patterns, melting glaciers and ice caps, rise in sea level, changing weather patterns and increased incidents of flood, drought etc. These adverse events pose a threat to not only the biological and physical environment but also to the socio-economic well being of the people. Increase in extreme weather events is leading to biodiversity loss and threatening the ability of mankind to feed itself. Maplecroft in its 7th annual “Climate Change and Environmental Risk Atlas” found that climate change is amplifying risks in 32 countries, including India, Bangladesh, Nigeria, Ethiopia and Philippines, resulting in food insecurity. A common underlying denominator of these countries is that they are heavily dependent on agriculture with 65% of the workforce employed in this sector and 28% of their GDP coming from it. Crop ecologists estimate that for every

1.8°F rise in temperature above historical norms, grain production will drop by 10 per cent (Brown, 2006).

Food system:

The food system encompasses all the activities and actors in the production, manufacturing, transport, retailing, consumption and their impact on environment, nutrition and health of the people. It can be understood through the forces of demand and supply. Demand for food in the form of consumption and dietary choices and supply of food through production, processing and marketing. The demand and supply of food is shaped by socio-economic and cultural determinants affecting the choices of people, access to the resources, the quality and safety of food. Climate and climate change has direct impact on the food system through productivity, nutritional quality, safety etc. The land system is responsible for maintaining the supply side of the food system. It is driven by population, socio-cultural norms, technology, governance structures etc. It is affected by the food system through land use change and affects the climate system through the albedo affect and the release of GHG in the atmosphere. In short, we can say that the land, food and climate systems are all interlinked, they affect and are affected by each other. So, change in one system leads to a change in another system as well.

Food security:

According to the IPCC special report on Climate Change and Land, the world’s land and water resources are being used at unprecedented rates, which combined with climate change will have dire consequences for the food security of humanity. Food and Agriculture Organisation has a vision, “of a world without hunger is

one in which most people are able, by themselves, to obtain the food they need for an active and healthy life, and where social safety nets ensure that those who lack resources still get enough to eat” (FAO, 2017). This vision of FAO has its roots in the definition of Food Security, adopted at the World Food Summit in 1996,

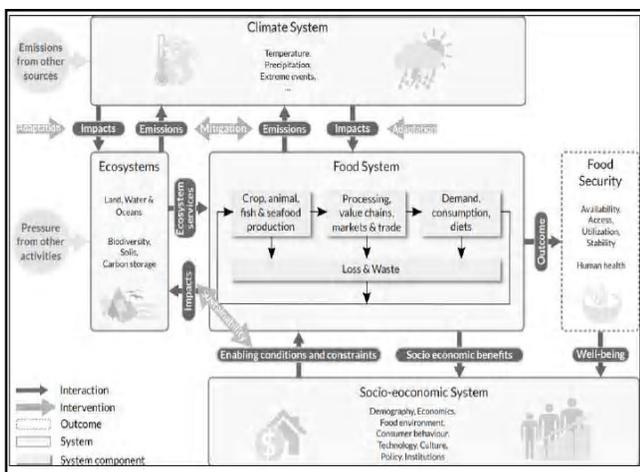
“Food Security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”

“All people at all times” implies the need for equitable and stable food distribution, it also covers the need for inter-generational equity, and therefore “sustainability” in food production. “Safe and nutritious food ...for a healthy life” implies that food insecurity can occur if the diet is not nutritious, including when there is consumption of an excess of calories, or if food is not safe, meaning free from harmful substances (IPCC, 2017).

The current food system not only feeds the world population but also supports the livelihood of 200 million people. Agriculture is important in two ways- it provides the food people eat and is a source of livelihood. Agriculture as an economic activity generates between 1% and 60% of national GDP in many countries, with a world average of about 4% in 2017 (World Bank, 2019). Since 1961, food supply has increased by more than 30% but still, 821 million people are undernourished, 151 million children are stunted, 613 million women and girls aged 15 to 49 suffer from iron deficiency and 2 billion adults are overweight or obese (IPCC, 2019). Given the current food system, the FAO estimates that there is a need to produce about 50% more food by 2050 in order to feed the increasing world population. But, if the current scenario continues unabated then the achievement of this target appears quite bleak. Climate change is affecting the food security through increased temperatures, changing precipitation patterns and extreme events.

Climate change and food security:

The IPCC Report on Global Warming of 1.5°C found that “climate-related risks to food security are projected to increase with global warming of 1.5°C and increase further with 2°C”. According to the International Fund for Agricultural Development, at least 70 per cent of the poor live in rural areas and most of them depend partly or completely on agriculture for their livelihoods. Thus, agriculture is important for food security in two ways- it



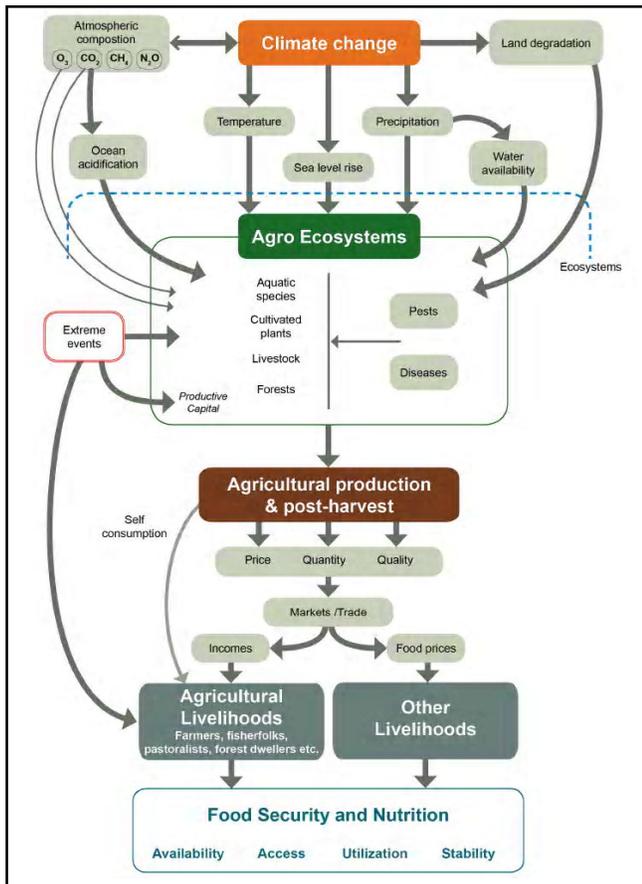
produces the food people eat and provides them with their source of livelihood. It is estimated that 500 million smallholder farms in the developing world are supporting almost 2 billion people, and in Asia and sub-Saharan Africa these small farms produce about 80 per cent of the food consumed (IFAD, 2011). Agriculture is a primary source of livelihood for about 36% of the world's workforce. In the heavily populated countries of Asia and the Pacific, this share ranges from 40 to 50 per cent, and in sub-Saharan Africa, two-thirds of the working population still make their living from agriculture (ILO, 2007). The need of the hour is not that more food should be produced but that everyone should have access to it, in the right quantity and at the right time. Climate change affects food security both directly as well as indirectly. It has a direct impact on food production by impacting the yield and indirectly through water availability, pollination services, pests, diseases, nutritional quality etc. Its effects are projected to be positive in temperate regions and negative in tropical ones. The impact of climate change on food security can be understood in detail by its affect on the four pillars of food security, i.e. food availability, economic and physical

access to food, food utilisation and food stability.

Climate change impact on food availability:

Food availability refers to the presence of sufficient quantities of food with appropriate quality available to the people either through domestic production or imports. Food availability is used as a measure of food security and it is directly impacted by climate change. Climate change impacts food availability through its effect on food production, processing, storage, distribution and exchange. Variations in temperature patterns as a result of climate change, is having both positive as well as negative impacts on crop yields. Increasing temperatures are affecting agricultural productivity by raising the yields of some crops like maize, cotton, wheat in higher latitudes, while yields of others like maize, wheat, barley are declining in lower-latitudes. Crop yield studies in India have found that despite adaptation activities, increased day temperatures has led to a decline in wheat yields by 5.2% since 1981. A study looking at wheat growth and yield in 3 different climate zones of China from 1981-2009 found that impacts were positive in Northern China and negative in Southern China (Tao *et al.*, 2009, p.190). Crop yield studies focusing on India have found that warming has reduced wheat yields by 5.2% from 1981 to 2009, despite adaptation (Gupta, Somanathan and Dey, 2017, p. 591). Pakistan has also experienced changes in food productivity owing to climate change. From 1980 to 2014, spring maize growing periods have shifted an average of 4.6 days per decade earlier, while sowing of autumn maize has been delayed 3 days per decade (Abbas *et al.*, 2014, p. 44). A similar study with sunflower showed that increases in mean temperature from 1980 to 2016 were highly correlated with shifts in sowing, emergence, anthesis, and maturity for fall and spring crops (Tariq *et al.*, 2018, p. 282). The people living in the mountainous region of Hindu-Kush Himalayas are particularly vulnerable to climate change, facing an increase in extreme events, with frequent floods and drought like situations leading to a decrease in agricultural production and an increase in food insecurity. The people living there already lead a life of struggle, being physically isolated with poor infrastructure and limited access to markets, and due to climate change this struggle is further exacerbated- where people now have to fight for food and livelihood.

Climate change has had a negative impact on agriculture and food security in Africa. It has impacted



not only the food availability, the food choices of people but also their very livelihood. According to reports, farmers in Nigeria have experienced a decline in their livelihood. There has been a decline in yields of fruits like mangoes and crops like wheat, maize, sorghum.

The IPCC Report on Climate Change and Land says with high confidence that “pests, diseases, and vectors for both crop and livestock diseases are likely to be altered by climate change.” About 50% of pests and vectors will change ranges by 2100 under the current GHG emissions. Some species could extend their reach till the poles and higher latitudes. For example the increase of temperatures in the Mediterranean Basin fosters conditions for the establishment of tropical species that were not able to thrive there before. This will affect disease management at both local and national levels and lead to crop losses. Changes in temperature, rainfall and wind patterns is expected to lead to proliferation of desert locust Africa and coffee nematode in Brazil. Pests and diseases arriving in areas not equipped to deal with them, will have a negative impact on the yield, leading to food insecurity. Almost 10-16% of global food harvest is lost to pests and crop diseases each year. Weeds are the highest potential cause of losses, estimated at 36 per cent.

Climate change impact on food access:

Access to food means that all people at all times have the ability to obtain and purchase food at affordable prices. Given the trans-boundary nature of food supply chains, a decline in food production will not only have implications at the local or national level, but also affect the availability and price of food in other regions of the world. Volatile food prices would have severe impacts on import-dependent developing countries, while consumers in large industrialized countries would be relatively unaffected (King *et al.*, 2015). Food inequalities will increase, from local to global levels, because the degree of climate change and the extent of its effects on people will differ from one part of the world to another, from one community to the next, and between rural and urban areas (Wheeler and Braun, 2013, p. 512). We live in a globalised world where happenings in one place have an effect on another place. For example, Russia, which is the world’s second largest supplier of barley, experienced severe drought in 2010, which led to an increase in the prices of barley in other countries. When food prices rise, low income consumers are more vulnerable as they have a limited purchasing capacity.

People most vulnerable to climate shocks are the world’s 2.5 billion small scale farmers, forest dependent communities whose income and food depend on natural resources. According to a FAO Report, 2016 “Small-scale farmers produce 63 and 69 per cent of the food in Kenya and the United Republic of Tanzania, respectively, whereas 70 per cent of small family farms are food producers in Nepal and 85 per cent in the Plurinational State of Bolivia.” They feel the impact of climate change twofold as they consume and sell the food produced. Thus, they consume less and sell even less. In Malawi, an increase of 1°C in temperatures, reduces the overall consumption per capita by about 20% and food calorie intake by almost 40%. The higher prices and low purchasing capacity will lead to less healthy diets and malnutrition. The State of Food Security and Nutrition 2018 Report states that the number of undernourished people in the world is 821 million, up from previous year’s 815 million and 784 million in 2016.

Climate change impact on food utilisation:

Food utilization includes food quality, nutritional availability and food safety which have a direct impact on human health. It depends upon how food is used, whether the diet can be maintained by a person, having sufficient nutrients. It is the capacity of an individual or a household to consume and benefit from food. A person having physical and economic access to food can be food insecure if he cannot get a balanced and nutritious diet. Climate change directly affects the food quality by altering the plant and animal biology which humans consume. Changing temperatures has led to a change in the metabolism of plants, which has affected their rate of growth, yield and nutritional quality. It has led to an alteration in the nutrient concentration and lipid composition. For example, apples in Japan have been exposed to higher temperatures over 3 to 4 decades and have responded by blooming earlier. This has led to changes in acidity, firmness, and water content, reducing quality (Sugiura *et al.*, 2013 p. 2418). Warming induced change in sugar composition can alter the colour and aroma of fruits like grapes. In regard to nutrient quality, a meta-analysis done by IPCC, 2019 from seven Free-Air Carbon dioxide Enrichment (FACE), (with elevated atmospheric CO₂ concentration of 546–586 ppm) experiments found that wheat grains had 9.3% lower zinc, 5.1% lower iron and 6.3% lower protein and rice grains had 7.8% lower protein content. A meta-analysis

of FACE trials on a range of rice cultivars shows that protein declines by an average of 10% under elevated carbon dioxide, iron by 8% and zinc declines by 5%. Furthermore, a range of vitamins show large declines across all rice cultivars, including Vit. B1 and B2 by 17%, Vit. B5 by 13% and B9 by 30%, whereas Vitamin E increased. As rice is a staple diet of many people especially in Asia, it can be easily concurred that climate change will undermine the nutritional status of millions of people in the world. According to FAO, 2 billion people lack the essential nutrients to lead a healthy life and with climate change this figure will only increase further. In 2017, Asia and Africa recorded the highest prevalence of undernourishment with 11.4% and 23.2%, respectively. There are many ways by which climate change can affect the nutrient consumption of humans by changing the yield of important crop sources of micronutrients, altering the nutritional content of a specific crop or by influencing decisions to grow crops of different nutritional values.

Climate change exerts a huge influence on food safety and human health through the changing population dynamics of contaminating microbial organisms. Many viruses and bacteria are sensitive to climate extremes like temperature and humidity, that can alter their survival and transmission patterns and lead to increase in viral, bacterial contamination of food and water. Changing temperature and precipitation patterns, humidity, occurrence of extreme events can change the activity of mycotoxin producing fungi and the contaminant pathways through which microbes can enter the human food chain. For example, the multiplication of *Salmonella spp.*, a major contributor to food-borne disease and estimated to be responsible for over 50,000 deaths in 2010, markedly depends on temperature. A recent study indicates that cases of salmonellosis increased by 5.5 per cent for each 1 °C increase in mean monthly temperature in Kazakhstan (FAO, 2018, p. 74). As a result of extreme events like flooding, there can be a delay in the supply of food from one place to another which can cause its spoilage. Increase in humidity can create conditions that can lead to mould growth and result in mycotoxin contamination of crops that are ripening in the field. This problem is further exacerbated in cases where drying efficiencies are not good.

Climate change impact on food stability:

Food stability refers to the ability of people to access and use food in a steady way without any intervening

periods of hunger. The IPCC reports have time and again stressed a rise in extreme weather events if the present situation continues unabated. This increase in extreme events will have a negative impact on food production, access and thus food stability. Climate change will lead to a decline in crop yields, which in turn will lead to increase in prices of food which for the marginalized poor people will be hard to afford. The impact of climate change will be more strongly felt in developing and underdeveloped countries of Asia and Africa. In 2017, food insecurity was higher in all the regions except North America and Europe, with notable increases in Africa and South America.

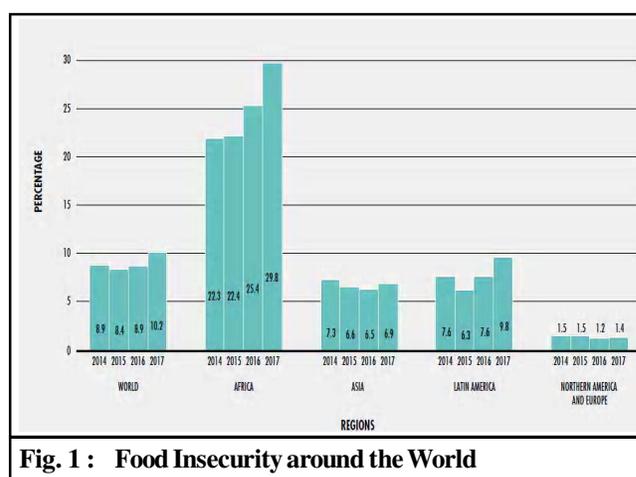


Fig. 1 : Food Insecurity around the World

Conclusion:

Climate change is leading to rising food insecurities around the world and with the added burden of loss of livelihood, hunger, poverty, we get a bleak picture. The sustainable development goals can only be achieved if we are to develop a climate resilient food structure along with adaptation techniques to climate change. Agriculture and food system are the keys to solve the problem of climate change. If we combine the supply side actions of the food system like efficient production, transportation and processing with demand-side interventions like modification of food choices and reduction of food loss and waste, this will reduce GHG emissions and enhance food system resilience. Such interventions can lead to an increased food supply, without any price rises and thus solve the problem of hunger which is significantly worse in countries with agricultural systems that are highly sensitive to the vagaries of climate change. If we want to achieve a world without hunger, malnutrition and poverty by 2030, it is imperative that we accelerate

actions to strengthen the resilience and adaptive capacity of food systems and people's livelihood choices in response to climate variabilities and extremes. This will require the development of policies and programmes that are aimed at climate change adaptation and mitigation in the areas of agriculture, disaster management, building up resilience of coastal communities etc. Such strategies should be gender sensitive including all the stakeholders and have a multi-sectoral approach. The integration of the Paris Agreement on Climate Change and the Sendai Framework on Disaster Risk Reduction is a very good policy framework to guide actions related to achieving the 2030 Sustainable Development Goals of Zero Hunger, No Poverty and Climate Action.

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